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[In this Index subjects, titles and authors' names are all included, for convenience, in one alphatbetically arranged list. Where necessary, articles are indexed under two or more headings. Often the Index is consulted by persons who have only a vague inkling of the title or nature of the article sought. In such case a search under every heading that might relate to the subject should be made. A number of cross-references are given to assist in this purpose. The asterisk (*) is equivalent to "Illustrated."]

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# WESTERN ELECTRICIAN

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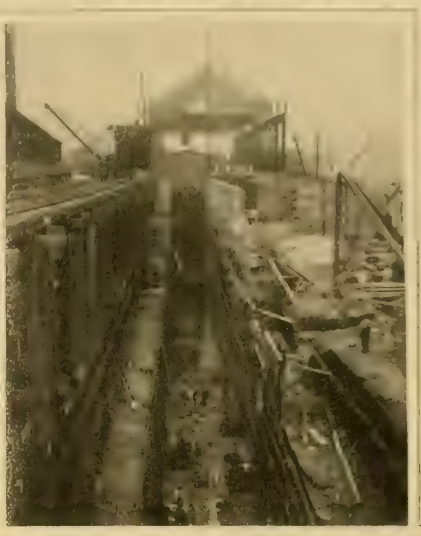
## Power Development on the Canadian Side at Niagara Falls.

By Orrin E. Dunlap.

Ten years ago the attention of electrical engineers and scientists throughout the world was directed toward Niagara Falls, N. Y., with intense interest in anticipation of the outcome of the test of the installation in wheelpit and power house No. 1 of the Niagara Falls Power Company, which company, on recommendation of an international commission, had adopted a unit of 5,000 horsepower for its development. The adoption of this unit of development was far in advance of anything that had been attempted at that time. In addition to the question of the success that was to be attained by the method adopted for the development of power, there was also a question attending the transmission of the generated power to available markets. The question of transmission was also considered by the International Niagara Commission in 1890, only 15 years ago, and that commission had presented to it four methods of delivering developed power to consumers. These were by wire or manila rope, by compressed air, by hydraulic pipes, or by electricity. Compressed air was then thought by many to be the coming advantageous method of transmitting power, and even when the inspiration of developing the power of the Falls of Niagara was arousing the enthusiasm of capitalists, there were men who pointed out that the use of water-power was on the decline because the factory had to go to the power plant instead of the energy being carried to the factory.

By October 4, 1890, the Niagara Falls Power Company had settled [illegible] the tunnel on the New York side [illegible] progressed night and day, so that [illegible] Rudolphe Baumann, a Swiss engineer [illegible] hand wheel that controlled the [illegible] great turbine. The test was [illegible] was interested. All looked forward [illegible] when the 50,000 horsepower of the [illegible] be completed, and the energy sent to distant consumers. The installation and the electrical transmission were a success in every particular, and the Niagara Falls Power Company has gone on and erected a second great station at Niagara Falls, N. Y., in which the development is 55,000 horsepower, giving it a total power output from its two plants of 105,000 horsepower. These wonderful power plants have been visited by about every electrical engineer of prominence in the world, one might say. Every facility for their inspection has been afforded, and it is but fair to say that the success of the Niagara development has made it easier to enlist capital in many other power projects that have benefited various parts of the country, thus giving vigor to the electrical industry.



Horseshoe Fall in the Grasp of Winter.
Wheelpit of Electrical Development Company of Ontario.

Wheelpit and Section of Power House of Canadian Niagara Power Company.
Birdseye View of Power House of Ontario Power Company at Water's Edge and Transformer Station on High Bluff of Victoria Park.

POWER DEVELOPMENT ON THE CANADIAN SIDE AT NIAGARA FALLS.

[illegible] Tesla to have [illegible] agara current [illegible] power develop- [illegible] York side at [illegible] engineers have the same gen- [illegible] plants soon to [illegible] Canadian side at Niagara as they had in connection with the mission in 1890, only 15 years ago, and that commis- On the New York side the establishment of the New York state reservation in 1885 had the effect of forcing the site of the big power development a mile back from the falls, but on the Canadian side Victoria Park has been thrown wide open to the development of the power of the Horseshoe Fall.

### The Canadian Niagara Power Company.

The first company to secure an agreement with the commissioners of Victoria Park for the development of power was the Canadian Niagara Power Company. For years this company, which is allied to the Niagara Falls Power Company, held the ex-

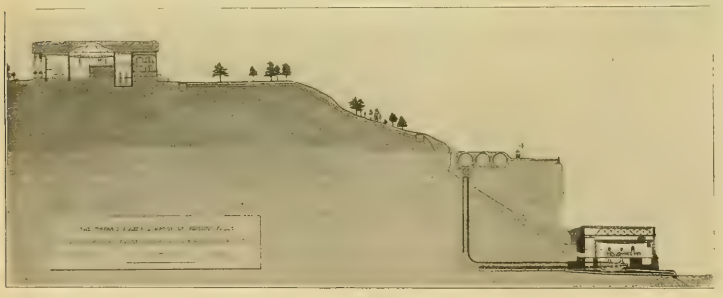
clusive rights for the development of power in Victoria Park, but after several years and before the commencement of its development it relinquished the exclusive privilege. Having obtained the first concession, the Canadian Niagara Power Company was first to select a site for its development. It located about 2,200 feet back from the brink of the Horseshoe Fall and decided that its plan of development should be very similar to that of the Niagara Falls Power Company. The site of its development being but 2,200 feet back from the gorge has made it possible to economize to a considerable extent, especially in the construction of its tunnel, which is but 2,200 feet long, as compared with the tunnel on the New York side, which is about 7,000 feet long.

The same general conditions of rock were found in driving the Canadian tunnel and in sinking the wheelpit as on the New York side. Water is diverted from the river by a short canal emptying into a forebay, from which it flows into penstocks that discharge into turbines near the bottom of the wheelpit. So accurately and carefully has all the work of the Niagara Falls Power Company been planned that the Canadian Niagara Power Company has found reason to make few changes in its development.

In general appearance the power house is very similar to the big stations on the New York side and has a covered forebay. This station will be notable, however, from the fact that the generating units are to be of 10,000 electrical horsepower each, which is double the size of the unit that attracted so much attention on the New York side 10 years ago, and which, it may be remarked, has not yet lost interest. The wheelpit and power house have been planned for 11 of these units, making a total output capacity of 110,000 horsepower, or double the capacity of either of the stations on the New York side, and 5,000 horsepower more than the two combined. The generators will be wound for three-phase current at about 12,000 volts, 25 cycles, at 250 revolutions per minute. This frequency will give a uniformity with the plants on the New York side and will permit parallel operation. When transmitted to the New York side this three-phase 12,000-volt current will be passed through step-down transformers and changed to 2,200 volts, two-phase, the transformer plant to be located on the New York side.

Among the advantages of the unit of 10,000 horsepower is the lower cost of generator per horsepower and the lower cost of turbines per horsepower, as a 10,000-horsepower unit calls for but little more space in wheelpit or station than a unit of 5,000 horsepower. The diameter of one of the 10,000-horsepower generators is about 19 feet. The generators are of the vertical-shaft type, with internal revolving field, the revolving parts weighing nearly 150,000 pounds. This company has the right to run its cables to the American side over the upper steel arch bridge. It has also secured a complete right-of-way along the Canadian side of the river for a transmission line to Fort Erie opposite the city of Buffalo. A portion of the installation in the station of the Canadian Niagara Power Company is about ready for operation, and it is altogether likely that the first Niagara power to be delivered in Toronto, Ont., will come from this power house. This transmission may begin in the spring. Mr. H. W. Buck is the electrical engineer of the Canadian Niagara Power Company and Mr. A. H. Van Cleve is the resident engineer, having recently succeeded Mr. Cecil B. Smith in this position.

GENERAL PLAN OF WORKS OF ONTARIO POWER COMPANY AT NIAGARA FALLS.



SECTION THROUGH POWER HOUSE AND DISTRIBUTING STATION OF ONTARIO POWER COMPANY AT NIAGARA FALLS.

### The Ontario Power Company.

The second company to apply to the commissioners of Victoria Park for power rights was the Ontario Power Company, whose plan of development is notably different from that of either of the other companies on the Canadian side. This company takes its water supply at a point on the river above the other power companies, where it has constructed an outer and an inner forebay, the outer forebay having an area of about eight acres and the inner forebay an area of about two acres. In flowing from the river into the forebay the water will pass an ice curtain and will be screened in passing from the outer to the inner forebay. At the lower end of the inner forebay the gate house will be located, and here the water will flow into steel pipes that will carry it to a spillway near Table Rock, from which point it will be carried by penstocks to the turbines located in the power house at the water's edge in the gorge, a short distance below the Horseshoe Fall.

From the time ground was broken the work of the Ontario Power Company has been most interesting. Large dams were built and quite an area unwatered, the spectacle being one that called eminent geologists to visit Niagara to investigate the section of river bed laid bare. An immense amount of concrete work has been done, and even new islands created. At one point the river bed was broken away over a large section in order that the required depth of water might be obtained in the forebay, but when the water is again allowed to flow over the scene of the work much that has been done will be hidden. The screen house, which will be over 300 feet long, and the gate house in its length of 120 feet, are not expected to in any manner mar the scene of their location.

The Ontario Power Company contemplates a development of 180,000 horsepower, which would call for the diversion of nearly 12,000 cubic feet of water per second through its proposed three pipe lines, each of which is expected to carry nearly 4,000 cubic feet of water per second. These pipe lines are to start from the gate house and run to a point on the bluff over the power house, the distance being a little over 6,000 feet. The pipes are to be 18 feet in diameter and made of steel plates that have a thickness of half an inch, being reinforced every four feet by eight-inch deck beams riveted to the upper section. Each pipe is expected to furnish sufficient water for the development of 60,000 horsepower. The first of the big steel pipes was laid during the last summer, the work commanding much attention. In order that it may not detract or trespass on the beauty of the park the pipe was laid in a trench, the excavation of which was most difficult at times. When in position it was sheeted with concrete in order that there might be no unequal pressure of the earth covering, care being taken to first sandblast and paint it to prevent rust. Conducting terminals were also attached at short distances to gather electric currents that might cause damage by electro-

lysis. Between the two ends of the big pipe there is a drop of nearly 30 feet.

At the lower end of the pipe the water from each pipe will be taken from the spillway by eight penstocks, six of which will have a diameter of about nine feet and two a diameter of about 2½ feet, the larger penstocks carrying water to the turbines of the main generators and the smaller supplying the turbines attached to the exciters. In the erection of the penstocks the commissioners have been very careful to see to it that the huge pipes were concealed from view, and for this reason in order that their presence might not interfere with the natural beauty of the cliff when viewed from the New York side the penstocks are being erected in shafts and tunnels as indicated in the plans presented herewith.

Every possible effort was made during the fall and early winter to get the first section of the power house so far advanced that it might be roofed in before severe weather came. This was accomplished early in December, the work being of concrete. The location of this power house is very close to the base of the Horseshoe Fall, and it will be subject to a heavy ice deposit during the majority of winters. However, the engineers have given careful consideration to this question and they anticipate no difficulty. The installation of the power house will consist of twin turbine wheels mounted on a horizontal shaft and direct-connected to generators of 10,000-horsepower capacity. When operating at 187 revolutions per minute the generators will deliver three-phase 25-cycle 12,000-volt current. A gallery at the rear of the station will provide room for the exciters, governors, etc., for the operation of the station, each exciter to be of 500 horsepower and to make 300 revolutions per minute.

In some respects the development of the Ontario Power Company will be similar to that of the Niagara Falls Hydraulic Power and Manufacturing Company on the New York side of the river a short distance down stream; but in the fact that the controlling apparatus of the generators is to be located in the transformer station, which will stand on the bluff in the rear of Victoria Park, over 500 feet back from and over 250 feet above the power station, a new feature in the Niagara power development is found. The power house and distributing station will have telephone connections. The power cables will be carried in the exciter penstock tunnels to the top of the cliff and from there to the transformer station in conduits.

Indications are that the Ontario Power Company

CANADIAN NIAGARA POWER COMPANY'S STATION DURING ERECTION.

adopted the wheelpit and tunnel method of obtaining power. The tunnel that is being driven will have a length of about 2,100 feet and its portal will be located behind the sheet of water of the Horseshoe Fall. The section of the tunnel will be somewhat larger than either of the other Niagara tunnels, its dimensions being about 24 feet wide and 26 feet high. The wheelpit will be about 415 feet long, 22 feet wide and over 150 feet deep, and from either end will run a discharge tunnel which will discharge into the main tailrace about 165 feet from the wheelpit. In shape this tunnel will also resemble a horseshoe.

SCENE NEAR POWER HOUSE OF CANADIAN NIAGARA POWER COMPANY.

will get its station in operation next summer. The engineers of the company are Mr. P. N. Nunn and Mr. L. L. Nunn. Mr. Banker R. Paine, who has long been an ardent advocate of Niagara power, is resident manager of the company.

### The Electrical Development Company of Ontario, Ltd.

The Electrical Development Company of Ontario, Ltd., was the third company to seek power rights in Victoria Park. It was organized by men who are interested in the street railways of Toronto,

The power house will cover the wheelpit and will have a length of nearly 500 feet and a width of 70 feet. It will be built of stone, but its general appearance will differ from the big stations now at Niagara. Not only in connection with this company's development but with all the industrial work being done in Victoria Park, the park commissioners are using every effort to see that none of the works or buildings is allowed seriously to mar the natural beauty of the park. The generators to be installed

chased between Niagara Falls and Toronto and steel towers are being erected along it, so that this transmission line will probably be first to carry Niagara power to Toronto. As sites for factories the Electrical Development Company of Ontario, Ltd., has purchased over 500 acres of land on the Welland River, two miles back from the falls.

### How the Power is to be Used.

It will be observed that the Canadian Niagara Power Company contemplates a development of 110,000 horsepower, the Ontario Power Company a development of 180,000 horsepower and the Electrical Development Company of Ontario, Ltd., a development of about 125,000 horsepower, or a total development by the three companies of 415,000 horsepower. Naturally the question will arise as to the manner in which this immense amount of energy is to be used. It is known that a portion of it is to be transmitted to Toronto and that some of it will be used in the immediate vicinity of the development. Under the terms of the agreements all of the power is to be transmitted outside the park boundaries, and it is provided that it may be transmitted to the United States, but should there be a demand, each of the companies is bound to supply at least half of its product to customers on the Canadian side. It has been intimated that when the Canadian power was ready there would be several large industries ready to avail themselves of the new source of power in British territory, but as yet no large manufacturing establishments are building at Canadian Niagara. The Welland Canal is but a few miles distant from the power houses, and it would appear likely that this might coax industries located on this waterway to have the power transmitted to them, as they would have direct water connections with the seaboard.

It was only recently announced that the Ontario Power Company had made a contract with the Niagara, Lockport and Ontario Power Company to deliver 30,000 electrical horsepower to it at the international boundary line at or near the Whirlpool on July 1, 1905, and an additional 30,000 horsepower by January 1, 1907. This contract was made for a period extending to April 1, 1950, with renewal rights for 60 years more, or to 2010. Under the agreement the Niagara, Lockport and Ontario Company is to erect a transformer station on the American side near the point of crossing and to construct a transmission line as far as Rochester, N. Y., by July 1, 1905. These contracts indicate that some of the product of the Ontario Power Company will find its way to a market on the New York side. Between Niagara Falls and Rochester there are many thriving villages and cities, and it is likely that they will be furnished Niagara power. In the fact

Concrete Work for Ontario Power Company.

Building Steel Flume for Ontario Power Company.

POWER DEVELOPMENT ON THE CANADIAN SIDE AT NIAGARA FALLS.

that the Niagara, Lockport and Ontario Power Company has made a contract with the Ontario Power Company for 60,000 horsepower is found a reason for believing that there will be no Niagara power development at Lockport as has long been talked. On December 18th the Common Council of Niagara Falls, N. Y., granted the Niagara, Lockport and Ontario Power Company a franchise to string its power cables through the streets of that city under the same restrictions placed on the other power companies, while it also granted permission to the Niagara Falls Gas and Electric Light Company to place its wires in conduits. This latter company is now supplying gas, but it holds a franchise for electric lighting from the former village government. So far as electricity is concerned, both companies are newcomers in the field and their plans will be developed by future events.

Quite naturally, Niagara as a source of electric power is destined to have important connection with the contemplated electrification of the steam railroads of New York state, especially the New York Central. On this subject much unauthorized matter has been printed connecting the New York Central with this or that power company. Considering the service that the public demands from a railroad like the New York Central, it would seem highly probable that when it comes to western New York for electric power the three great installations controlled by the Niagara Falls Power Company and the Canadian Niagara Power Company will be likely to influence its decision as promising a steady, constant, reliable source of power.

A Source of Large Revenue.

In connection with the development on the Canadian side at Niagara electrical engineers and others will be astonished at the revenue received by the commissioners of Victoria Park for the power rights they have granted. The Canadian Niagara Power Company obtained its charter in 1892, and up to 1902 had paid the commissioners the sum of $215,000. This company now pays $15,000 a year, as does also the Electrical Development Company of Ontario, Ltd. The Ontario Power Company pays an annual rental of $30,000, making the annual rentals of the three power companies no less than $60,000. But in addition to this $30,000 a year as a minimum payment for any quantity of power under 20,000 electrical horsepower the Ontario Power Company will pay $1 per horsepower for all sold above 20,000 up to 30,000; 75 cents per horsepower for all above 30,000 up to 40,000, and 50 cents per horsepower for all sold or disposed of above 40,000 horsepower.

The agreement of the Canadian Niagara Power Company, in addition to the annual rental, calls for payment at the rate of $1 per annum for each electrical horsepower generated, and used and sold or disposed of over 10,000 electrical horsepower up to 20,000 electrical horsepower, and the further payment of the sum of 75 cents for each electrical horsepower over 20,000 and up to 30,000, and the further payment of the sum of 50 cents for each electrical horsepower over 30,000 horsepower. This would make the company's gross rental on 30,000 horsepower $32,500 per year, payable half yearly, and this applies to power used in the United States or Canada. It is understood that the third company's agreement is similar to this. In addition to all this revenue the park commissioners get $10,000 a year from the Niagara Falls Park and River railway, and up to 1902 that company had paid $110,000. Other sources of revenue have given the commissioners over $100,000. Based upon the expenditures of the last 15 years, the average amount required for maintenance and permanent improvements in the park has been $48,000.

On the subject of the final effect of the power development on the park the commissioners in their last report say:

"All of the works and structures connected with the electrical power projects have been designed with the object not only of doing the least possible injury to scenic conditions, but the commissioners are confident in the belief that when the several works

VIEW SHOWING PROXIMITY OF WORKS OF ONTARIO POWER COMPANY TO THE HORSESHOE FALL.

are completed the consensus of opinion by the vastly increased number of visitors that are expected to visit the park will abundantly sustain them in their contention that the park, as a whole, with its wealth of electrical machinery, will then be of tenfold greater interest to the great majority visiting it; and in addition not only will the immediate locality beyond the park be built up into one of the great manufacturing centers of the world, but the quickening impulse and vivifying effects of the world's latest and most perfect form of energy—created and sent forth by the Falls of Niagara—will be felt from end to end of the province."

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Generating set No. 1 of the Canadian Niagara Power Company was set in motion at 11:30 a. m. on Monday, January 2, 1905. William H. Beatty of Toronto, Ont., president of the company, operated the wheel that governed the flow of water from the penstock to the turbine, and in a few minutes the mighty generator responded. It was speeded up to its capacity of 250 revolutions per minute, and at 12 o'clock unit No. 2 was successfully started, making 20,000 horsepower available for use. In honor of the starting of the first units of the station there was quite a notable party of guests present, including Edward D. Adams, Francis Lynde Stetson, William B. Rankine, directors, of New York; George Urban, Jr., and Charles R. Huntley, Buffalo; de Lancey Rankine, Niagara Falls; while from the Canadian side came J. F. Langmuir, chairman of the Victoria Park Commission, Commissioners A. W. Campbell, James Bampfield, George H. Wilkes, Superintendent James Wilson; also A. Monro Grier, K. C., secretary and solicitor of the Canadian Niagara Power Company, W. H. Brouse, a director, Messrs. D. Coulson and J. Henderson of the Bank of Toronto, and others. Three additional units are being installed, which will be ready by May 1st, and this will give 50,000 horsepower available at that time.

## Electrical Exports for November.

The electrical exports for the month of November, 1904, amounted to a total value of $1,189,332, as compared with $713,035 in November, 1903. This increase of $476,297 is the largest of any month in the year 1904, compared with the corresponding month in 1903. Both classes of electrical goods—electrical appliances and electrical machinery, the former including telegraph and telephone instruments—show a good gain. In the export of electrical machinery the figures are nearly double those for November, 1903. The figures in detail are as follows: Electrical appliances—November, 1903, $346,005; November, 1904, $459,476. Electrical machinery—November, 1903, $367,030; November, 1904, $729,856.

In looking over the destination of the electrical machinery exported from the United States during November last it is interesting to note that Japan heads the list of all importers of this class of goods, having taken during the month $205,091 worth of electrical machinery—an exceptionally large amount. This is Japan's largest figure for any one month, and the third time in 1904 that it has headed the list of importers of American electrical machinery—in February, with $119,856, and in March, with $201,617.

The following-named countries were the principal buyers of American electrical machinery in the month of November, 1904: Japan, $205,091; British North America, $176,162; Mexico, $85,840; United Kingdom, $78,887; Philippine Islands, $44,072; British Australasia, $38,627; British Africa, $28,032; Germany, $17,042; Hongkong, $5,807; France, $4,384; Brazil, $4,157.

## The Arc Lamp on the Battlefield.

The British army has adopted a portable first-aid station for use on the battlefield, known as the Ivel Motor First Aid Station. This consists of a large armored electric automobile van in which the surgeons may be moved from place to place and work comparatively safe, from rifle balls at least. The operations of the medical corps are facilitated by the use of an arc lamp in the van, which derives its current from the batteries. The lamp is placed behind a shield, with the carbons low down, in such a manner that the light is thrown up to a large shade hung above, whence it is reflected in diffused and shadowless form.

# ELECTRICAL PROGRESS IN UNITED STATES IN 1904.

By H. H. [illegible]

A general survey of the field of electrical engineering during the last year creates the impression that, while lacking in the sensational discoveries of its recent predecessors, the year 1904 has been one of substantial scientific and commercial development. It has been rich in experience for the electrical engineer, and will undoubtedly be classed in history as one of the great years, in view of the fact that no astonishing inventions have been made. The completion of the Louisiana Purchase Exposition has been the feature that has attracted more attention than any other single event. At St. Louis were brought together, in a comparatively small space, a collection of exhibits which typified the status of engineering at the present time. Not only in material results was the Exposition an important feature of the year, but its educational value through the congresses and conventions was even greater. Through the medium of this exposition a remarkable opportunity has been presented for the study of contemporary electrical engineering, which study develops first of all, the fact that electrical engineering, once an apparently distinct science, is no longer such, but now forms an integral part of all engineering. Indeed, so evident has this become that several times during the last summer prominent speakers at the exposition predicted that at no future universal exposition would a separate department of electricity, with its own building, be a possibility. Even at this exposition many of the most important electrical exhibits were in the palaces of Transportation, Machinery, Education, and elsewhere. Hence it is becoming increasingly difficult to review the advancement made in the science and art of electrical engineering, differentiated as such.

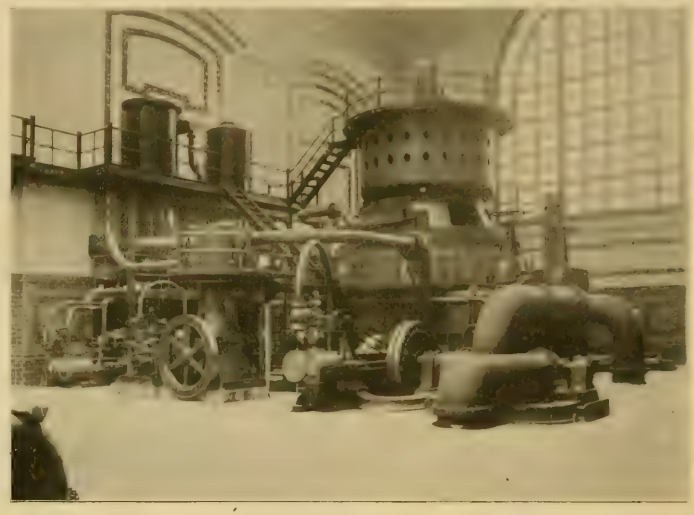
### Generation and Transmission.

An indication of the increasing use of the electric current for many purposes is found in the demand for very large power units. Plants of 50,000 horsepower no longer attract great attention, these large installations being the result of the tendency to do away with the many small and uneconomical stations and to concentrate in a few great ones. There is also manifest a desire to utilize more fully the available waterpowers so that the benefits of cheap electric energy may be more generally enjoyed.

It is noticeable that many of the very large stations completed or projected during the last year have employed steam turbines as the power units. It is therefore evident that this type of engine may now be considered as beyond the experimental stage. The fact that the New York Central Railroad Company will use turbines in its two power houses at Yonkers and Port Morris for supplying power for operating its trains in the vicinity of New York city places upon this type of engine the stamp of approval in a most emphatic manner. The Boston Edison Illuminating Company is also installing a turbine station to have an ultimate capacity of 60,000 kilowatts with Curtis turbines of 5,000 kilowatts each. Even larger are the engines under construction by the Westinghouse Machine Company for the Pennsylvania railroad for use in the latter's New York terminal. These are of a capacity of 5,500 kilowatts, or 7,400 electrical horsepower each. These giant installations are being imitated upon a smaller scale by numerous public and private plants throughout the country. At the same time the reciprocating engine is not going out of fashion altogether, as is plainly indicated by the use of this type in the new station of the New York subway, the largest steam-driven plant ever built, which has been placed in regular service in the last few months. Enough has been said, however, to show that this is a period of prosperity for the steam turbine, and this is farther indicated by the fact that most of the great engine-building firms are now launching into the turbine business.

Public interest in waterpowers has to a large extent centered in Niagara Falls during the last year. The several companies which are now investing large sums at that place have overcome construction difficulties well-nigh appalling. This money has been invested with great faith in the future demand for power, as there is not in sight at present the necessity for producing such amounts as will be developed. However, the fact that the Niagara Falls Hydraulic and Manufacturing Company has under way an 80,000-horsepower enlargement of its present plant is an indication that some such demand exists. The present plants have a combined capacity of nearly 150,000 horsepower, while those in process of construction represent nearly a half million more. It [illegible] restraining the promoters of these enterprises. In [illegible] its appreciation by an increased use of the privilege. The present limit of the amount of power transmitted into [illegible] 27,000 horsepower, and the demand now nearly reaches the capacity.

While Niagara, the great eastern waterpower center, is prospering, so also are the power centers in the Far West. The western plants distribute their power over much greater areas than do the Niagara Falls plants and they employ consequently higher pressures. The importance of the high-pressure transmission problem is indicated by the large amount of attention given to it in the meetings of the electrical associations and in the conventions of the year. While nothing radical has been attempted in the use of extremely high pressures, the service has been improved and its scope extended. The Northern California Power Company is one of the new comers in this line, and it has already organized a comprehensive system. It has now about 250 miles of transmission line and employs 25,000 volts as the line pressure. Another new and interesting plant is that of the Puget Sound Power Company, which employs a line pressure of 55,000 volts and is installing a capacity of 20,000 horsepower, to be later doubled. The plant supplies Seattle and Tacoma with power, these cities being 48 and 32 miles, respectively, from the power house on the Puyallup River. Service was begun from this plant on April 14th, and it was put into full operation on July 23, 1904. The interesting underground plant at Snoqualmie Falls has been enlarged, and its new capacity is nearly taxed, which is still another indication of the increasing demand for electric power in the Far West.



A 5,000-KILOWATT STEAM-TURBINE SET IN L STREET STATION OF BOSTON EDISON COMPANY.

### Electric Transportation.

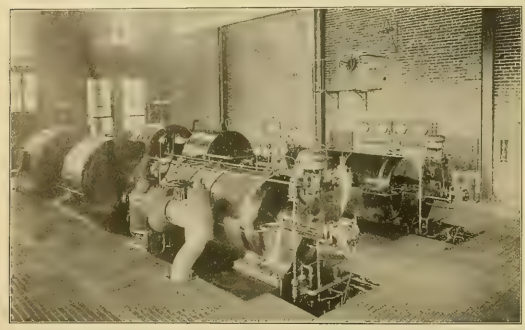
After a general survey of power generation, the utilization of this power demands attention. The largest portion of electric power generated is used for transportation purposes. In this field the year 1904 has been one of great development. The year began with the prospect of the immediate introduction of a single-phase alternating-current series motor for traction purposes. Although this introduction has been slower than was expected, yet great progress has been made. The attitude of the railroads has changed [illegible] They are four in number, of two poles each, and the armatures are mounted directly upon the driving axles. The locomotive frame forms part of the magnetic circuit, thus economizing weight.

In the larger cities the congestion of traffic has forced the railways underground, resulting in such undertakings as the Boston subway, the Chicago freight tunnels and the New York subway. The first named has now been in operation for a sufficient time to demonstrate its efficiency. A recent report shows that it has cost up to June 30, 1904, somewhat over $4,000,000. The Boston Elevated railroad pays for its use a rental greater than $200,000 a year. A new section has been recently completed and another is under way.

The Chicago freight tunnels form another example of the tendency mentioned. In order to facilitate the handling of freight traffic, a number of horseshoe-shaped tunnels have been constructed beneath business streets of the city for the purpose of handling freight and merchandise and diverting this business from the congested streets. The tunnels, of which about 22 miles have been completed, are of two sizes—six feet wide and 7½ feet high and 11 feet 2½ inches wide and 12½ feet high. They are comparatively deep-level, the floors being from 35 to 40 feet below street grades. Electric locomotives of special construction will pull narrow-gauge freight cars on tracks in these tunnels. Quite recently, and significantly, the steam-railroad interests of Chicago, through the Chicago Subway Company, have secured control of this interesting tunnel system.

Of great interest this year has been the opening of traffic in the New York subway, and although the road has been in operation such a short time, it is already doing a large [illegible]

its place as the most important feature of transportation in New York city. Regular operation was begun on October 27th, since which time upward of 200,000 passengers a day have been handled. The power for this road is supplied from a plant consisting of nine engines, directly connected to 5,000-kilowatt generators, which produce the power current. The lighting current, which is separate, is generated by three steam turbo-alternators of 1,875 kilowatts each. The reciprocating engines are of the well-known Manhattan type. The three-phase



TWO 1,000-KILOWATT STEAM-TURBINE SETS IN RAILWAY PLANT AT ELYRIA, OHIO.

current is distributed at 11,000 volts and 25 cycles. This current is received at eight sub-stations, which number may ultimately be increased to 12. Here the current is transformed to 625 volts for use in the third rail. The converter units have a capacity of 1,500 kilowatts each. A complete system of car control is one of the most important features of this new railway. The cars are equipped with 200-horsepower motors, two for each car, both mounted on one truck. The control system is of the multiple-unit type, the motorman operating the main controller by means of solenoids, the current for which is handled in a small controller located in the cab. This is the latest type of the General Electric Company, and it embodies a number of interesting features, among which the most important is the automatic acceleration. This is described later in connection with the exhibit of the General Electric Company at the World's Fair.

While the city roads have been actively developing, a great deal has also been accomplished by the interurban railways. In fact, the present time is a period of great activity in this direction. The character of the cars put into operation this year is a distinct advance, both in weight and power allowance. As high as 500 horsepower per car is used on roads containing considerable grades, while 300 horsepower is a not uncommon value. The "interurban" has taken its place as a competitor of the steam railroad, and it is absorbing a large amount of business. There are already a number of interurban-railway centers, large cities with radiating electric railways connecting with the smaller cities within a radius of 100 miles. In the Middle West and in the Far West the development is most rapid, Ohio, Indiana and Illinois being three of the most important interurban states. Possibly the most famous of these roads is the Aurora, Elgin and Chicago railway, connecting the cities named and the surrounding territory. One of the largest systems in the country now is the Indiana Union Traction Company, which operates about 260 miles of line with an equal number of cars, including the city cars, which are operated by the same company in a few of the smaller cities along the line. During this year the company has completed the Indianapolis and Northern Division, comprising about 110 miles of track and connecting Indianapolis, Logansport and Peru, cross-connecting with the lines formerly owned by the Union Traction Company of Indiana. This division of the road is supplied with power at 20,000 volts, three phase and at 25 cycles per second, from the power station at Anderson. There are seven sub-stations on this division, each located near one of the smaller cities through which the road passes. The sub-stations contain rotary converters, each of 250-kilowatt capacity, and they also have regulating storage batteries of 320 ampere-hours' capacity. The Indiana Union Traction Company connects at Indianapolis with several other important interurban roads, all using, as the Indianapolis terminal, the new station completed about three months ago by the Indianapolis Traction and Terminal Company. This station embodies those features desired in a union station, comprising a commodious train shed, waiting rooms, ticket offices, and all of the conveniences expected in a well-designed steam-railroad station. The train shed has a capacity of 50 cars at one time, and several thousand passengers can be easily handled. From this station hourly trains can be taken for most of the important points in central Indiana and a few in neighboring states. Limited service, in which speeds of 60 miles per hour are frequently reached, alternates with the local or accommodation service, providing for through passengers as well as those who desire to ride but a short distance. The rates on these roads are much lower than upon steam lines, and they are well patronized.

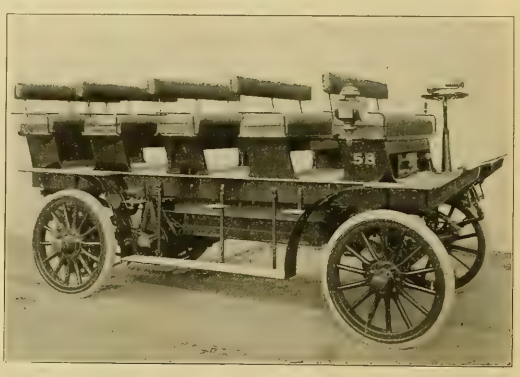
ELECTRIC-RAILWAY TERMINAL STATION AT INDIANAPOLIS.

### The Alumino-thermic Process.

Among the developments of the year in the line of electrometallurgy, the one of greatest interest to the electrical engineer, especially if he is interested in railway work, is the alumino-thermic process of Dr. Hans Goldschmidt. This process involves the utilization of the energy stored in metallic aluminum for the production of high temperature. The substance known as "thermit," consisting of powdered aluminum and iron oxide, is used already to a considerable extent for welding steel rails. The simplicity of the process enables it to be employed where the more elaborate methods of welding would be out of the question. For the welding of rails a steel mold is clamped about the joint, and into this is poured the molten metal directly from the crucible, in which a small amount of thermit has been ignited. Many other applications of this material are being developed, and this is very fortunate for the aluminum industry, which is said to feel already a stimulation, due to the demand for aluminum to be used in the manufacture of thermit. As the demand for aluminum has not been increasing very rapidly, a new development of this kind will be very welcome to those interested in producing this metal.

### Electrical Exhibits at St. Louis.

No better way of becoming acquainted with the status of electrical engineering in 1904 could be afforded than that presented by the exhibits at the World's Fair at St. Louis. Naturally the exhibitors strove to show the recent advances made by them in their several branches of the art, while the exposition management made a special effort so to group the exhibits that they would convey a distinct impression of progress in each department. Hence it was possible to cover the field of electrical engineering systematically and with economy of effort.



ELECTRIC BRAKE FOR 20 PASSENGERS (WITH CANOPY TOP REMOVED).

While such undertakings as those already described could not be represented by material exhibits, there are a number of achievements which lend themselves particularly well to this purpose. A general survey of these will be helpful in connection with this review. In order to systematize this survey it will be well to divide all of the exhibits into the following classes: Power generation and distribution, transportation, mechanical applications of electric power, communication, and lighting.

The power plant of the Exposition, which served both for exhibit and for the furnishing of the necessary power about the grounds, was the largest ever installed for temporary use, and it was in every way a model plant. Naturally, one would have expected to see the steam turbine as a prominent feature in the service plant, but while some excellent examples were shown as working exhibits, the main dependence for power supply was placed upon the reciprocating type of engine. The large service power plant installed by Westinghouse, Church, Kerr & Co., consisted of four marine-type engines with direct-connected generators of a total capacity of 8,000 kilowatts, generating three-phase alternating current at 6,600 volts and 25 cycles per second. This plant supplied power for operating the 2,000-horsepower induction motors used for driving the turbine pumps which supplied water for the cascades. It was also connected with a high-pressure distributing system which furnished current to the various sub-stations about the grounds. At these sub-stations the power was converted into the particular form required for the local service. One of the most interesting of these sub-stations was located in the Palace of Electricity. Here the alternating current was reduced in pressure and part of it was converted into direct current in rotary converters and motor transformers for use about the building. A complete conduit system connected the power plant with the sub-stations, so that no wires were visible about the grounds except in out-of-the-way corners.

One of the most interesting features of the power plant, all of which was located in the Palace of Machinery, was the large Allis-Chalmers combined vertical and horizontal engine driving a Bullock generator. This engine may probably be said to be the largest single unit ever operated at an exposition. The capacity was rated at 3,500 kilowatts, but this was frequently exceeded when the unit was carrying approximately 6,000 horsepower of lighting load used to illuminate the buildings at night.

The third section of the plant was the direct-current installation, furnishing power to the Intramural Railway. It consisted of seven Crocker-Wheeler generators of the railway type, directly connected to various types of engines and one to a waterwheel, the whole forming not only a useful power plant, but an instructive exhibit.

Aside from the machinery described, which furnished power to the Exposition for general purposes, a large number of other engines supplied power for exhibitors' use. The gas engine did not make the showing at the Exposition that was expected in

view of its recent rapid development, although there were some very fair factory working exhibits in the line.

Transportation received a great deal of attention at the Fair, and the importance of this great industry was strongly emphasized. About the ground could be seen several examples of electric transportation. Upon the lagoons, the electric launches demonstrated the practicability of the mode of locomotion. The launches were each equipped with 24 cells of storage battery, each of the rated capacity of 140 ampere hours. These operated two horsepower motors and the boats were built to maintain a moderate speed and to travel as much as 100 miles on a single charge.

On the roadways various types of automobiles gave satisfactory service carrying up to 40 persons each, in a few cases. These vehicles made about 25 miles on a battery charge.

The Intramural Railway was another exhibit on a grand scale, while at the same time it was a profitable investment for the Exposition company. The cars were supplied by the St. Louis Car Company and had a length of 44 feet over all. They were equipped with four G. E. No. 70 motors, and the multiple-unit control system was employed. At certain hours of the day two or more cars were used

located north of the Transportation Building. Upon these tracks was also shown a small single truck

ture of this equipment was the magnetic track brake of the Westinghouse Traction Brake Company. In this brake a powerful electromagnet grips the track when the motor current is turned into it. This magnet, through the system of levers, applies the wheel brakes and automatically regulates the pressure thereon. The amount of current furnished to the solenoid by the motors is determined by the voltage controller, which diverts part of the motor field current in case the armature voltage becomes excessive. In this system the braking is produced by the wheel brakes, by the track brakes and by the back torque of the motors.

The Palace of Electricity also contained a number of examples of recent progress in transportation. The three companies which are manufacturing electric-railway motors at the present time—the General Electric Company, the Westinghouse

kinds of aerial supports for the antennæ were em-

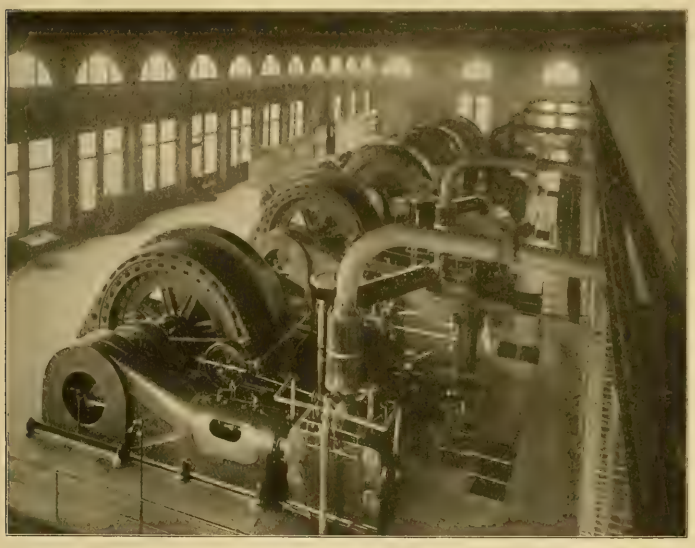
for experimental purposes. The "wireless" tower from which the press dispatches were sent daily, was a center of great interest, and the hissing sound of the signals could be heard for a long distance. On Electricity Day, September 16th, the De Forest company dispatched messages between St. Louis and Chicago, probably

to that date. The Marconi company also had an instructive exhibit on a much smaller scale.

The telephone was most instructively exhibited, as several of the companies had in operation regular exchanges of considerable size. The most recent improvements in manually operated switchboards were shown and the automatic telephone was represented by a complete exchange connecting various points in the Palace of Electricity.

The field of telegraphy was represented also in a commercial way. Both the Western Union and the Postal Telegraph-cable companies had large working exhibits which did a regular business at the same time. The Yetman typewriter and device for sending telegraphic messages was well represented. This invention is making rapid progress in replacing the simple Morse key still used in large numbers. The Yetman machine resembles an ordinary typewriter in appearance and action, but, in addition to writing out the messages, it also transmits to the circuit the dots and dashes of the Morse code much more rapidly than is possible by hand. It is becoming increasingly popular with operators. Mr. P. B. Delaney was present at his exhibit in the Palace of Electricity, showing in operation his automatic system of machine telegraphy. In the Delaney system a perforated tape is prepared by means of a special punch, and this is fed into the sending machine at a very rapid rate. The circuit contact is made by spring fingers which press upon the paper and complete the circuit through the perforations. The message is received upon an electrolytic tape, and it is possible to send as many as 2,000 words per minute.

The interior of the Palace of Electricity at night was a revelation to those who were not familiar with the rapid strides electric lighting has made within the last year or two. The most conspicuous was the Cooper Hewitt mercury arc vapor light with its green color. Mercury-vapor lamps were shown both by the Westinghouse and General Electric companies. This light is meeting with favor in localities where its actinic value can best be appreciated. For photographic purposes it is unequaled, and photographers are now absolutely independent of sunlight. The lamp is simple of operation and surprisingly economical of power. It is much more efficient as a lighting source than the arc light, or even than the Geissler tube. The claim is made, and apparently well substantiated, that but one-half watt per spherical candlepower is required. The commercial application of this lamp is progressing satisfactorily, and it will undoubtedly be one of the features of the lighting of the near future. Another novel, interesting and efficient light source which is just beginning its commercial life is the magnetite arc. This light, invented by Mr. C. P. Steinmetz, employs one copper and one magnetite terminal. The arc has a bluish color, and it is a highly efficient source of light. It differs from the carbon arc in that the arc is the light source, while in the latter case the light comes from the positive carbon almost entirely. The consumption of the magnetite is very slow as compared with that of carbon in the open



RECENTLY COMPLETED POWER STATION OF INDIANA UNION TRACTION COMPANY AT ANDERSON, IND.

in each train, so that the multiple-unit control, as well as the Christensen multiple-unit air-brake system, was given a satisfactory public trial.

The Palace of Transportation contained a number of electrical features. Each of the large car building companies had instructive exhibits, notable among these being that of the St. Louis Car Company, which showed by actual models the development of the street-railway car from its earliest days to the present time. The John Stephenson Car Company, with an eye to the future, had designed and constructed a car for the speed of 120 miles an hour. This was noticeable, on account of the sharp ends, intended to reduce the head air pressure. The body was mounted upon six-wheel trucks, and it is the intention to install upon each car four motors of a total capacity of about 800 horsepower. Another car built for the Scioto Valley Traction Company by the American Car and Foundry Company, was the most liberally supplied with motor power of all the cars upon the grounds. The four 125-horsepower General Electric motors were controlled by the new multiple-unit system of this company, the very large currents handled making necessary the use of a double set of contactors.

The exhibit of the J. G. Brill Company was very complete, showing several new types of street-railway cars. A very modern type of interurban car was one of an order of 20 recently built by the Cincinnati Car Company for the Indiana Union Traction Company. The body is divided into two compartments, the forward one being for smokers, and luxuriously furnished. The fittings were arranged for buffet service. This car was equipped with four Westing-

Manufacturing Company and the Bullock Electric Manufacturing Company—all showed examples of the most recent types of motors. The General Electric Company, among its interesting features, had a working exhibit of an equipment similar to that furnished for the New York subway. The 200-horsepower motors were controlled by the latest automatic system with an accelerator, in which the rate of acceleration is limited by the draft of current, being entirely independent of the will of the motorman. The Westinghouse company also exhibited its automatic system of control known as the turret type, so called from the arrangement of the switches in turret form. This system differs from that of the General Electric Company in that the switches are operated directly by air cylinders and pistons, while in the latter case the motive force is furnished by solenoids. The Westinghouse company also showed a series alternating-current motor in operation, a fact which may be taken as typical of one of the most important advances of the year. The Bullock company is a newcomer in the field of electric-railway motor building, but it was able to show its ability to equip cars with direct-current motors of a satisfactory type.

In the application of mechanical power for the driving of machinery, particularly in moderate and small sizes of units, it has come to be a general rule that the electric motor will be used in one way or another. If the machine tool is large, it will have one or more electric motors of its own. If a number of small machines are to be driven, they may have individual motors, or, more probably, they will be driven in groups. The induction motor and the

carbon arc, and the luminous efficiency produced is very great.

The yellow light of the Bremer flaming arc was conspicuous by the side of its whiter neighbors. This lamp has also a very high efficiency, the light being produced by the consumption of luminous substances in the arc. This light is also one of the newcomers in this field, and it emphasizes the demand for a better light source than the ordinary incandescent lamp or even than the fairly efficient carbon arc. The Nernst lamp has made the progress which was predicted for it upon its appearance a few years ago. It is now a considerable feature in the lighting business of this country, and it can no longer be considered as in the experimental stage. The most recent improvement in the light source has been the perfection of the multiple-glower type for operation upon 110-volt circuits. Another improvement has been the introduction of a device for switching part of the glowers out of the circuit when a reduced light is desired. The extent of business in Nernst lamps can be seen by the statement that there have been nearly 400,000 glower units placed in service in this country for various classes of lighting. The newer lights just described represent the important novel recent developments, but the fact should not be overlooked that the standard arc and incandescent lamps have been improved in quality until they are well-nigh perfect in their several classes.

ELECTRICAL CONGRESS AND OTHER GATHERINGS.

In the preceding paragraphs the attempt has been made to show by the study of the exhibits at the World's Fair the most conspicuous electrical advances of the year. The contributions which have been made through the medium of the Exposition of the science and art of electrical engineering are of great importance. The material exhibitions, however, are not of more importance than the gathering of the scientific workers in the congresses and conventions. The most far-reaching and general congress, the climax of all the conventions of the summer, was that of the arts and sciences. The method pursued in the organization of this monumental gathering was to secure from a recognized master in each of the various arts and sciences a resumé of the recent progress in his particular field of research. This undertaking was carried out precisely as it was planned, no expense being spared to make it a complete success. Engineering and the scientific aspect of electrical engineering were included within the scope of this congress.

Of greatest immediate interest and practical use to the electrical engineer was the Fifth International Electrical Congress, with its Chamber of Delegates appointed to officially represent the several countries which unite to promote scientific progress. The president of the Congress was Professor Elihu Thomson, with Dr. A. E. Kennelly as general secretary, and Mr. W. D. Weaver as treasurer. The vice-presidents were Mr. B. J. Arnold, who was president of the American Institute of Electrical Engineers; Professor W. E. Goldsborough, chief of the Department of Electricity of the Exposition; Professor H. S. Carhart, Dr. S. W. Stratton and Mr. C. F. Scott. The remarkable number of upward of 2,000 members were accepted by the Congress before the sessions began. The papers for the Congress were written upon invitation, and the responses reached over 150. In connection with the Congress were held several joint meetings, one being of the American Institute of Electrical Engineers; another of the American Physical Society with the corresponding section of the Congress; still another, that of the American Chemical Society with the electrochemical section. Still another joint meeting was held between the Municipal Electricians and the section upon electric communication. Finally, and most important of all, was the joint meeting of the American Institute of Electrical Engineers, the Institute of Electrical Engineers of Great Britain and the section, dealing with electric transportation, the time of this meeting being devoted to the practicability of alternating-current electric motors. It is evident from these remarks that the Congress was by all means the most successful ever held.

In connection with the Congress, a very successful tour was conducted for the benefit of the foreign visitors, among whom were very many distinguished engineers and teachers, such as Dr. Svante Arrhenius, from Sweden; Professor Moise Ascoli, from Italy; Professor Luigi Lombardi, from Italy; Lieut-Col. Crompton, from England; Dr. H. T. Barnes, from Canada; Professor John Perry, from England, and Professor Guido Grassi, from Italy; and many others equally distinguished.

The action of the Chamber of Delegates of the Congress was simple, but very satisfactory. It was so recently taken that it will not be necessary to recapitulate it here.

In addition to the congresses which have been mentioned, there was held a most successful engineering congress, which, as the name implies, dealt with all branches of engineering, including electrical engineering. There were also a number of conventions of the technical societies and of the business associations, which were enthusiastically supported.

WELDING A RAIL JOINT BY THE GOLDSCHMIDT ALUMINO-THERMIC PROCESS.

During the summer the Electric Railway Test Commission, appointed by President Francis, for the purpose of utilizing the exceptional opportunity afforded by the presence of the large collection of railway apparatus, was at work testing the performance of the various exhibits. The commission was composed of Messrs. J. G. White, H. H. Vreeland, J. H. McGraw, W. J. Wilgus and George F. McCulloch. The executive committee consisted of Professors W. E. Goldsborough, H. H. Norris, B. V. Swenson and H. T. Plumb. These were assisted in an advisory capacity by a large number of operating engineers and manufacturers, and in the actual testing by a number of young men from the technical schools. The report of this commission will be issued shortly, comprising the results of the various lines of tests.

This review would not be complete without mention of the Edison anniversary and the founding of the Edison medal. The year 1904 included the twenty-fifth anniversary of the introduction of the incandescent lamp. A large number of those who had been associated either directly or indirectly with Mr. Edison proposed to celebrate this event by the founding of a medal to be awarded to a student from a university or college of the United States or Canada, in which there exists a regular course in electrical engineering, for the production of the best thesis upon an original subject. This medal was instituted at the annual dinner of the American Institute of Electrical Engineers, held on February 11th, at the Waldorf-Astoria in New York, at which Mr. Edison was the guest of honor. This dinner proved to be one of the most noteworthy meetings in the history of electrical engineering. About 500 guests met to do honor to the great inventor. The importance of the incandescent lamp to the welfare of the country was made evident by the statement that in the 25 years since its introduction, the consumption had grown from nothing to 30,000,000 lamps per year in this country. The founding of the medal, the custody of which was assumed by the American Institute of Electrical Engineers, will undoubtedly have great influence in the production of satisfactory theses in our technical schools.

## Electrical Exports of 1904.

With an estimate for the month of December, the total value of the electrical exports from the United States for the year just closed can now be presented. The amount is $10,960,231, the largest of any year on record. In 1903 the amount was $9,856,047; in 1902, $9,997,195, and in 1901, $7,452,783. The following table shows the value of electrical exports from the United States by months for the year 1904, with December estimated. The first column of figures represents goods classified as electrical appliances, which includes telegraph and telephone instruments; the second column is for electrical machinery, and the third gives the totals.

ELECTRICAL EXPORTS BY MONTHS IN 1904.

| | Appliances. | Machinery. | Totals. |
|---|---|---|---|
| January | $ 375,044 | $ 455,091 | $ 830,135 |
| February | 370,880 | 510,707 | 881,587 |
| March | 334,224 | 596,073 | 930,297 |
| April | 311,440 | 530,276 | 841,716 |
| May | 292,997 | 517,961 | 810,958 |
| June | 374,557 | 598,541 | 973,098 |
| July | 369,614 | 493,372 | 862,986 |
| August | 340,254 | 486,361 | 826,615 |
| September | 349,421 | 492,415 | 841,836 |
| October | 352,404 | 661,267 | 1,013,671 |
| November | 459,476 | 729,856 | 1,189,332 |
| *December | 413,000 | 545,000 | 958,000 |
| Total | $4,343,311 | $6,616,920 | $10,960,231 |

*Estimated.

The total figures for the year 1903 were as follows: Appliances, $4,751,545; machinery, $5,104,502; total, $9,856,047. Goods classified as electrical appliances thus show a slight falling off for 1904, as compared with 1903. Electrical machinery, however, shows the large gain of $1,512,418. As official figures are not yet available for the month of December, further comparisons will be for the first 11 months of 1904.

Considering the department of electrical machinery only, the large gain in electrical exports for the year 1904 over previous years may be attributed to the exceptionally strong buying of Japan. That country alone imported electrical machinery during the first 11 months of 1904 to the value of $1,104,290, as compared with $272,103 for the corresponding period in 1903. For the first 11 months of 1904 British North America was the largest purchaser of electrical machinery from the United States, having imported $1,499,480 worth. Japan was second; the United Kingdom third, with $1,100,022; Mexico fourth, with $605,591, and British Australasia fifth with $321,980.

## Ohio Interurban Meeting.

The regular monthly meeting of the Ohio Interurban Association was held at the McKinley Hotel in Canton last week. About 25 roads were represented. The subject that took up the greater part of the time was "interline ticketing," or a long-distance ticket that could be used over a number of roads. A rather complicated ticket was presented, but this was simplified in many ways, and the contract, or rather rule, was made brief and to the point. The suggestion that the class of the ticket be printed thereon was not well taken. Nothing on the ticket will show that it is limited to any certain time, but the general rule will make it good for 30 days after the date stamped on the back. Some privileges will be allowed passengers that steam roads do not permit. The purchaser will not be required to sign it.

Each coupon will show what road sold the ticket and over what line it may be used. All accounts will be settled by balance at the end of each month, this being considered the best manner of disposing of the matter for the present, at least. Two colors of paper will be used for tickets—gray for round trip and blue for single trip. Like everything else that has been done by the association, the use of the ticket is not compulsory on the part of the members, but it is recommended that all use the form as the best and most convenient that can be devised. It is believed it will promote business and prove a good plan.

The uniform baggage question is causing considerable difficulty, and the association has not yet been able to settle upon a satisfactory method of handling it. Five more roads have become members of the association and nine new members have been admitted. The next meeting of the association will be held in Dayton.

# BRITISH ELECTRICAL ENGINEERING DURING 1904.

[From the London correspondent of the Western Electrician.]

For several years one particular branch of the electrical industry in Great Britain has called for special mention, but during 1904 interest has been more generally sustained. Upon the commercial and industrial side a not particularly happy state of affairs has existed. For one reason or another the large firms have been in low water compared with the past, but it is satisfactory to note that toward the end of the year a change for the better set in. In seeking for a cause for the depression there is an old friend, "foreign competition," to fall back upon, but there is reason to believe otherwise this time. It has been suggested that the great public has given to Mr. Chamberlain's fiscal policy has created an uncertainty as to the future, which has tended to disturb the equilibrium; but little weight need be attached to this so far as electrical engineering is concerned. One effect, perhaps, of the Chamberlain propaganda has been to stay the hand of promoters of electrical schemes, for the parliamentary session of 1904 was probably the dullest on record for many years.

There has been a great outcry again in connection with municipal trading, but in rather a different direction, viz., an agitation is growing in volume against the reckless expenditure now being indulged in by local authorities all over the country, and as a consequence everything points to a suspension of all but absolutely necessary public works in the near future. A further curb has been put upon municipal expenditure by the great vigilance of the officials of the Local Government Board, who, when called upon to investigate applications for loans for electrical purposes, now test the estimates put before them in a manner somewhat disconcerting to the authorities concerned, but, it must be confessed, to the benefit of the ratepayers. The eminently satisfactory feature of the year has been the enormous progress which is being made in the colonies, and a large proportion of the orders for which, happily, have found their way into the hands of home manufacturers. Details of the technical progress are given below.

### Supply of Electric Current.

The advent a few years ago of the large electric-power companies for supplying electrical energy over large areas demonstrated the necessity for paying greater attention to the question of high-tension generation and transmission than has hitherto been the case. The year 1904 has probably seen the first signs of what the electric-supply [central-station] business in Great Britain will evolve itself into, at any rate for some years to come. To mention only a few typical instances, one has only to refer to the Carville power station erected by the Newcastle Electric Supply Company for the purpose of supplying current to the North Eastern railway, the Chelsea power station for supplying current to the District railway as well as the tube railways controlled by Mr. Yerkes, the Neepsend station of the Sheffield corporation and the Dublin three-phase station. Probably, however, we shall have to look to the power companies' stations for guidance as to what the future electric power station is likely to be, and the two views given of the North Metropolitan Electric Power Supply Company's generating stations may be regarded as more or less typical of what has been accomplished during the last twelve months.

The Willesden station probably contains the most interesting features, as it is one of the very few instances in this country where double-current generators are employed, and certainly the only one from which any considerable area is supplied. This station as a matter of fact was first designed in behalf of the Willesden Urban District Council and was put into operation some 18 months ago, but it has since been acquired by the power company and is now gradually being brought into use as a portion of their larger scheme, of which the Brinsdown power house forms another unit. This latter, it will be seen, differs in its equipment, containing as it does a number of Brush-Parsons turbine sets. The generating pressure is 11,000 volts three phase 50 periods per second, this being transmitted direct to sub-stations.

Of the remaining power companies only the South Wales undertaking has come into operation during the year. This company, apart from the Newcastle undertaking, has gone ahead much faster than its contemporaries and at present has no less than four main generating plants under construction, and all of them are supplying a certain number of consumers. The largest is at Pontypridd and is, I think, "bulk" supply companies, inasmuch as at present the [illegible] lieries which have never hitherto been afforded the opportunity of [illegible] supply of electric power.

That the methods of the power companies in central-station design as well as generation and distribution of electrical energy are likely to be followed by the large municipalities is evident by the opening of the new high-pressure single-phase [illegible] other corporations find themselves of necessity forced to build new stations to cope with their increasing demand, the same result may be looked for. It is quite unlikely, however, that many of the smaller municipalities which have parliamentary powers will attempt to erect their own works, unless it is absolutely impossible to obtain a supply from a power company. That there must be a number of small continuous-current stations erected is inevitable. Many local authorities are still enamored of the financial advantages of a combined dust-destructor and electricity works, and a few have been opened during the year. There is also the prejudice that still exists against companies of any description in certain quarters to be broken down.

A possibility open to local authorities in the generation and distribution of electrical energy which has only been put into practice in one instance is a combination of municipalities for the purpose in question. A few years ago the Stalybridge, Hyde, Mossley and Dunkinfield local authorities, all in the neighborhood of Cheshire, obtained powers from Parliament to undertake a scheme of electric supply and traction in the four districts named, and the first portion of the installation was opened this year. The generating plant in this instance consists of 750-horsepower triple-expansion engines driving 500-kilowatt alternators generating 6,000 volts three phase at 40 periods per second. Up to the present the scheme has not reached any great magnitude, but only the initial portion has as yet been inaugurated.

In the matter of the details of station equipment one or two points of interest may be mentioned. In the power stations for the London County Council, for Mr. Yerkes' series of railways and for the North-eastern railway the remote-control switchboard has been installed. I believe the principle of this is it being stated that [illegible] into this country [illegible] sets of 1,500 kilowatt capacity are now being in-

The question of the conversion of our [illegible] steam railways to electric traction has again occupied the attention of traction engineers to a very great extent. The year opened with the inauguration of electrical service upon the Northeastern and the Lancashire and Yorkshire railways and will probably close with the operation of electrical trains upon the District railway. The exact position and height of the conductor rails having now been mutually agreed upon by all the steam-railway companies of the kingdom, it only remains for the increased financial prosperity of those few old steam lines now working electrically to be sufficiently demonstrated for a large development in this direction to take place. That success has attended the conversion of the Northeastern railway, the Lancashire and Yorkshire railway and the Mersey railway in respect of their suburban lines is undoubted, but the skeptical are no doubt still arguing that "novelty" traffic has been responsible for much of the increased traffic and prefer to wait for results extending over a longer period. At the same time it is unlikely that anything but suburban lines will be taken in hand for the purposes of electrification in the immediate future, the reason for this being the various opinions held by the responsible engineers as to the most suitable system for the long-distance main lines of the country. To mention only one instance, a well-known electrical engineer advising one of the South of England companies favors the single-phase system with overhead wires, and in this he has many supporters, but until either one particular system demonstrates its superiority over its fellows or in some way a greater degree of unanimity among traction experts is brought about, no movement on

WILLESDEN STATION OF NORTH METROPOLITAN POWER COMPANY (SHOWING DOUBLE-CURRENT GENERATORS).

an extensive scale by the railway companies as regards their trunk lines may be looked for.

The equipment of the Lancashire and Yorkshire railway is in all respects similar to that of the Northeastern railway, which has already been described in the Western Electrician. The District railway, however, differs in some respects, principally in relation to power-house equipment. In the first place, the undertaking attracts attention by reason of there being several tube railways, which will be worked more or less in conjunction with it. All will derive their motive power from the same generating station, which consequently will be the largest of its kind erected purely for railway purposes. The design of the power station is due to an American, Mr. J. R. Chapman of Chicago. Eventually there will be no less than 80 Babcock & Wilcox boilers, which—an unusual feature for this country—are arranged on two floors. Westinghouse-Parsons turbines are installed, the generators being 5,500-kilowatt three-phase machines generating at 11,000 volts, the frequency being 33 1-3 periods per second. There will, of course, be numerous sub-stations in connection with the various railways served by this power house. The equipment of the tracks of the District railway is almost complete and the new trains are expected to be running early in 1905.

AN ENGLISH HIGH-PRESSURE SWITCHBOARD.

The construction of the various tube railways is also in an advanced stage. The Metropolitan railway (which has no connection with Mr. Yerkes, but which is joint owner of some of the District Company's lines) is also well forward with its reconstruction for electrical working, trial trips having been made some weeks back. The power station which this company has erected at Neasden, although designed in a somewhat different manner, contains the same type of machinery, viz., Westinghouse-Parsons sets. The Great Northern and city electric railway, running from the northern suburbs of London to the city, was opened in February. Although called a "tube" railway, the tunnels are as a matter of fact 16 feet in diameter, the full size of a steam railway. The object originally was to run both steam and electric trains over these lines, but for some reason the arrangements between the two companies were not concluded. Before completing this section on railway traction mention should be made of the enterprise of the Northeastern railway in dealing with its freight traffic. During the year locomotives have been delivered upon the Newcastle lines for dealing with this traffic which are equipped with both the third-rail shoe and an overhead attachment, the object being to run the same locomotives over the passenger lines, which are equipped with the third rail, and also over the purely freight lines, which are now fitted with overhead wires. The view of the locomotive given herewith, however, shows the overhead attachment tied down as it will be when passing over the passenger lines.

The development of electric tramways in Great Britain nowadays follows such standard lines that it is mere repetition to deal with it at any length. One of the outstanding features of the year, however, has been the prominence given to and the success achieved by Mr. J. S. Raworth's system of regenerative control for electric tramway motors. The principle of this system is that the current generated by the motor going down hill, in addition to braking, also returns to the line. In a description of the system given before the Society of Arts it was stated that the regenerative motor differs from the series motor principally in the field windings. As far as its general construction is concerned, it is a series motor, and the details of construction in many of the motors in use for series control are said to be exceedingly well adapted for regenerative requirements and give excellent results in practice. The field windings are composed of shunt and series coils, wound and insulated separately from each other.

Another event of the year in the tramway world was the fight between the Newcastle corporation and the local company outside its boundaries on the question of whether there should be reciprocal running powers. There are several instances in this country where mutual running powers have been arranged, but at Newcastle no agreement could be come to, and the company took the matter to Parliament. The affair lasted for many months, and although eventually the company was victorious in carrying its point, the proceedings showed in a strong light the unhappy relations existing between municipal and private enterprise in this country.

A matter over which many people find cause for complaint is the belatedness of the report of the Royal Commission on London Traffic. The commission ceased to take evidence in June last, but up to December 10th, when this is written, the report had not been presented. The reason for complaint is that for many years schemes of locomotion in London have been put back, and the Royal Commission has added another three years to the delay already occasioned by other circumstances.

During the year two other towns have emulated the example of Wolverhampton and decided to adopt a surface-contact system. Torquay corporation has entered into an agreement to adopt the Dolter system, and the Lincoln corporation has signed a contract for the installation of the Griffiths-Bedell system. In this connection it may be mentioned that all the old Wolverhampton horse lines have now been converted to the Lorain surface-contact system.

The Board of Trade, chiefly with a view of minimizing danger to the public, has issued certain new regulations. The carriage of goods upon tramways has been developed to a degree hitherto considered impossible, while the adoption of double-deck covered-in cars is spreading rapidly. Glasgow, Liverpool, Sheffield and numerous other places have them in use very extensively.

### The Power Companies.

Apart from the technical questions concerning the power-supply companies dealt with in the early portion of this article, there has been considerable progress on the commercial or business side. The transfer of the municipal works at Willesden to the North Metropolitan Electric Power Supply Company has placed this concern in an advanced position so far as the means for the supply of energy are concerned, although at present the bulk of its supply is taken by the North Middlesex tramways and the Willesden Council. Away from London, the Yorkshire and South Wales schemes are well forward. The former is particularly well favored, owing to the number of small local authorities owning powers to supply electricity, but with whom it would not be good policy to erect their own works. These authorities are coming to agreements with the company rapidly, while the cotton and other industries in Yorkshire will also prove a fruitful source of revenue to the company.

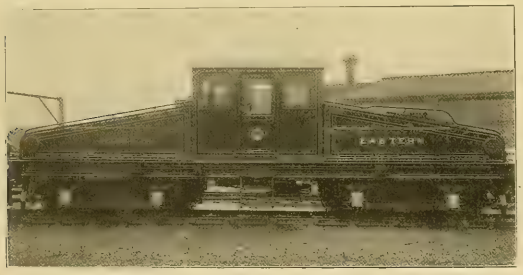
The South Wales scheme is noteworthy by reason of the numerous collieries, iron works and the like already taking a supply. In this case also evidence is already at hand that the very small municipality can deal profitably with the company and another has just received parliamentary powers on the understanding that it take its energy from the company. Early in the year a huge scheme for the North of Wales stone quarries, etc., was authorized, and here overhead wires have been authorized for the first time under such circumstances. Energy will be generated by means of waterpower.

### Telegraphy, Telephony and Space Telegraphy.

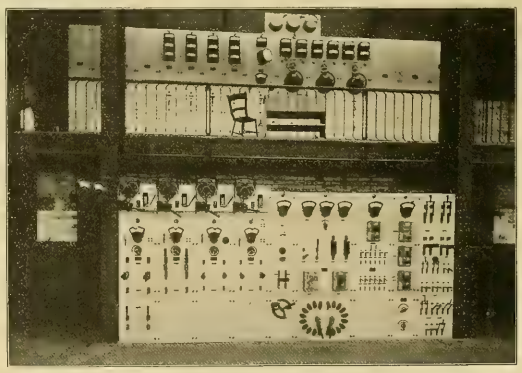
The competition of the all-British Pacific Cable with those of the Eastern Telegraph Company has been a source of some discussion. The financial results of the working of the Pacific cable have occasioned serious consideration by the home country and the colonies and a conference has been called, but once or twice postponed. There has been an actual loss of some $500,000, and during the present year a further deficiency of $450,000 is anticipated, and this will have to be borne by the contracting parties in certain agreed proportions.

Further improvements in the communication between the south of England and Scotland have to be recorded. This is a question upon which almost incessant complaints are heard, but the extension of the underground mains will eventually give all the required facilities.

A great deal was said during the parliamentary session as to the acquisition, either by agreement or arbitration, of the National Telephone Company's telephone system by the government, and, owing to various anomalous statements made by ministers,



Electric Freight Locomotive of Northeastern Railway.



Switchboard at Brinsdown Power House of North Metropolitan Power Company.

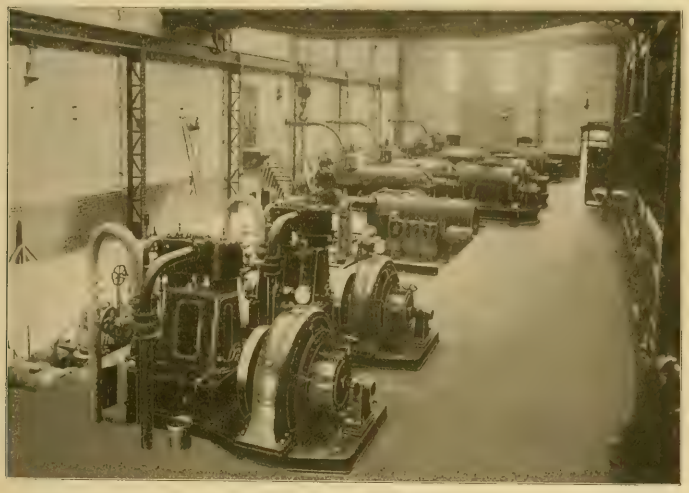
TWO EXAMPLES OF BRITISH ELECTRICAL ENGINEERING.

the public seemed to look for a definite pronouncement concerning this toward the middle of the year. Confusion arose as to whether it was proposed to purchase the London system only, or the system throughout the country, and it is doubtful whether anyone outside the cabinet has any clear idea of what is in the mind of the government. The only definite promise extracted from the government was that no agreement or arrangement would be entered into with the company without it being placed before the House for full discussion.

New municipal telephone systems under the act of 1899 have not been conspicuous by their number, only Swansea and Hull having opened their exchanges. At Glasgow it was proposed to change the system of working, but I do not know how far the idea progressed. Certain it is that the financial results in almost all cases have met with much criticism, and much is made of the fact that the period of the license and the period of the loans for erecting the exchange do not, in some cases, correspond. It may fairly be stated that municipal telephony has not progressed to the extent anticipated by the originators of the 1899 act.

The wireless-telegraph act, which was more or less rushed into being at the very end of the last session of Parliament, was the first attempt on the part of the government of Great Britain to secure any sort of control over this branch of telegraphy, although, at the same time, many people hold the view that such control really existed under the monopoly granted to the Postoffice concerning means of telegraphic communication. The act was also noteworthy in being one of the few exceptions in connection with which an explanation is published by the government of the intention and scope of the act. It is, of course, unnecessary to say that the purport of the act is to insure that all installations of wireless telegraphy on British territory shall be licensed, and even experimental apparatus have to secure a license, somewhat modified in character. Following the lead of the mother country, the remainder of the colonies which had not already issued a similar edict, have now done so. This being so, the position of the British delegates at the next conference in Berlin will no doubt be modified to come into line with the act of 1904.

The position of the Marconi company, so far as its relations with the British government are concerned, took a turn for the better at the early part of the year, when it was announced that the Postoffice had intimated a readiness to conclude an agreement which would not only give the greatest satisfaction to the public generally, but would also duly safeguard the interests of the shareholders. Such an agreement, it was pointed out, involved negotiations of a most complicated character, and this can be the only reason which can be assigned for our not having heard more of this matter since early April. Quite late in the year the Marconi company was reported to have sent messages from Cornwall to Italy. In the middle of the year there was some rumor as to the formation of an English De Forest company, but nothing further seems to have been done in this matter.



BRINSDOWN STATION OF NORTH METROPOLITAN POWER COMPANY.

an extensive scale from the point of view of number of installations, great progress is being made in Australia, where the huge scheme of electric supply and traction for the Sydney corporation is nearing completion. The new works which have recently been opened are again the work largely of British contractors, the total cost amounting to over $900,000. A few further instances must also suffice so far as Australia is concerned. There are now 125 miles of electric tramways in New South Wales, and a scheme for the electrification of all the South Australian railways and tramways has just been presented. The city of Melbourne has sanctioned an additional expenditure of $125,000 upon its electrical undertaking, $150,000 is to be borrowed for the Launceston undertaking, while the Newcastle scheme is to be reorganized.

In the above I have merely picked at random some of those places where progressive movements have been manifested during the year, not with the idea of giving a complete account, but just to give a general idea of how the colonies are following closely the policy adopted at home and abroad in electrical matters. In fact, a few years will probably suffice to bring all the important colonies on a level with Great Britain in the matter of electrical supply.

### Miscellaneous.

The fact that the government introduced a bill for the much-desired amendment of the electric-lighting acts, and after putting many people to much expense, abandoned it for a second time, caused much dissatisfaction, especially as one of the evils which the new bill would have removed had cost two electric supply undertakers, just previously, several thousands of pounds. This was as regards vibration from electricity works, the law concerning

and this year a new station was opened, the machinery being [illegible]

In addition, however, it is proposed to spend some $500,000 upon the electricity undertaking in Cape Town. The number of other towns in South Africa installing either electric lighting or tramways, or both, would be too great to give in detail, but a few samples will serve to show the state of the industry there—a condition of affairs which has largely come about during the year. A large and interesting gas-engine scheme is in hand for Johannesburg, and the same town has received sanction to borrow $[illegible] for the extension of the subscriber telephone exchange. At Port Elizabeth a scheme involving the employment of three 400-kilowatt steam-turbine generators has been accepted, and at Bloemfontein a system of electric tramways has been sanctioned.

In a similar way, although perhaps not upon such

sham, on the northwest coast of England, by the Midland Railway Company, while the Admiralty has in hand an equally complete scheme for the whole of the naval dockyards and workshops.

With regard to lamps and lighting, quite a number of new types of arc lamps have been introduced, mostly, however, of foreign or American origin. A good specimen of [illegible] put on the market in the shape of the Foster arc lamp which is said to work equally well on both alternating and continuous-current circuits. The Gilbert arc lamp has also been improved and a new attachment added for employment on tramway poles. Improvements on the Nernst lamp have also been effected, and although perhaps not quite so much public lighting is now being carried out by this lamp, yet the prospects for the sale of the lamp generally continue to improve.

In the motor-car industry little progress has again to be reported, and the motor-car act of 1904 seems hardly to have minimized the number of accidents, through furious driving. For the reason stated above, the electric car is seldom a culprit.

The Engineering Standards Committee has continued its useful work, and in electrical engineering has evolved a series of standards for generators, motors and transformers, after a lengthy conference with manufacturers, consulting engineers and others.

The bill which was introduced into the House of Lords, to legalize the metric system of weights and measures was abandoned by the government, after a committee of lords had spent several days considering it, Lord Kelvin being a member.

Beyond sharing in the general industrial depression, the electrical industry has had little to complain of during 1904. G

## Annual Dinner of the Institute.

The annual dinner of the American Institute of Electrical Engineers will be given in the ballroom of the Waldorf-Astoria, New York city, on February 8th and promises to be a most interesting occasion. In view of recent electric-railway developments the Institute has decided to devote this dinner to emphasizing the triumph of electric traction. A number of pioneers and leaders will be present, an original menu has been designed and some novel features will be introduced, while the list of speakers includes men of national and international reputation. The dinner will be served for $5 per cover without wine or cigars, and, as is usual on these occasions, ladies will be present. Notices will be sent to the members forthwith, and it is requested that an early response be made in order that proper care can be taken of all applications. Over 400 were seated at the Edison dinner last year, and the attendance in February promises to be equally large.

The utilization in France of the mountain streams and glaciers for furnishing power in the development of electrical energy is attaining large proportions. A late achievement is the lighting of the entire city of Grenoble by electricity generated 27 miles away. Ornate standards, 30 feet high, with curving pendants terminating with powerful arc lights, have been erected in the streets. Sixty dollars is the cost of installing and lighting a single lamp for a year, but the subsequent cost, for lighting simply, will be comparatively small, it is said.

# ELECTRICAL PROGRESS OF 1904 ON THE CONTINENT.

By A. De Courcy.

Progress in electrical affairs has been generally good in the leading countries of Europe during the last year, both from a commercial and an engineering standpoint. From the number of new enterprises which are starting up, we may argue a greatly increased market for electrical apparatus in the ensuing period. This is especially to be noted in the case of electric traction and space telegraphy, as well as the use of hydraulic power.

As regards France, the American companies are securing a good share of the business. This is mostly divided between the Westinghouse and the Thomson-Houston companies. The former is now well established in the large works at Havre, and recently built part of the equipment for the Paris subway. It is making a new move in the way of gasoline automobiles, and is just entering the market with the new Schmid car, which promises to be a success. The Thomson-Houston Company also turned out considerable apparatus for the subway at its Paris factory. Besides tramway outfits for the French market, it is building a considerable number of machines for its Mediterranean branch company, which is making installations in Italy and Greece. A group of French and Chilian capitalists has lately formed a company at Paris for operating the extensive copper mines of Chili. These gentlemen are designing an electric blast-furnace method, using a waterpower plant for the current. The lighting of Paris is a question which the municipality is now considering, as the contracts of some of the leading companies will soon expire, and a new regime will have to be looked for. To this end a technical commission has been formed, headed by Professor Mascart.

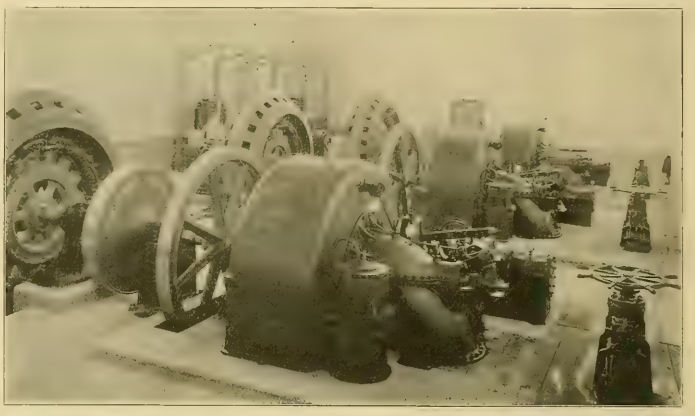
The electric companies of Germany have now almost entirely recovered from the effects of the recent crisis, and trade is reported to be generally good, although the profits are not large. One of the leading commercial events is the combine between the Allgemeine company and the American General Electric Company. The working territory of each is to be defined, and in some cases they will work in common. The European Thomson-Houston companies are naturally included in the agreement. Besides, the Allgemeine is to go extensively into the manufacture of steam turbines, and for this purpose it is forming branch companies. It has also made a combine with the Brown-Boveri concern, and expects to buy up a great number of steam-turbine patents.

Electrical trade in Italy has been very satisfactory during the year. It has been so far divided mainly between the American, German and Swiss companies, but some new Italian enterprises are starting up, especially in Milan, where three large firms have made a combine. An increasing market for apparatus is promised, in view of a number of new enterprises. For instance, the government is to construct five long interurban telephone lines. Electric traction will be used on part of the Adriatic railroad, and this company is also to buy a large number of accumulators. The municipality of Venice is to purchase a number of motor boats.

Russia is showing considerable progress. The electric-lighting plants of St. Petersburg and Moscow are on the increase. The Moscow station is to add two steam turbines and the St. Petersburg three. A leading question is the use of hydraulic power for supplying the latter city, and another project is a 400-mile suspended electric railway from St. Petersburg to Moscow. Electric motors have proved so successful in the Baku oil region that the leading companies propose to adopt them on a large scale.

### Stations and Power Transmission.

Among the large hydraulic plants in the Alpine region of France may be mentioned that of Bournillon. It is located on the Bourne River, from which it obtains a fall of 320 feet. Power is transmitted at 35,000 volts to the towns of Vienne and Romans, lying at 24 and 42 miles, respectively. The station is laid out to receive six turbine-dynamo groups of 1,250 horsepower each. At present three groups are installed (see illustration). The turbines are an example of the latest French manufacture, and are furnished by Bouvier & Co. of Grenoble. They have a new form of automatic speed regulator. The alternators are built at the new factory of Schneider & Co. and deliver 3,800 volts, which is raised by transformers for the long-distance line.



BOURNILLON HYDRO-ELECTRIC PLANT IN ISERE REGION, FRANCE.

The Westinghouse company lately installed a plant in Portugal which supplies current for the new tramway running from Cintra, on the coast, to Praia das Maças, eight miles distant. The station here illustrated contains two generators of 270 kilowatts. These groups supply current at 550 volts for the traction line. An alternator group also furnishes 2,200 volts for the local lighting of Cintra.

Mention should be made of a new gas-engine plant in Russian at Walthamstow, which uses Westinghouse gas engines. Two Dowson gas generators are used here. The three gas engines are coupled to Westinghouse and Helios generators of 80 horsepower, which give 560 volts and 150 amperes. The plant contains two large batteries of 140 Tudor cells each. Current is distributed for local use by five feeders working at 230 volts.

An important hydraulic plant has been lately installed in the Mediterranean coast region of France by the Thomson-Houston company. It is located at Plan du Var, and works in connection with the Mescla and Levens stations. A 90-foot fall is secured for the three 600-kilowatt groups which are to be installed before the end of the year. Turbines of the Francis (Swiss) type, of 600 horsepower, are used to drive three-phase alternators, giving 11,000 volts and 25 cycles. These three plants supply an extensive region.

The new station at Zurich, Switzerland, contains some unusual features, as it uses steam engines combined with hydraulic power. The hydraulic part of the plant consists of 10 turbines driving a common shaft, with two 200-kilowatt steam engines as a reserve. The shaft drives four 200-kilowatt alternators, delivering 2,000 volts. The steam outfit consists of engines coupled to three-phase Oerlikon alternators giving 2,000 volts and 50 cycles.

The use of the new Brown-Boveri-Parsons steam-turbine sets is on the increase in Europe, and the following new plants may be mentioned: The Montluçon Gas Company has one turbine-dynamo of 1,100 kilowatts which delivers direct current at 280 volts. The Société Biterroise uses a turbine-dynamo of 330 kilowatts, giving 1,500 volts. One of the large Paris gas companies has lately installed three turbine groups of 400 kilowatts, which deliver 500 volts for operating the motors throughout the works. The Marly waterworks, near Paris, has a 300-kilowatt turbine and alternator set, working at 500 volts.

While on the subject of power transmission, I may mention a very successful mining plant which is one of a number that the Allgemeine company installed in Germany. The plant here illustrated, the Zeche Recklinghausen, uses an endless cable to elevate the load. The pulley for the cable is driven by a 50-horsepower, three-phase motor, for which current is supplied from a neighboring station.

### Electric Traction.

Electric traction shows important developments during the year along all the different branches. Especially noteworthy is the interest which the different governments are taking in the question of electric traction on the main lines of railroad or

Cintra Tramway Plant in Portugal.

A New Sub-station of the Paris Metropolitan Railway.

the equipment of new electric railroad of consid-
erable length. Thus the Swedish government re-
cently authorized the construction of a central sta-
tion and a special track for testing alternating
current systems. The generating plant at Trol-
hoda will have two De Laval steam turbine sets, fur-
nishing 3,000 volts. This will be raised to 20,000
volts for the line. One of the electric locomotives
is to be furnished by the Westinghouse company,
and it will carry the transformers for lowering the
voltage. The Siemens-Schuckert Company is also
to provide a locomotive, and it is expected that the
Allgemeine company will furnish a passenger train
of two motor cars and two trailers.

The Swiss government is also to make a series
of official tests, and if these are successful it pro-
poses to apply electric traction on a large scale
upon the railroads and utilize the waterpower of
the country. The Oerlikon company has already
built a short section of track for trying its new
locomotives. These will take 1,500 volts single phase
directly from a trolley wire.

In Italy a series of comparative tests are soon
to be made on the Valtelline lines, between the Ganz
three-phase and the Finzi monophase systems. The
latter has been very successful on the Milan tramway
lines. The new Finzi motor car has four motors

NEW OVERHEAD PORTION OF PARIS METROPOLITAN RAILWAY.

of 100 horsepower, using from 200 to 400 volts.
The Ganz Company has already delivered three new
locomotives for the Valtelline system. One of the
novel features is a double motor, consisting of a
high and a low-voltage motor placed side by side
on the same shaft. They are coupled separately or
together, to give different speeds.

Russia is not behind hand in the movement, and
the owners are now preparing to use electric loco-
motives on the St. Petersburg-Oranienbaum line,
one of the Baltic railroads. Electric trains will be
run along with steam trains, and an interesting com-
parison will be afforded. This will help to decide
the question as to the use of electric traction in
the future, especially upon the St. Petersburg-Mos-
cow railroad.

As to recent progress in Germany, I may mention
a new accumulator car which now runs on the Dres-
den suburban line. The car has 184 cells placed
under the seats, and uses 370 volts on the four mo-
tors. The Allgemeine company has recently con-
structed a very complete testing car for use on the
extensive Berlin system. It contains a switchboard
with testing instruments and also a table with a
set of Weston instruments. Different apparatus al-
low the inspectors to make all the needed tests upon
the lines.

In France, the work on the Paris subway continues
to be the most important. One of the new branches
of the subway has lately been opened, and it has
proved a great convenience. The next section is
well under way, and it will have a long overhead
portion, besides two bridges across the Seine, which
are now building. To provide for the increased
traffic, the Metropolitan central station is now
doubling its capacity, while two new sub-stations
have lately been built. One of these is shown in an
accompanying illustration. It receives high voltage
from the main line and lowers it to 500 volts by
a set of Thomson-Houston rotaries. A specially
new feature is the fireproof motor car, which made
its appearance not long ago. The front cabin, con-
taining the apparatus, is built of sheet iron and
asbestos, and an air space separates it entirely from
the body of the car. The Westinghouse company
has furnished a fireproof motor for these cars, de-
signed by Mr. Albert Schmid, which uses an as-
bestos-covered winding.

### Electric Lighting.

The Allgemeine company has had very good suc-
cess with the Nernst lamps in 1904. At present
it manufactures two standard types, one of these
being a large lamp for independent suspension, while
the second type, which is in more common use, can
be inserted in an ordinary lamp socket. Two pic-
tures show one of the new chandeliers with the B-

[illegible]

the Auer Company of Vienna stopped making the
lamps several months ago, as it found that the diffi-
culties of producing the filaments were too great
to make them a practical commercial success. On
the other hand, the Siemens & Halske company has
brought out a new lamp with a filament of tantalum,
or an alloy of this metal, and asserts that it is much
superior to the osmium lamp. A Berlin company
has recently commenced to manufacture a mercury-
vapor lamp on a new principle. It consists of a
glass tube with a bulb at the central part. The
lower part of the tube contains an arc carbon sur-
rounded by mercury. The upper corresponding car-
bon is moved vertically by a solenoid to produce an
arc between the carbons. The arc thus burns in
the mercury vapor which is formed. It starts up
rapidly and gives a very good light, which has the
advantage of containing red rays. Only 0.5 watt per
candlepower is used, and the carbons burn very
slowly. Another new mercury-vapor lamp is made
by Heraeus & Hanau. It uses an inverted U-tube
of quartz, with mercury in each branch. The arc
is formed in the bend of the tube. A special branch
tube, also containing mercury, is used to aid in start-
ing up the lamp.

### Space Telegraphy.

Considerable progress has been made in space
telegraphy during the year in the leading countries
of Europe. In France the government decided to
take control of all such operations in the future, in
the same way as the telegraph lines, and it is now
taking measures to establish a number of stations
along the coast. The first of these, at Porqueralles,
on the north coast, has already been opened for
traffic, and messages can be telegraphed here from
the interior and transmitted to vessels at sea. Later
on the different coast stations will form a network
of communication which will prove of great value
from a military and a commercial viewpoint. Mean-
while, experiments are being carried out near Paris
between two stations 20 miles apart. Here the op-

Type A (of Large Size).

Type B in Electric Car.

GERMAN NERNST LAMPS.

erators of the future stations will be trained and all
the new devices will be tested. The stations now
use the Mors (Paris) apparatus. Captain Ferrié of
the city engineering department has been making
experiments on the Eiffel Tower. A long wire hung
from the tower serves as a mast wire, and signals
can be sent at great distances.

Italy has made a great advance during the year
and is installing a number of large stations. Several
of these are about completed and are to be used for
official and private messages. Of these, the Bari

MINING PLANT AT THE [illegible] SHAFT IS
DORTMUND, GERMANY.

the Slaby-Arco-Braun patents, is said to have no
less than 88 posts in Germany alone, besides many
others in different countries. The German govern-
ment expects to install a number of new posts in
different parts of the country, especially along the
frontier, so that in case of war it will have a system
which is independent of land lines. The Russian
Siemens & Halske company has now formed a spe-
cial branch for constructing space-telegraph appa-
ratus, and recently made a combine with the Berlin
Aerial Telegraph Company. The former company
controls the Popoff system, while the latter owns a
number of patents and has a wide experience. All
the vessels of the Russian war fleet are said to be
equipped with Popoff apparatus. Messages will soon
be sent across Lake Baikal, which will be an ad-
vantage for the Trans-Siberian road. The distance
here is but 25 miles and can be easily covered. The
Slaby-Arco-Braun system of apparatus, constructed
by Siemens & Halske of Berlin, is used in this case.
Each of the posts consists of a central building with
two high masts placed 100 feet on either side and
connected by a wire. Current will be supplied from
a station near the railroad.

[Continued on page 18.]

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## DATES AHEAD.

Michigan Engineering Society (annual meeting), Lansing, Mich., January 11th to 13th.

Nebraska State Independent Telephone Association (annual meeting), Lincoln, Neb., January 18th and 19th.

Northwestern Electrical Association (annual convention), Hotel Pfister, Milwaukee, Wis., January 18th and 19th.

Independent Telephone Association of Wisconsin (annual convention), Hotel Pfister, Milwaukee, January 25th and 26th.

Ohio Independent Telephone Association, Columbus, Ohio, March, 1905.

National Electric Light Association (annual convention), Denver, June 6th, 7th and 8th, and Colorado Springs, June 9th, 10th and 11th.

ELECTRICALLY considered, the year 1904 was a year of important gatherings and of progress in railway and transmission work. In other directions its record was not especially conspicuous. Among the meetings and conventions the most noteworthy was the International Electrical Congress held in St. Louis as one of the congresses of the Louisiana Purchase Exposition. Although negative in official results, this meeting was important in paving the way for a more sensible treatment of the question of uniformity of electrical units by an international commission, which may eventually become permanent. It was also recommended that steps be taken to secure the co-operation of the technical societies of the world by the appointment of a representative commission to consider the question of the standardization of the nomenclature and ratings of electrical apparatus and machinery. About 160 papers were presented to this Congress, and the official report of the proceedings, in three large volumes, which is expected to issue from the press shortly, will be an addition to technical literature of great value.

Other meetings of technical interest were the Boston convention of the National Electric Light Association, the Transmission convention of the American Institute of Electrical Engineers in Chicago and the Vienna tramway conference. Then, too, the meetings of the technical societies of Great Britain, France, Germany and the United States were perhaps of more than ordinary value. The St. Louis Exposition embraced much of electrical interest, including a very striking illumination.

In pure science the year was characterized by continued researches into the phenomena of radio-activity, with much discussion of the elusive N-rays and other alleged forms of radiation even more mysterious. Other subjects of study were the electric charge of the sun, the ionic theory, the phenomena of the earth's magnetism, the electrical conductivity of the gases, measurement of wave-lengths, and the magnetic effect of moving charges. Most of these topics were considered in the section of the International Electrical Congress devoted to general theory.

Railroad men now generally concede that the "electrification" of terminals in large cities and of many branch lines and feeders appears to be inevitable. The work on the terminals of the New York Central and Pennsylvania systems in and near New York city has opened the eyes of many steam-railroad men, hitherto very conservative on the subject. Interurban electric railways are constantly growing in length, importance and efficiency of operation. One of them, near Chicago, now partly double-tracked, is to be ultimately a four-track road. Their managers discuss such subjects as "interline tickets," freight business and baggage handling. The single-phase railway motor has been developed during the year, and is already, if we mistake not, in regular operation, although so recently that no results can be stated. An important event was the opening of the great New York subway in October, while the acquisition of the interesting tunnel system in Chicago by steam-railroad interests was a transfer of much significance. Altogether the electric railway is in a far stronger position at the beginning of 1905 than ever before.

Power-transmission problems were attacked scientifically and effectively in 1904. Voltages up to 80,000 and lengths up to 200 miles are now considered practicable where conditions warrant. Indeed, Mr. Ralph D. Mershon, in a recent paper, sets a limit of about 550 miles—if only the amount of power to be tranmitted is large enough, say 200,000 or 300,000 kilowatts. But this amount is so great that it would seem that Niagara affords the only prospect of supplying it. Very interesting work is under way at Niagara Falls, particularly on the Canadian side, as is shown by the leading article in this issue, but apparently no transmission farther than Toronto—a distance of about 90 miles—is contemplated. The year has also seen transmission work of much importance on the Pacific Coast, in the Rocky Mountain region and in Mexico and other foreign countries. The annual meetings of the Pacific Coast Electric Transmission Association and the two-day Transmission Convention held in Chicago in June indicate the importance to which this branch of the electrical industry has attained.

The year has brought forth nothing startling in electric lighting, although the magnetite arc lamp has attracted attention, and older methods have been improved. The steam turbine is steadily pressing forward; gas engines are employed to an increasing extent, and there is renewed talk of the possibility of a gas turbine. Electric heating shows some progress. In electrochemistry the field is constantly expanding.

In the domain of communication there is not much to report. Rapid telegraph systems continue to promise well—and not to be used to any great extent. The telephone-manufacturing business shows some falling off compared with 1903, due partially, no doubt, to the fact that the Independents have now erected exchanges in so large a proportion of the larger cities that not many strongholds remain to be taken. There still exists, however, an almost unlimited field for telephone extension, for there should be an instrument in the home of every fairly comfortable family in the United States. Automatic telephony appears to be advancing steadily but not sensationally. Space telegraphy can report progress, for it was usefully employed in the early stages of the Russo-Japanese war to transmit messages from newspaper dispatch boats at sea, while later, in the United States, messages were sent overland for distances of 350 miles or more.

Thawing ice in water pipes has excited considerable attention during the year, for the electrical process is undoubtedly the best for the purpose, and it opens a source of revenue to central stations in northern states that is not to be despised.

The death-roll of 1904 embraced, among others, the names of Finsen, von Hefner Alteneck and General Webber abroad, and William Wallace, Gen. C. H. Barney, William O. Garrison, C. D. Crandall and A. B. Cornell at home.

As shown by the Western Electrician's estimates of electrical and auxiliary manufactures given on the opposite page, there was a slight decrease in the value of the output of 1904 as compared with 1903, the respective figures being $230,510,000 and $234,750,000. This is a falling off of but 1.8 per cent., however, and considering the decreased volume of business in all other industries is not a bad showing. Turning to the export trade, it is gratifying to note that the valuation of electrical machinery and apparatus shipped from the United States in 1904 was larger than in any preceding year. This result is largely due to the recent prominence of Japan as a buyer of American electrical machinery. In Great Britain the correspondent of the Western Electrician reports that the electrical interests did not have a prosperous year, while on the Continent, particularly in Germany, commercial conditions in the electrical trade show a decided improvement.

A large portion of the space in this New Years issue is devoted to articles reviewing the electrical history which the year 1904 has made. It has not been a specially noteworthy or brilliant year, but, on the whole, it was far from being a bad one. That 1905 may excel it in every way—that it may truly be a happy year to all to whom these presents may come—is the wish which the Western Electrician extends to its readers.

# STATISTICS OF ELECTRICAL MANUFACTURES.

A light falling off in the value of electrical and closely allied manufactures in the United States is shown by the year 1904 as compared with 1903. The Western Electrician's annual detailed estimates are given in the following table, and the total for the year just closed is $230,510,000, which is a decrease of 1.8 per cent from the $234,750,000 of 1903. This showing is not surprising; the surprise, if any, will be caused by the fact that the shrinkage is not greater, for in all, or nearly all, lines of business in the United States the volume was less in 1904 than in 1903. The electrical industry, in almost keeping pace with the record of the year before, certainly stands well.

An examination of the figures shows that while there has been a falling off in several lines, others hold their own or show a slight increase. Thus, the valuation of steam turbines used to drive electrical generators has more than doubled, comparing 1904 with the year preceding. Vapor lamps, too, have exactly doubled in value of output. Gas engines for electrical use continue to show a steady increase, while reciprocating steam engines exhibit a falling off. Boilers, both water-tube and fire-tube, display a marked gain, but it is possible that the estimates in this line were too low in 1903. Electric fans continue to decrease in value of output, and this fact may be accounted for by the cold summers of the last two or three years. Decreases [illegible] slight gains, while the demand for electrical heating [illegible] whole [illegible] yet the hiatus between these two systems of communication is still very considerable. In other lines there are a few interesting changes in some cases, but in most [illegible] is shown either to be about the same in 1903 and 1904 or to manifest a difference one way or the other which is not especially significant.

The Western Electrician feels that it has a right to take pride in the figures of electrical and auxiliary manufactures given annually in its New Years numbers. These figures are exactly what they purport to be—estimates. But they are very far from being mere guesswork; they are based on estimates furnished by a large number of expert authorities in the various lines of the electrical and allied industries. The mass of figures secured by a careful consideration and collation of these individual estimates is laid before the electrical public while it is fresh and of value in taking stock of the year's progress; and it would be impracticable to secure it in any other way. The table is designed to show [illegible] in showing general tendency rather than [illegible] minute in detail; and the figures herewith presented are set forth in the confident belief that they are substantially correct approximations of the volume of business in the lines indicated. They are made possible by the [illegible] eminent in the electrical and allied industries; and to the [illegible] thanks.

## WESTERN ELECTRICIAN'S ESTIMATES OF THE VALUE OF ELECTRICAL AND AUXILIARY MANUFACTURES IN THE UNITED STATES.

| Articles. | For the Year— | | | |
|---|---|---|---|---|
| | 1901. | 1902. | 1903. | 1904. |
| Arc lamps and appurtenances | $ 1,725,000 | $ 1,935,000 | $ 2,025,000 | $ 2,200,000 |
| Auxiliary steam plant for electrical installations, such as pumps, condensers, separators, feed-water heaters, injectors, piping, etc | 1,850,000 | 2,000,000 | 1,950,000 | 2,200,000 |
| Bells, buzzers, push-buttons, call-boxes, annunciators | 720,000 | 815,000 | 800,000 | 780,000 |
| Belting used in electrical plants | 600,000 | 615,000 | 575,000 | 500,000 |
| Boilers for electrical plants (water-tube) | 6,000,000 | 5,100,000 | 4,500,000 | 5,000,000 |
| Boilers for electrical plants (other than water-tube) | 1,850,000 | 2,400,000 | 2,000,000 | 2,800,000 |
| Cables, underground, aerial and submarine | 18,000,000 | 18,650,000 | 19,700,000 | 16,500,000 |
| Carbons for lamps, batteries, brushes or other electrical purposes | 1,985,000 | 2,300,000 | 2,600,000 | 3,100,000 |
| Cars and trucks for electric railways | 3,700,000 | 7,500,000 | 7,500,000 | 7,500,000 |
| Circuit-breakers | 230,000 | 300,000 | 1,200,000 | 1,250,000 |
| Conduits (underground) and similar material | 1,700,000 | 1,925,000 | 2,350,000 | 2,650,000 |
| Conveyors, coal and ash, used in electrical plants | 650,000 | 750,000 | 750,000 | 800,000 |
| Cranes and hoists, electrically operated | 2,730,000 | 3,500,000 | 4,750,000 | 3,875,000 |
| Dynamos and motors, including parts of machines, boosters, rotary converters, motor-generators, etc., and all motor applications, such as automobiles, not specifically enumerated in this list | 41,500,000 | 48,000,000 | 52,000,000 | 51,000,000 |
| Electroplating and other electrolytic apparatus not elsewhere specified | 325,000 | 275,000 | 300,000 | 250,000 |
| Electrostatic machines, induction coils, medical sets, etc | 250,000 | 325,000 | 425,000 | 550,000 |
| Elevators, electric (mechanism only) | 1,800,000 | 2,000,000 | 2,000,000 | 2,000,000 |
| Engines, gas, gasoline or oil, used to drive electrical machinery | 950,000 | 1,300,000 | 1,500,000 | 1,800,000 |
| Engines, steam (reciprocating), used to drive electrical machinery | 16,425,000 | 17,000,000 | 16,500,000 | 14,700,000 |
| Fans, electrically operated and direct-connected | 1,350,000 | 1,500,000 | 1,450,000 | 1,200,000 |
| Fire-alarm apparatus, also burglar alarms, crossing indicators, etc | 800,000 | 950,000 | 950,000 | 1,100,000 |
| Fixtures for electric lighting | 4,200,000 | 4,100,000 | 4,250,000 | 4,125,000 |
| Fuses | 175,000 | 185,000 | 250,000 | 300,000 |
| Glassware, electrical | ..... | 500,000 | 450,000 | 600,000 |
| Heating and cooking apparatus, electrical | 285,000 | 330,000 | 325,000 | 425,000 |
| Incandescent lamps | 4,150,000 | 5,000,000 | 5,400,000 | 5,750,000 |
| Instruments for measurement and meters of all kinds; also ground detectors, scientific and laboratory apparatus, photometers, Leyden jars, X-ray outfits, etc | 3,250,000 | 3,750,000 | 3,850,000 | 3,850,000 |
| Insulating material, fiber, tape, etc | 1,135,000 | 1,250,000 | 1,400,000 | 1,600,000 |
| Insulators (glass and porcelain) | 1,600,000 | 1,750,000 | 1,900,000 | 1,550,000 |
| Interior wiring supplies, as tubing, interior conduit, molding, junction boxes, rosettes, outlet boxes, etc | 1,050,000 | 1,000,000 | 1,950,000 | 1,975,000 |
| Lightning arresters | 390,000 | 425,000 | 470,000 | 450,000 |
| Nernst lamps | ..... | 350,000 | 450,000 | 425,000 |
| Poles, cross-arms, brackets and pins | 3,875,000 | 4,350,000 | 4,700,000 | 4,850,000 |
| Primary batteries | 550,000 | 685,000 | 775,000 | 800,000 |
| Railway supplies, electric, such as trolleys and other contact devices, strain insulators, cross-overs, rail-bonds, etc | 1,575,000 | 2,150,000 | 2,150,000 | 1,900,000 |
| Rheostats, car controllers, motor starters, etc | 1,050,000 | 3,200,000 | 3,400,000 | 2,850,000 |
| Shafting, pulleys, clutches, etc., used in electrical generating plants | 475,000 | 425,000 | 400,000 | 285,000 |
| Sockets, switches, cut-outs | 1,850,000 | 3,500,000 | 3,675,000 | 3,800,000 |
| Space-telegraph apparatus | ..... | 200,000 | 250,000 | 380,000 |
| Steam turbines used to drive electrical machinery | ..... | 500,000 | 1,200,000 | 2,500,000 |
| Storage batteries, including those used on automobiles | 4,500,000 | 4,500,000 | 5,000,000 | 5,000,000 |
| Telegraph instruments and apparatus | 120,000 | 200,000 | 200,000 | 265,000 |
| Telephones and telephone-exchange apparatus, including telephone switchboards | 18,750,000 | 21,000,000 | 19,500,000 | 17,200,000 |
| Third rail for electric railways | 300,000 | 500,000 | 500,000 | 715,000 |
| Transformers, stationary | 3,250,000 | 4,200,000 | 4,500,000 | 4,450,000 |
| Vapor lamps | ..... | ..... | 30,000 | 60,000 |
| Waterwheels, used to drive electrical machinery | 1,125,000 | 1,300,000 | 1,500,000 | 1,230,000 |
| Wire, bare | 16,200,000 | 17,500,000 | 18,350,000 | 18,000,000 |
| Wire, rubber covered | 5,750,000 | 6,425,000 | 8,250,000 | 8,200,000 |
| Wire, weatherproof | 8,500,000 | 8,750,000 | 9,000,000 | 8,500,000 |
| Wire, all other electrical | 1,725,000 | 2,000,000 | 2,700,000 | 2,500,000 |
| Miscellaneous, including switchboard frames and panels, signs and flashers, automatic stokers for electrical plants, wire guards, electrical toys and toys, projectors, solenoids, igniters for gas engines, waterwheel governors for hydro-electric plants, commutator compounds, lamp adjusters, etc | 1,500,000 | 2,000,000 | 2,150,000 | 3,500,000 |
| Total | $192,470,000 | $221,165,000 | $234,750,000 | $230,510,000 |

# BUSINESS OF THE YEAR 1904 IN REVIEW.

The following symposium is based on responses to the Western Electrician's request for expressions of opinion from representative concerns in the electrical industry reviewing the business of 1904, with a forecast, where practicable, of that of 1905. These letters make interesting reading; they are far from being merely a dry chronicle of business routine; not a few give insight into the deeper philosophy of trade. They come from various localities and represent the diversified branches of the industry. They are almost uniformly cheerful in tone and presage a good year in 1905.

### Belting.

**Main Belting Company**, Philadelphia (W. T. Plummer, secretary): We have been busy through the year 1904, and consider that prospects today are better than they were a year ago. We hope and believe they will be realized.

**Shultz Belting Company**, St. Louis (J. A. J. Shultz, president): In the year 1904 we sold more dynamo belts than we have for any year for a long time, and we think the outlook for another year is very good. It seems to us that more people are using belts for dynamos now, especially in the plants that are not limited for room.

### Central-station Heating.

**American District Steam Company**, Lockport, N. Y. (W. D. Hall, treasurer): Our business during the last year has far exceeded our expectations. We have installed a great many new exhaust steam-heating plants for electric companies in various cities of the country, besides making extensive additions to those already built, and owing to the large amount of work which we had on hand we were unable to complete some of the plants before the cold weather set in and stopped operations in some of the northern cities. In several towns farther south we will be able to continue work during the winter months. One of the principal considerations on the part of the electric-lighting companies in putting in exhaust steam-heating plants is the advantage it gives the company in securing the electric lighting and power in large office buildings which have their own engines, boilers and lighting equipment. By being able to supply steam heat in addition to electric light and power, the company can secure contracts for the heat, light and power in these buildings which they otherwise could not obtain. At the present time, when fuel is becoming higher in price every year, it is necessary for electric companies in order to compete with other methods of lighting and other electric companies, that they should utilize their by-product, which, in their case, is the exhaust steam from the engines. The outlook for business the coming year is very bright, and from the number of inquiries we are receiving the probabilities are that we will be very busy.

**Evans, Almirall & Co.**, New York (F. N. Jewett, Chicago agent): Central-station heating allied with and supplementary to central-station electric plants passed through a boom period in 1902, waned in 1903, and in 1904 the volume of business was about 60 per cent. of 1903. Central-station managers have found that the badly designed and badly executed plants, both from an engineering and commercial standpoint, of previous years were not profitable, and the central-station managers are now more cautious in entering the field of central-station heating. It is now more difficult to finance central-station plants and to place bonds thereon than it was in the boom days, investors realizing the failures of the past. With careful design, the best appliances and material, and proper rates for service rendered (being considerably higher than rates advocated in the past), the central-station heating business is placed on a more secure footing. The prospects for the coming year are fair; business should equal but not greatly exceed 1904.

### Construction and Supplies.

**Arnold Electric Power Station Company**, Chicago (George A. Damon, managing engineer): Our business last year was much better than during the previous one and prospects were never brighter than at present. The single-phase traction motor is now on the market, and this should make possible the construction of interurban lines which have been held back awaiting development. The interurban electric line has found its place and is winning favor among investors, particularly in Chicago, so that it will not be long before good propositions in the western states can be financed without "going East." Steam-turbine and also gas-engine improvements make it unwise to plan a power plant without considering both of these prime movers, and the coming year can be counted on for considerable progress along these lines. Good waterpower properties are now being sought by those who have watched the success of transmission plants already in operation, and the wayside grist mill is now being replaced by pretentious hydro-electric properties on many western streams. There is apparently enough prosperity in sight for all of us.

**Commercial Electrical Supply Company**, St. Louis (J. P. Casey, sales manager): The year just closed has been very satisfactory from an electrical supply point of view, and the volume of business was considerably in excess of that of any previous years. While prices have been down somewhat, still, trade has been steady, and with the business placed in St. Louis, through the World's Fair, we did not feel the general depression of business, due to the presidential election year. The great Southwest has no doubt bought more of its goods in St. Louis in the past year, and is now at that point where it has faith in the ability of St. Louis to take care of its entire wants. The railroads have also contributed to business success recently through their interest in, and efficient service rendered in and out of, the city, the result of which has been increased trade in isolated and central-station equipment and supplies, and new installations of telephone apparatus and construction material generally.

**Hodge-Walsh Electrical Engineering Company**, Kansas City (R. W. Hodge, president): The business year just closed has been, as a whole, a satisfactory one. The number of electric-lighting plants and telephone exchanges in Kansas City territory has been largely increased during the year, though the new installations have not equaled the number installed in 1903. During the latter part of the summer of 1904 the sale of lighting and telephone supplies was rather light; yet the early fall brought a substantial increase in the demand, which continued well up into December. Our engineering department has been busy all the season, having had a very profitable and successful year. The outlook for 1905 is good, and Kansas City jobbers and engineers will surely have a satisfactory year.

### Dynamos, Motors, Electrical Machinery.

**Allis-Chalmers Company**, Milwaukee (F. F. Coleman): The Bullock Electric Manufacturing Company has, within the year just passed, come under the control of the Allis-Chalmers Company, and is now the electrical department of that company. This department has enjoyed a year of prosperity during 1904, and begins the new year with its shops so crowded with work that additional room is imperatively needed, although a two-story building, 300 feet long and 101 feet wide, was but recently completed and added to the equipment. Another addition to the plant, a building four stories in height and to measure 210 feet in length by 55 feet in width, is already under contract and ground has been broken for the foundations. Bids are now being considered for an addition of 12,500 square feet to the area of the machine shop known as No. 3. The constant expansion of the fields of electrical application assure to the electrical industry continued and increased prosperity. The indications are that the shops of the Bullock company will be called upon to take care of a great volume of business during the coming year. Not only has the volume of the electrical business been large during the last year, but there has been a marked increase in the size of the units built. Several generators of from 5,000 kilowatts' to 6,000 kilowatts' capacity have been turned out and installed, and there is now being finished a motor-generator set of 8,000 horsepower. This contains the largest electric motor ever built. The company's facilities for handling large work are exceptional. It has tools and appliances for turning out promptly units of any size up to 10,000 kilowatts' capacity. It has already installed in one plant the largest direct-current generator ever built, having a rating of 3,000 kilowatts and the largest 60-cycle engine-type generator in the world, with a rating of 3,200 kilowatts. The Allis-Chalmers Company is now making a feature of producing steam-electric units complete in its own shops, every part of which has been designed and built for a part of such unit.

**Crocker-Wheeler Company**, Ampere, N. J. (Rodman Gilder): We are entering the new year with every prospect of doing a heavy business, although during the last few months there has been a marked depression in the field of electrical manufacture. We believe that the times of prosperity, which are confidently expected, will bring such results as to justify our elaborate preparations during the last few months. We have been establishing new branch offices and making new connections, and are now in a position to do business in every state of the Union, in Canada, Mexico, Cuba, etc. Having entered the field of alternating-current manufacture we have virtually doubled our possibilities of doing business. For more than 16 years we have been holding and successfully marketing direct-current motors and generators for every industrial purpose. We now have made arrangements with Brown, Boveri & Co. of Switzerland to use their alternating-current designs and patents in America. This has enabled us to skip the experimental stage in this line and to take at once a position with the foremost builders of alternate-current apparatus in the world. One of our most important territories in that of our Chicago office, where we carry our largest stock of machines except at the works at Ampere, N. J. In taking up the manufacture of alternating-current machinery, we have by no means neglected our older line. We have reinforced the successful efforts of our own engineers by retaining the engineerng firm of Dodge & Day, "experts in shop equipment," whose services are now at the disposal of our customers. It will thus be seen that we have made elaborate preparations to handle the business of 1905.

**Emerson Electric Manufacturing Company**, St. Louis (H. L. Parker, president): Business in the line of fan motors and ceiling fans is largely dependent on the weather, and the season of 1904 was not a favorable season for such business, it being the coldest in 35 years, as per report of government weather service; add to this the fact that it was the third consecutive cool season, and, further, that while the cost of material and labor have both increased, the tendency has constantly been toward lower prices for our product in this line, and some of the trials and difficulties of the fan motor manufacturer can readily be understood. The outlook for 1905, owing to above circumstances, is not pleasing, but if favored by a generally hot, or even a normal season, will doubtless prove satisfactory as far as sales are concerned. In our line of small power motors, both alternating and direct, the results were very satisfactory, and we look for a steady and permanent increase in this business, as the country at large is in prosperous shape and the use of electricity in small units is rapidly increasing. We are constantly adding to our lines new styles and adaptations in order, as nearly as possible, to be ready to meet any call we may have for small power motors for either alternating or direct circuits. We, therefore, predict for 1905 a generous and satisfactory increase in these lines.

**Fort Wayne Electric Works**, Fort Wayne, Ind. (F. S. Hunting, sales manager): The business of the last year suffered very materially during the first half from causes which produced the depression the last half of last year. Many enterprises depending for their completion upon the sale of bonds or other financial schemes were held up, with the result that new business was very greatly diminished. In the latter half of the year, however, the financial conditions of the country seem to have improved, with a resulting improvement in the electrical business. Business conditions seem very materially improved over the corresponding time last year. The outlook for business next year we feel is very good.

**Hobart Electric Manufacturing Company**, Troy, Ohio: Our labors have been largely along the line of standard motors and dynamos from one to 75 kilowatts. Our trade has not been indicative of the condition existing generally, for we have been able during 1904 to increase our volume over that of any previous year. This may be attributed in part to the fact that we have not heretofore enjoyed the fulness of our privileges because of inadequate manufacturing facilities. The enlargements and improvements which we have made, following our re-organization, have permitted the onward flow of that current of trade which was retarded by our limitations. Our new and improved type of machines has also been contributory. So far as we are able to scan the horizon of 1905, the outlook seems very hopeful and encouraging.

**Northern Electrical Manufacturing Company**, Madison, Wis. (Otto Kney): The business of this company has been of a very satisfactory character. The volume exceeds that of any previous year. Prospects for 1905 are excellent, though void of any boom indications.

**Triumph Electric Company**, Cincinnati, O. (W. H. Jacob): Like all other manufacturers, not only in our own particular lines, but all other lines, we have suffered somewhat from the lack of business, or in other words our business during the last year, or in 1904, was not quite up to what it has been for the last several years. We might, however, say that during October and November business picked up materially. In November we closed more contracts than we had done in any two previous months during the year. This is also true for December, so that, judging from this, as well as the inquiries that we are receiving and the orders that we have in view, business for 1905 is going to be far ahead of the last year.

### Electric-heating Appliances.

**Prometheus Electric Company**, New York (Max Loewenthal, electrical engineer): Everyone who has watched the progress of the electric-heating industry during the last year will admit that it has been augmented considerably, and the manufacturers of these apparatus have not only received the support of the electric-supply dealers to a marked degree, but the electric-light companies also have manifested a wholesome desire to assist materially in the introduction of these up-to-date appliances. In many cases special rates have been given to customers who use electric-cooking apparatus or irons in considerable number, and some of the lighting companies have instituted an electric-heating department, with a canvasser in charge of the same. Publication of live articles on electric heating in the various Edison bulletins has also been of great service to the industry; and if the manufacturers, supply dealers, contractors and central stations will work in harmony with the common end in view, to acquaint the public with the advantages of electric cooking and heating, by getting the circular matter into the homes, by reducing the cost of apparatus, as well as current supply, and by demonstrating to the public the use of these devices, there can be no doubt that the electric heating and cooking industry will be largely benefited during the coming year.

**Simplex Electric Heating Company**, Cambridge, Mass. (James I. Ayer, manager): We are pleased to state that business during the last year has been very satisfactory, and, in some directions, beyond our expectations. As to the outlook for 1905 we feel that the prospects were never better. Two years ago we made very extensive additions to our plant, looking, as we felt, far into the future; we are beginning, however, to approach the limits of our capacity and have much exceeded that of our equipment, so as to compel us to run overtime most of the last 60 days, notwithstanding a considerable increase in our force and machinery. The faith of the country in the assurance of President Roosevelt that the people will get a square deal is undoubtedly largely responsible for the general conditions existing and the extremely satisfactory outlook.

### Electrotherapeutical Appliances.

**McIntosh Battery and Optical Company**, Chicago (C. Alfred Smith, president): You ask for a brief review of the business as concerns the manufacturers of apparatus for the therapeutic application of electricity during the year 1904, and a few words on the outlook of 1905. With this company there has been more of satisfaction attending the prosecution of this branch of electrical manufacture during the last year, 1904, than at any time in the quarter of a century during which we have prosecuted this work. The satisfaction comes from the fact that the medical colleges are doing more each year for the mental equipment of their graduates along the line of electrotherapeutical instruction; and in consequence there is less of empiricism and more of well-directed mental guidance on the part of purchasers and users of this apparatus. The demand for X-ray diagnosis and, the broadening of the field for the real, as well as the imaginary, helpful application of this wonderful penetrating ray has caused a very rapid growth of small as well as larger manufacturers of coils, tubes, fluoroscopic screens and the various paraphernalia of X-ray generation and application. At the same time there has been vastly more of intelligent appreciation and intelligent use of the galvanic current for electrolysis, general galvanism and galvano-cautery. The most annoying feature in this branch of electrical work lies in the simplicity of construction of the cheaper forms of batteries and electrodes, together with the almost culpable ignorance of many of the physicians or self-styled "electro-therapeutists" who make use of these various devices. This cause a demand for low-priced goods and has brought into the market many manufacturers who seek only the commercial end, without any care or feeling of responsibility for the quality of that which they offer to the would-be purchaser who makes his selection frequently from a picture, without either knowledge or ability to judge as to the scientific or practical features of the instruments. The outlook for 1905 promises an increased interest on the part of physicians and a correspondingly more satisfactory condition of trade with those manufacturers who are putting day by day more of brains and careful method into the prosecution of their business. The day of low-priced, cheaply constructed trash will never pass. There will always be a multitude of purchasers who will seek for something cheap, instead of looking for something good; but the results of the last two years, and particularly the correspondence and orders of 1904, indicate that physicians, either through their unfortunate experience in the past, or perhaps more largely through the better instruction offered by the medical colleges and the special schools of electrotherapeutics, are better qualified to judge the quality of the apparatus they are seeking. They know what results to expect; they know that the results which can be obtained are governed by immutable laws; they know that if the results which they ought to obtain are not worked out, the cause lies not in failure of the law, but in fault of the means of application. The development during the last year in the therapeutic application of the alternating-dynamo current has been very great and the manufacturer of correct applicators and electrodes for the adaptability of this current to purposes of massage, sinusoidal vibration and stimulation, galvano-cautery, and the lighting of diagnostic lamps, has very greatly broadened the somewhat narrow field of past years. The West, Southwest and Northwest seem still a more fertile field for this branch of manufacture than the East; but the more expensive apparatus finds its most satisfactory purchasers in the East. The foreign demand, as indicated by inquiries and also by orders, is developing rapidly.

### Engines, Gas and Steam.

**Fitchburg Steam Engine Company**, Fitchburg, Mass. (F. Fosdick, president): In our engine business through the last year we have had all we could do with full force and full number of men, approximately one-third being for the electrical line of business; and while general business has fallen off some, the electrical demand has been pretty nearly as large as heretofore. In the last six weeks the inquiry for this class of work has been constantly increasing, and we anticipate for the coming year quite as large a business as for any of the last six years of pushing business. The larger part of our work in the electrical line has been for direct-connected units, and we find a constant increase in the average size of these. We are not making the largest units, taking only as high as 1,200 horsepower, but our average in this direction is constantly rising.

**Harrisburg Foundry and Machine Works**, Harrisburg, Pa. (W. R. Fleming, president): This company has been exceedingly fortunate and gratified on having been able to operate its entire plant day and night without interruption now for over five years. We take this as an indication that machinery well built and of reputation, although higher in price, finds a more steady demand from the best purchasers than other policies. The gross business of this company for 1904 was only seven per cent. lower than that of the high-water-mark years of 1902 and 1903, and prices have been fairly satisfactory. We view with distrust the policy which seems to be prevalent among other manufacturers in our line wherein they are continuing to quote machinery at lowest ebb prices, notwithstanding a considerable advance all along the line in raw and crude materials, and feel that some reckoning must accrue and business troubles engender by a lack of reasonable conservatism under present conditions. Looking forward to 1905 we find, while inquiries for delivery into the next year are numerous, there is a disposition to hold off until business results are determined and prices finally adopted for the future. We can see, however, no reason preventing a reasonable expectation for a very large business during the coming year, and this company is preparing to increase its manufacturing capacity accordingly.

**Marinette Gas Engine Company**, Chicago Heights, Ill. (T. C. Miller, president): While we have had a fairly good year during 1904, there has been a marked

improvement since the recent election, and we have booked more good substantial orders during the last three weeks than during the previous three months. The prospect [illegible] is favorable to a prosperous year during 1905 [illegible]. We have recently installed one of our large three-cylinder engines direct connected to a generator for the government at Fort Hamilton, N. Y., and have shipped a number of direct-connected units to the Portuguese government at Lisbon, Portugal, and are now installing a direct-connected engine and generator in the Colon Industrial Exhibit [illegible], and have booked a number of orders for private and municipal lighting plants, and from present indications the coming year will prove a banner year in our business.

FIXTURES.

**Enos Company,** New York (Manson T. Enos, president): We take a great deal of pleasure in responding to your request, all the more so because we are decidedly optimistic in our views. The last year has been productive of great strides all through the electrical field, and it is pleasing to note that the most recent development has been in the way of practical improvements and appliances which are of real service, rather than mere clever devices. Electricity as an illuminant must ever hold first place by reason of its easy manipulation and its ready adjustment to suit the higher artistic tastes in the matter of decoration. The outlook for the coming year is particularly bright. People are coming to recognize more than ever that the mission of the lighting fixture is twofold—to illuminate and to decorate—and the tendency throughout the country, we find, is toward a better grade of work. Artistic, harmonious lines are now being asked for, where in past years they have hardly been recognized when presented. Education in this and all other branches of electricity is on the increase, and we are hopeful that the coming seasons will represent a banner year in the advance of what Benjamin Franklin first recognized in 1752, and is being energetically used and appreciated by all in 1905.

INCANDESCENT LAMPS.

**Franklin Electric Manufacturing Company,** Hartford, Conn. (J. Camp, treasurer): The year just ended has been a fairly satisfactory one in the incandescent-lamp trade. The volume of business has been exceedingly large, although the industry has doubtless suffered somewhat from the general business depression prevailing in other lines. The art of incandescent-lamp manufacture has made considerable progress, and the quality of material has been generally improved. Indications point to an increased volume of business during the coming 12 months.

**Moline Incandescent Lamp Company,** Moline, Ill. (A. H. Kreitler, general manager): The outlook for the future, we think, is exceptionally bright. The year just past will possibly show in the aggregate smaller sales than 1903, but, believing that we have passed the dull period, we look for an exceptionally active year in 1905. In this immediate vicinity additions to plants for enlargement and betterment purposes have been quite heavy within the last year, and arrangements are being carried forward for additional enlargements for 1905 a share of which business we expect to receive.

**Shelby Electric Company,** Shelby, Ohio (J. C. Fish, president): The business of this company during the last year has been very satisfactory indeed. We have shown a very good increase over the business of any preceding year. We anticipate that there will be a corresponding gain during the year 1905. We do not know whether to attribute this to our advertising or to the natural advantages of the "Useful Light" lamps.

INVENTION.

**Thomas A. Edison,** Orange, N. J.: I beg to state that I am so very busy with my various enterprises I have no chance to do any writing whatsoever.

POLES, TIES, CROSS-ARMS.

**Eccleston Lumber Company,** New York (J. B. Eccleston, president): The largest consumers of poles have been experimenting considerably during the last two or three years, realizing that the supply of Northern cedar and chestnut poles is becoming scarcer and higher-priced all the time; and the result of their experiments has been a frank acknowledgment that the southern white cedar or juniper poles are in every way as desirable and more economical than the northern cedar. During the last year there has been over 400,000 of these southern cedar or juniper poles used, which was all it was possible to get out in the swamps south, and at no time did the supply anywhere equal the demand. It is the opinion of those best posted that 1905 and the year to follow will see a tremendous quantity of southern red cypress poles universally used, as the supply of cedar or juniper is very limited, and there is practically no limit to the amount of cypress than can and will be used for the purpose of poles.

**H. M. Loud's Sons Company,** Au Sable, Mich. (H. Kimball Loud): We would say in regard to the trade in Michigan white cedar poles that the demand has been very good with us during the entire year. We have shipped more in 1904 than any year in the last four years, at fair prices. The demand for short poles has been especially good and we believe the market is pretty well cleared of the shorter lengths. The outlook for 1905 is very good. We believe that there will be a very good demand at fair prices, but nothing in the shape of a boom.

**C. H. Worcester Company,** Chicago: The cedar pole business during 1904 has been what we would call an off year. The large telegraph and telephone companies—usually heavy consumers of poles—during the last year have limited their requirements to supplies in our line actually needed, resulting in cutting off of about 50 per cent. of the usual trade. The Independent telephone trade has, however, been fairly good, the demand coming along fairly steadily, but in nearly every instance light in character, indicating that orders were being held to immediate requirements only. Prices on a few sizes have declined somewhat, but, as a whole, the price situation has held up remarkably well considering the lighter demand. The majority of the dealers are entirely out of such sizes as seven-inch 35-foot and seven-inch 40-foot poles, and very few of the dealers have much stock on hand 35 feet long and up. The outlook for business during 1905 appears to us very encouraging, although there is nothing yet in the situation to indicate any marked increase in the general requirements of the trade. The production this year will be lighter than usual, but this fact will be offset by somewhat larger stocks than usual being carried over by the dealers. With a good healthy demand for poles during 1905 there will probably be a slight stiffening in prices, but we do not look for any pronounced advance unless the demand should increase very greatly. We notice a marked tendency among the better class of trade to discriminate against slim poles. Companies which heretofore have bought "woods run" poles are now applying butt measurements and refusing poles which will not fulfill these requirements. This is largely due to the fact that a great deal of slender stock from the Northwest has been coming into the market and, where no measurements are specified in purchase of poles, these slender poles go in at the same price as poles which have greater girth, strength and stability.

SPACE TELEGRAPHY.

**American De Forest Wireless Telegraph Company,** St. Louis (Lee De Forest): The development of the American De Forest Wireless Telegraph [illegible]

[illegible] United States. [illegible] On December 9th, [illegible] established between [illegible] relay [illegible] distance, [illegible] every-day commercial service, operated [illegible] with [illegible] kilowatts of energy.

SPECIALTIES.

**Federal Electric Company,** Chicago (L. F. Bruce): During the last year the electric-sign and specialty business with us has been most encouraging. We find that central stations throughout the country are giving a great deal of time and thought to the selection of revenue-producing specialties, which are easily handled, and which increase their revenue. Judging from the general trend of business during the last year, we are led to believe that in the year of 1905 the electric-sign field will be considerably enlarged. Our numerous sources of information have shown to us that there is from 10 to 18 cents per kilowatt-hour net, which can be easily gotten from the electric-sign field alone. We also note the general tendency to buy a higher grade of goods than formerly. This is especially gratifying to us, as we are manufacturers of high-grade products, which if put into competition on a price basis alone would be hard to sell. It seems to be an age of high quality at a moderate expense.

**Green Fuel Economizer Company,** Matteawan, N. Y. (A. H. Blackburn, general manager): Whereas our business in 1904 in the electrical line was not of as large a volume as in 1903, at the same time it was very satisfactory, considering the conditions of general business. From the amount of new work we are working on and which there seems to be prospects of closing, we are very well satisfied that the prospects for 1905 are very bright.

**H. W. Johns-Manville Company,** New York (J. W. Perry, manager electrical department): We are pleased to advise you that the year just closed has been a period of unequaled prosperity in our electrical business. We have turned out more material from our factories by a very large percentage than during any previous year. Notwithstanding that there has not been a great deal of new electric-railway work throughout the country, our enclosed-fuse business has developed to a wonderful extent, closely followed in proportion of increase by our line material. The outlook for the coming year in this country, particularly in railway work, seems to be more promising than at any time within the last decade, and our European business also justifies us in an optimistic view. Our factories, notwithstanding constant additions and improvements, are rushed to the utmost to keep up with our orders. We have every reason to believe that the year 1905 will be an exceptionally big year in all kinds of electrical supplies; and feel, from past experience, that we will have no fault to find with the share which may fall to our lot.

**McRoy Clay Works,** Brazil, Ind. (E. F. Kirkpatrick, sales manager): The underground conduit business of the United States for 1904 did not reach the record of 1902 and 1903 by many million feet, but, compared with years previous to those mentioned, it shows an increase and a growth, although prices were lower than in any other year. More underground conduit work was completed in 1902 and 1903 than in any previous several years, exceeding 1904 by about 40 per cent. We expect to return in 1905 to the "normal" of the years previous to the conduit boom of 1902 and 1903, added to the natural "new" business which comes from new corporations and through ordinances by municipalities in smaller towns ordering wires underground, and from other sources. And with no presidential nominations and national election, with the uncertainty of their results staring us in the face, and with a far more rosy sky financially in sight than at this time last year, the conduit business, its kindred interests and all branches in the commercial world, should be materially improved in 1905.

**Pass & Seymour,** Solvay, N. Y. (J. W. Brooks, sales manager): The year just closing has been exceedingly satisfactory to us, particularly the last few months, when our factory has been running with a larger force than ever before in our history. We certainly think that the outlook for 1905 is exceedingly bright, and are increasing our manufacturing capacity to take care of the same.

**D. M. Steward Manufacturing Company,** Chattanooga, Tenn. (R. B. Steward): In the sale of our lavite insulation we deal direct with the manufacturers of all kinds of electrical apparatus in all parts of the United States and many foreign countries. When their business is good, ours is good, and when theirs is poor, ours is poor. Our business in 1904 shows considerable increase over 1903. The months of September, October and November, 1904, are almost double the corresponding months last year. We now have more unfiled orders on file than ever before at the same time of the year. We believe that 1905 will be a splendid year for electrical business, and are preparing to take care of an increased trade.

**Yale & Towne Manufacturing Company,** New York (C. W. Beaver): Present indications point to a very substantial increase in our sale of electric hoists for the year 1905. At least 50 per cent. of the chain blocks in use today in the United States are of Yale & Towne manufacture. We expect to achieve that same record with regard to our portable electric hoists during the coming year.

TELEPHONE APPARATUS.

**Automatic Electric Company,** Chicago (H. H. Woodworth): The Automatic Electric Company has enjoyed a most prosperous and satisfactory year. We have equipped within the last 12 months nearly 50 exchanges—large and small—with our automatic telephone equipment. We have built and installed additional apparatus for large exchanges at Chicago, Ill., at Dayton and St. Marys, Ohio, which were put in service in 1903; we have completed and put in service exchanges at Grand Rapids, Mich., Portland, Me., Columbus, Ga., and Cleburne, Texas, all of which were begun late in 1903. We have installed and placed in service this year exchanges at Battle Creek, Mich., Lewiston, Me., Lincoln, [illegible]

**Ericsson Telephone Company,** [illegible]

**Farr Telephone and Construction Supply Company,** Chicago (E. W. Farr, [illegible]): [illegible] The rural [illegible] dealers.

**International Telephone Manufacturing Company,** Chicago (Henry Shafer, [illegible]): [illegible] telephones [illegible] during any previous [illegible] future is very promising. While the rush for unoccupied territory by new companies [illegible] previous years, the existing [illegible] thoroughly and perfectly covered the territory occupied and greatly increased their [illegible] trunk lines and long-distance [illegible] upon a much [illegible] demand by the Independent operating [illegible] highest class of equipment, [illegible] and efficient service, with the greatest possible conveniences to the users, has inspired the manufacturers to developing the apparatus to the highest point of [illegible] modernity that money and skill could advance it. This has placed the Independent manufacturers of the United States in the lead in foreign countries as well as fully protecting them in the home market. Our company has had remarkable success in applying the "Monroe Doctrine" to the telephone field, and is also making a substantial [illegible] through the "open door" and into the old world.

**Vought-Berger Company,** La Crosse, Wis. (M. I. Berger, secretary and treasurer): [illegible] with a boom. Orders and prospects came in far better than in any other December in the history of our concern. We cannot but feel that this presages splendid [illegible] the year 1905. We expect this next year to prove to be the banner year of Independent telephony. The year 1904 held its own in spite of the usual lull preceding a presidential campaign. Our shipments to the South and Far West indicate that these sections of the country have been successfully exposed to the fever, and have taken [illegible] Independent telephony. In regard to the electric-lighting field, would state that our experience is confined to the sale of our two-balls adjuster for incandescent lamps. It is apparent that the popular demand for an automatic cord adjuster is steadily increasing.

WATERWHEELS AND GOVERNORS.

**Abner Doble Company,** San Francisco (W. A. Doble): Our business in the waterwheel line during [illegible] has been very satisfactory, the volume being greater than we anticipated at the beginning of the year. The business has shown a substantial increase over the previous year and the outlook for the coming 12 months is very encouraging. Our present works have been overtaxed, and in order to provide facilities for our growing business, we have purchased a three-acre site with railroad connections near the commercial center of San Francisco, where we plan to erect a most modern plant equipped with the latest tools and appliances for the manufacture and testing of everything in the hydraulic line. An interesting feature of the last year's business on the Pacific Coast is the increase in size of hydro-electric units installed in waterpower plants. During the year the De Sabla power house has been completed, in which are installed two 3,700-horsepower and one 8,000-horsepower waterwheel units. The waterwheels are of the Abner Doble Company's manufacture and operate under a head of 1,561 feet. The 8,000-horsepower waterwheel is the largest ever manufactured on a single runner and is giving excellent service. We are now constructing three 8,000-horsepower waterwheels for the Electra plant of the Standard Electric Company. Another order filled during the last year was for two 75-horsepower units for the Pike's Peak Hydro-Electric Company of Colorado Springs, for operation under a head of 2,100 feet, the highest in the United States.

**Platt Iron Works Company,** Dayton, O. (W. H. Ingraham): We entered the year 1904 with a sufficient amount of business in our shops to keep our entire force and equipment employed for a period of four to five months, and the alleged decrease in the volume of trade was not in evidence until the months of June and July. Unfortunately there has been a diminution in our trade owing to the fact that the erection of contemplated power plants has been deferred. During the last 60 days there has been a marked increase in business, notwithstanding the fact that during the fall and winter there is always a falling off of orders, and because of this fact we begin the new year with abundant confidence.

**Replogle Governor Works,** Akron, O. (Mark A. Replogle, chief engineer): Our business changed hands about one year ago. Several months later Mr. Mark A. Replogle returned to his old post as chief engineer for the works. During the year we have abandoned the manufacture of electrical governors except where expressly ordered by our old patrons. We have inaugurated a series of new mechanical governors based on designs that we have been testing for the last five years. We now have a series of four governors that fully covers the field from the smallest impact wheel to the largest turbine plant that has yet been built. Our business is rapidly increasing, and our plant is being run night and day. The outlook for 1905 is very promising.

**Woodward Governor Company,** Rockford, Ill. (E. E. Woodward): Our interest in the electrical industry is confined entirely to the development of hydraulic power

to be used for electrical power transmission or lighting. Our business in this line is constantly increasing; the gain for 1904 was about 50 per cent. over any previous year. The use of waterpower for electrical purposes seems to keep pace with other electrical developments, and we look forward to greater activity in this line in 1905.

WIRES AND CABLES.

**Safety Insulated Wire and Cable Company,** New York (Ira W. Henry, vice-president): In looking over the backlog of sales for 1904, another triumphant column was erected by this company in the completion of the Alaska deep-sea ocean cable. This cable, which is the longest ever manufactured in America, and is equal in length to an Atlantic cable, marks a direct line of progress in a field that has heretofore been covered solely by European manufacturers. The confidence gained by this achievement leads us to hope that in the year 1905 Safety cables will take another step toward the girdling of the earth.

**Standard Underground Cable Company,** Pittsburg (J. W. Marsh, vice-president): I am pleased to say that our business for the year 1904 in underground and aerial cables, bare and weatherproof and rubber-covered wires and accessories has been a most satisfactory one in view of its having been a "presidential year." In fact, it has considerably exceeded our expectations. We are pleased to say that the indications for the year 1905 all point to a very large and successful year's business.

## Mortuary Record of 1904.

The year 1904 was a fortunate one in that comparatively few of the world's prominent scientists or engineers died during the twelvemonth. As a scientific man and at the same time one contributing a great deal toward the eleviation of human suffering perhaps the late Dr. Niels R. Finsen of Copenhagen was the one whose death was most conspicuous. His discovery of the Finsen rays and their application to the cure of various diseases of a malignant nature gained for him the Nobel prize in 1903 for the most noteworthy discovery in medical science. Major-general Charles E. Webber of London, Eng., was a man well known to the electrical fraternity and was a consulting engineer of much ability. William Wallace, an American pioneer electrical inventor, died during the year. Independent telephone men in the United States lost one of their stanchest supporters in Judge James M. Thomas. The men whose names stand out most prominently in the industrial side of the electrical business who have died during the last year are, perhaps, William O. Garrison of St. Louis, General Andrew Hickenlooper of Cincinnati and Richard S. Waring of Pittsburg.

A list of the men connected with some phase of electrical development who died during the last year follows:

January 4th.—Frank H. Clark of Chicago, connected with the Helios-Upton Company as receiver, had large experience in lighting work and electrical manufacturing; aged 55 years.

January 8th.—F. von Hefner-Alteneck of Berlin, Germany, one of Germany's most eminent electrical engineers and connected for many years with Siemens & Halske, and an inventor and scientist in the truest sense; aged 59 years.

January 10th.—General C. Henry Barney of New York, connected with a number of eastern telephone companies and prominent in the electrical supply business, superintendent of the Electric Launch and Navigation Company at the Chicago Exposition; aged 60 years.

January 17th.—William O. Garrison of St. Louis, president of the Columbia Incandescent Lamp Company, St. Louis; aged 42 years.

January 23d.—Alfred G. Bowers of Des Moines, Iowa, representative for the state of Iowa for the Fort Wayne Electric Works; aged 34 years.

February 2nd.—John L. Kebler of New York, vice-president and general manager of the Ward Leonard Electric Company.

February 3d.—F. E. Perry of Cincinnati, salesman for Bullock Electric Manufacturing Company.

February 27th.—Andrew Howard of Wilkinsburg, Pa., president of the Phœnix Glass Company; aged 67 years.

February 29th.—William A. McGuire of Chicago, president of the McGuire Manufacturing Company; aged 64 years.

March 13th.—John B. O'Hara of New York, a well-known electrical journalist; aged 38 years.

March 22d.—Chester D. Crandall of Chicago, manager for many years of the Western Electric Company; aged 50 years.

April 16th.—Frank W. Sabold of Albany, N. Y., well-known telephone and telegraph man and contract agent for the Hudson River Telephone Company; aged 47 years.

April 17th.—Frederick W. Nolker of St. Louis, president of the Missouri-Edison Electric Company; aged 29 years.

May.—General Andrew Hickenlooper of Cincinnati, combined the lighting interests of Cincinnati into the Cincinnati Gas and Electric Company, becoming its president; elected lieutenant-governor of Ohio in 1879.

May 12th.—Nelson Perin of Baltimore, Md., the first president of the United Railways and Electric Company of Baltimore.

May 21st.—William Wallace of Washington, D. C., a member of the well-known firm of Wallace & Sons of Ansonia, Conn., and one of the pioneers in the electrical business in this country; aged 79 years.

May 26th.—James A. Myers of Springfield, Ohio, president of the Robbins & Myers Company of Springfield; aged 55 years.

June 4th.—W. A. Vail of Minneapolis, a well-known telephone man and assistant general manager of the Northwestern Telephone Company; aged 45 years.

June 6th.—E. B. Chandler of Chicago, first superintendent of fire-alarm telegraph in Chicago; aged 66 years.

June 16th.—Charles M. Stebbins, Berlin, Germany, one time president of the St. Louis and Missouri River Telegraph Company and pioneer in western telegraph construction; aged 75 years.

July.—Parker F. Morey of Oswego, Ore., formerly president of the Portland General Electric Company; aged 60 years.

July 21st.—E. K. Adams of New York, an electrical inventor of ability; aged 30 years.

August 23d.—Richard S. Waring of Pittsburg, connected with many electrical enterprises, founder of the Standard Underground Cable Company, also of the Fowler-Waring Cable Company in London; aged 71 years.

September 2nd.—Clark Caryl Haskins of Chicago, pioneer telegrapher, inventor, writer on electrical subjects and an electrical inspector for many years; aged 77 years.

September 26th.—Dr. Niels R. Finsen of Copenhagen, noted scientist, discoverer of the Finsen rays, recipient of the Nobel prize in 1903 for the most notable discovery in medical science; aged 44 years.

September 23d.—Major-general Charles E. Webber of London, Eng., managing and consulting engineer, once chief engineer of the City of London Electric Lighting Company, and juror at various exhibitions; aged 66 years.

October 1st.—B. E. Greene of Brooklyn, N. Y., formerly electrical journalist; aged 42 years.

October 2nd.—Prof. Charles Selim Lemström of Helingsfors, Finland, distinguished Russian scientist; aged 66 years.

October 4th.—Henry C. Payne of Washington, D. C., postmaster-general of the United States, identified with telephone, lighting and street-railway interests; aged 61 years.

October 9th.—Desmond G. Fitzgerald of Suffolk, Eng., inventor, contributor to the electrical press and scientific investigator; aged 71 years.

October 14th.—Prof. B. S. Lanphear of Ames, Ia., assistant professor of electrical engineering in Iowa State College.

October 15th.—A. B. Cornell of Ithaca, N. Y., identified with the Western Union Telegraph Company and for some time its vice-president, governor of New York state from 1880 to 1883; aged 72 years.

October 26th.—Max Osterberg of New York, well-known consulting electrical engineer; aged 35 years.

November 8th.—James M. Thomas of Irvington, N. Y., at one time vice-president and general manager of the Telephone, Telegraph and Cable Company, and also connected with other telephone enterprises, a lawyer and probate judge and the first president of the Independent Telephone Association of the United States.

November 21st.—Frank H. Bristol of Waterbury, Conn., vice-president of the Bristol Company of Waterbury.

December 21st.—W. Forman Collins of Chicago, vice-president and general manager of the Western Electrician; aged 37 years.

## Generators for Lockport Power Development on Chicago Drainage Canal.

Proposals for furnishing and installing alternating-current generators and exciter generators will be received by the clerk of the Sanitary District of Chicago, 1110 Security Building. The generators for which tenders are invited consist of four 4,000-kilowatt, 6,600-volt, three-phase, 60-cycle machines designed to run at 164 revolutions a minute. In addition, there are to be two 250-volt, direct-current exciters running at 300 revolutions a minute. Proposals will be received until February 15, 1905, at noon, and will be opened by the board of trustees, which will hold a meeting on that day. Each bid must be accompanied by a certified check or cash to the amount of $3,000, which will be held by the Sanitary District until all bids have been canvassed and the contract awarded and signed. Bids must all be made upon blank forms furnished by the Sanitary District.

The California Gas and Electric Corporation of San Francisco has just ordered from the Stanley Electric Manufacturing Company two frequency-changing outfits of 5,000-kilowatts capacity each. These outfits are for use in connection with the contract which the California Gas and Electric Corporation has secured from the San Francisco Street Railway Company, and will change the 60-cycle current from the Bay County long-distance line to 25 cycles for further distribution among the sub-stations of the street-railway company. The contract awarded the Stanley company also includes transformers of 12,000 kilowatts.

## Electrical Progress of 1904 on the Continent.

[*Continued from page 13.*]

TELEPHONY.

Among the new inventions in the way of telephone transmitters may be noted the system devised by Sheers of Brussels. It consists of a diaphragm which is provided with an ivory button in the rear. The latter is caused to press against a kind of pouch of flexible material which contains granulated carbon. Inside the pouch are placed two carbon plates which form the electrodes, and the line wire is connected to them. The advantage of this arrangement is that the granules of carbon have a certain freedom of movement between the electrodes, and are not unduly compressed. Besides, there is no rigid connection between the diaphragm and the carbons. A thin wood plate forms the diaphragm, and the bag containing the granules is generally suspended between two such diaphragms, which are braced across by a strip. It is said that the transmission is exceptionally good, and, besides, the device is of the cheapest.

An improvement in microphones has been brought out by Stosberg, a German inventor, who, upon examination, found that the ordinary carbon contacts became covered with a deposit of powder after long use, and this interfered with the working of the instrument. He succeeds in preventing the spark, which he considers as the cause of the deposit, by using a resistance in parallel. The latter he finds is best made of 0.15 millimeter nickel-steel wire, having 25 ohms resistance. It is well insulated and placed in a coil inside the instrument. In this way he found a great improvement in the working of the microphone.

Nearly all the large cities of Europe show a marked increase in their telephone systems. At Budapest the four main telephone stations will soon be replaced by a handsome central station which will be one of the most complete in Europe. The main part of the plant is the large hall, which contains the switchboard for 10,000 subscribers. Its capacity can be increased to double this number. A second outfit of like capacity is to occupy the other half of the hall. The station in general is laid out for 40,000 subscribers. It uses the central-battery system, with lamp signals. The underground cables leading from the station are laid in beton conduits which represent 35 miles length. The underground system runs to 60 distributing points, where the wires pass overhead. There are no less than 3,000 miles of overhead wires. In Italy it is proposed to experiment with the Pupin system on the Naples-Rome-Turin line, which the government is to construct soon. The project will therefore be modified to this effect, and Parliament is to be asked for a credit of $200,000 to carry on the tests.

## Steam and Electric-railway Competition in Indiana.

Alarmed by the advances made by the traction companies, the steam roads are casting about for some means of competition whereby they may hold local traffic, says the Indianapolis correspondent of the Western Electrician. The most feasible plan is said to be the adoption of gasoline motors to draw local trains. The Lake Shore road, crossing Northern Indiana, has contracted for a number of 100-horsepowe gasoline engines so as to compete for local business with the interurban companies now paralleling the system. The Big Four is also making an effort to meet the trolley competition and regards the gasoline engines with favor. The traction companies are providing cars to be used next summer to deliver meat at points along their lines and are promised a good business by the packinghouses. There are indications of great strife between the steam and interurban roads to control the local freight and passenger traffic, and the year promises interesting developments.

## Time Signals Announce the New Year.

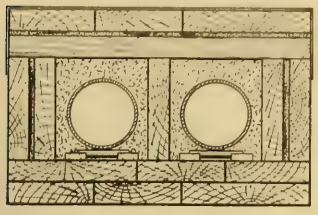
The usual time signals announcing the new year were sent to all quarters of the globe at midnight December 31st by telegraph from the naval observatory at Washington, D. C. At the observatory a wire was attached to the time clock and by special arrangement with the Western Union and the Postal Telegraph-cable companies the minutes as they ticked off were given a wide distribution.

Owing to the pressure of business on the submarine cables occasioned by the Japanese-Russian war the signals this year did not encircle the globe as completely as last year, when accurately timed they reached the Lick observatory in .05 second; Greenwich observatory, England, in 1.33 seconds; National observatory of Mexico, in 0.19 second; Sydney observatory, in Australia, 3.5 seconds, and the Wellington observatory, New Zealand, in four seconds.

## Independent Central Hot-water Heating Plant.

The Citizens' Mutual Heating Company of Terre Haute, Ind., a company organized among the leading citizens of Terre Haute to build and operate a central-station heating plant, has recently started the operation of a hot-water heating plant which has many features of interest to the municipal engineer. Primarily, it is an independent heating plant. This in itself is a new venture in the new municipal heating branch of the public-service field, and to the skeptical engineer would seem a doubtful venture. A plant built for heating alone, operating only seven months of the year, and not having the advantages of exhaust steam, as when operated in connection with an electric-light or street-railway plant, would, without undergoing the conditions, seem to be of doubtful utility. It resolves itself into a straight, coal-burning proposition, and the conserving of the heat to residences and business houses.

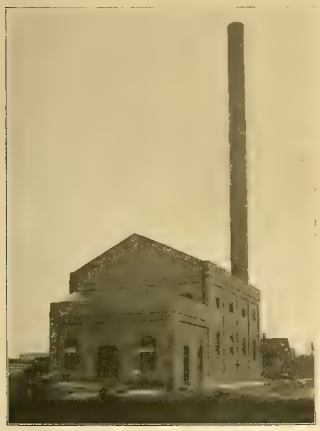
The conditions in Terre Haute, such as the large



INSULATION OF HOT-WATER HEATING MAINS IN TERRE HAUTE, IND.

territory to be covered, character of the buildings to be heated and the economical and efficient operation necessary, made it essentially a hot-water proposition. To intensify these were the absence of hills and elevations and tall buildings, the distance of the plant from the heating district, and the large number of individual hot-water plants installed. The system installed is the Schott balanced-column hot-water system, and a brief description of it will be of interest.

There is at present installed 25,000 feet of double-pipe street mains, varying in size from 12 inches to four inches, having a capacity of 250,000 square feet of radiation. By installing "tie lines" this will give the plant an ultimate capacity of 400,000 feet of radiation. The insulation of the underground mains is known as the Schott special insulation. The drawing gives details. It is built up of two-inch seasoned hemlock, with one-half-inch spaces, filled with a special insulator. The spaces between the



POWER HOUSE OF CITIZENS' MUTUAL HEATING COMPANY IN TERRE HAUTE, IND.

pipe and insulation are filled with soft-wood shavings, thus giving a dead-air-cell effect. The pipe is supported every 10 feet by a special roller and cast-iron roller plate. The top of the insulation is given a heavy coat of tar and covered with a heavy asbestos paper saturated with asphaltum. Expansion is taken care of by a metallic packed expansion joint of special design, ranging approximately 350 feet apart, surrounded and protected by a brick manhole with double covers. Service connections are taken off the street mains by means of a special fitting.

The power house or central heating plant, shown in the accompanying illustrations, is of modern brick and steel construction, thoroughly first class in all its details. It has installed at present four 250-horsepower Wickes water-tube boilers and two 16 by

[illegible] to 18 [illegible]
[illegible] and [illegible]
[illegible] of [illegible]
lighting system, consisting of a five-kil[illegible]
connected [illegible]
the power [illegible]
tem to be [illegible]
piping [illegible]
to be used [illegible]
one, while [illegible]
and a [illegible]
The boiler [illegible]
capacity to [illegible]
[illegible] being [illegible]
mond boiler [illegible]

Temperature [illegible]
cured by [illegible]
operated by [illegible]
nighcore air pump [illegible]
ated over the [illegible]

line laid in the same trench with the heating mains.

There was, at the starting of operation, in excess of 60,000 feet of radiation connected to the mains, giving promise of a very rapid growth. The service has been satisfactory in every respect, and the many advantages of regulated central-station heating are duly appreciated by the patrons. The complete plant and house equipment was designed and built by W. H. Schott of Chicago.

## Recent Direct-current Integrating Wattmeter.

The principal features involved in the recent developments in integrating wattmeters have been along the lines of increasing the driving torque, and, incidentally, the retardation, so that the accuracy on very small loads may be depended upon to a degree not attainable heretofore. Another important change recently accomplished is one of design, whereby the bearings may be readily inspected and renewal of spindle points and jewels made with the greatest

FIG. 1. RECENT DIRECT-CURRENT INTEGRATING WATTMETER.

possible ease, without having to use special tools. The most recent type of Duncan direct-current wattmeter embodies, to a marked degree, the foregoing improvements, together with others equally interesting and up to date.

Fig. 1 shows the direct-current meter with its cover in position. This cover is removable from the front, thereby permitting the meter to be installed quite close to the ceiling. It also fits closely into a felt-lined groove and is dust and insect proof. By way of testing the dustproof qualities of the meter, the makers installed one of them in a flouring mill 11 months ago and upon being inspected three weeks ago, it was found to be as clean and free from dust within as when first installed.

Fig. 2 shows the meter with cover removed, while Fig. 3 is a side view. The series field coils are machine-wound, then thoroughly taped to insure perfect insulation. The manner in which they are clamped to and held on their supporting rods is of striking simplicity. The armature is wound with 10,000 turns of No. 41 magnet wire. Its torque is from 20 to 25 per cent. higher and does not consume as much energy as the older types.

The retarding magnets are put through an artificial aging process, requiring six months, and by the time they are put into the meter they are fully guaranteed to be proof against becoming weak, even in the presence of strong external fields. This quality accounts for the meter maintaining its accuracy indefinitely, and does not change its characteristic after being calibrated at the factory. The retarding disk is made from the purest aluminum obtainable and is accurately weighed and balanced before being assembled.

fully

FIG. 2. DIRECT-CURRENT INTEGRATING WATTMETER — FRONT VIEW.

in position by a wire spring. Its insertion or removal requires but a moment and no trouble is experienced from the stripping or binding of threads.

To prevent successfully the brushes from getting out of alignment, they are mounted upon a suitable molded lava support, and, being firmly secured thereto, their tension upon the commutator is also maintained constant.

No part in the make-up of a commutator meter is productive of more trouble than the commutator itself. The Duncan Electric Company has made numerous experiments during the last two years in an effort to produce an alloy that would not be heir to all the troubles which direct-current motor meters have possessed since their adoption. The composition of the commutators of these meters prevents tarnishing and they do not turn black after being in service for a short time.

To overcome effectually the friction of the bear-

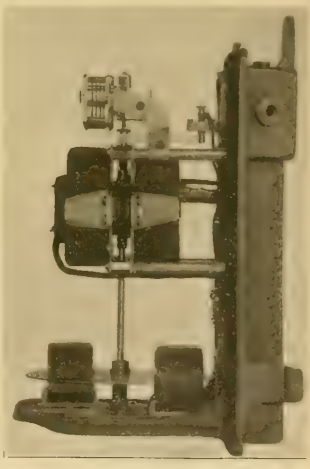


FIG. 3. DIRECT-CURRENT INTEGRATING WATTMETER — SIDE VIEW.

ings and enable the meter to measure accurately very small loads, the Duncan meter accomplishes the desired result with simple and reliable means. The compensating coil employed is rigidly and securely fixed within the front series-field coil and in close proximity to the armature, and its supplemental torque effect upon the armature is varied by cutting in or out of circuit a portion or portions of the turns comprising it. The terminals of the various

groups of turns or windings of the coil are connected to corresponding contacts of a "multipoint" switch having a small lever or arm, which makes connection with any of the contacts and brings into circuit any number of turns desired. To compensate for friction, the lever of the "multipoint" switch is moved so as to cut in turns of the compensating coil. To compensate for creeping, the lever is moved so as to cut turns out from the coil. These changes require but an instant and are absolutely permanent. There is no pushing in or out of a loose compensating coil which changes its position every time an attempt is made to fasten it, neither is there any change of position to contend with every time the series-field coils are subjected to abnormal rushes of current.

The range of the compensating coil is great, and, with its switch arm set for any given turns or compensation, it may be depended upon for permanency.

The binding posts in the meter are made fireproof and mark a great improvement. No wood or other combustible material is employed, but, instead, a specially prepared insulating fiber that is chemically treated with tungstate of sodium.

The appearance of the meter is particularly pleasing since its finish is that of a semi-dull hard-rubber black with the name plate silvered. The dials are large. They are made of porcelain and have no constants and read direct in kilowatt-hours.

## Motor for Railway Service.

The new Westinghouse No. 93 railway motor is representative of the gradual improvement in design which is the result of constantly accumulating data and experience. It supersedes the No. 56 motor, retaining those features which have made that motor successful, and adding many elements of design which constitute the best and most modern practice. Fig. 1 shows the general appearance of the motor.

In city service, a double equipment of these motors is suitable for operating single or double-truck cars of almost any size ordinarily used, that is, cars not exceeding 35 to 40 feet over all, and weighing without equipment or load from 23,000 to 30,000 pounds. In this service, with runs from one-eighth

FIG. 1. MOTOR FOR RAILWAY SERVICE.

to one-fourth mile in length, a two-motor equipment with a gear ratio of 16 to 71 will produce a schedule speed of 10 to 13 miles per hour, assuming a pressure of 500 volts and a straight, level track.

In suburban service, a four-motor equipment will operate cars from 40 to 45 feet over all, and weighing from 30,000 to 35,000 pounds without equipment or load. In this service, with average runs of from one-fourth to three-fourths mile, the four-motor equipment will maintain an average speed of approximately 17.5 miles per hour with gear ratios of 19 to 68 under the conditions previously stated.

In interurban service, with an average run of from three-fourths to 1½ miles in length, and with equipment and weight of car as above, schedule speeds of 23.5 to 28.5 miles per hour may be attained.

The general performance of the motor is shown by the curves in Fig. 2. The motor has a nominal capacity of 50 horsepower at 500 volts for one hour. The curves show the speed, tractive effort, and the brake horsepower which it will develop with currents of from 0 to 200 amperes at 500 volts. There is also a time-temperature curve. The motor has a continuous capacity of 50 amperes at 300 volts, or 46 amperes at 400 volts. Under the usual conditions of railway service, it will carry safely any loads within the range shown on the curve sheets, provided that the integrated heating effect does not exceed the heating effect caused by the continuous application of the above currents at the corresponding voltage.

In a shop test with 50 amperes at 300 volts or 46 amperes at 400 volts, the rise in temperature of the windings of the motor during an all-day run, will not exceed 75° C., as measured by thermometers. With the motors mounted under a moving car much better ventilation is obtained than in a shop test, and thus the temperature rise in service with the equivalent of these loads should be considerably less, and will usually not exceed 55° C.

The time-temperature curve shows the allowable amount and duration of such loads. The curve is based upon a rise in temperature of 20° C. in the interior of the coils under service conditions, after the motor is already heated to its ordinary running temperature. Thus, if the motor has been working for 10 or 12 hours at a load equivalent to 47 amperes at 300 volts, and has attained a temperature of 55° C. above the air, it may then, as shown by the time-temperature curve, carry loads equivalent to a continuous current of 110 amperes for 10 minutes with a further increase of not more than 20° C. If at the end of this period the load is again reduced to the equivalent of 50 amperes, the temperature will then gradually fall off to its former value of 55° C. above the air. The time-temperature curve thus shows what may be termed the safe overload capacity of the motor.

The frame of the motor is of cast steel, in two parts. It is roughly cylindrical in shape, and is

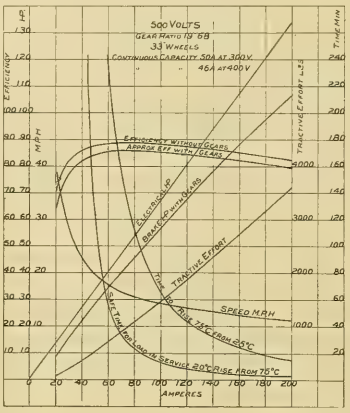



FIG. 2. CURVES OF OPERATION OF RAILWAY MOTOR.

divided in a plane through the axis of the armature shaft and car axle. The two halves of the frame are hinged together on one side, and are further held together by four bolts. The edges of the castings are carefully milled, so that a good joint between them is secured. Four pole pieces are built up of soft-steel punchings riveted together between wrought-iron end plates. They project radially inward, at angles of 45 degrees with the horizontal, and each is fastened to the frame by two bolts secured by lock washers. These bolts penetrate well into the stampings, but do not pass entirely through, thus leaving a smooth, unbroken pole face. The poles have projecting tips, which serve the double purpose of giving a proper distribution of the magnetic field, and retaining the field coils. The coils are held rigidly in place, and all vibration is prevented by flat steel springs placed between the coils and the frame. The coils are formed of copper strap, wound on the flat, the turns and sections being well insulated from each other by treated asbestos sheets. The coils are heavily taped and repeatedly dipped and dried and impregnated with special insulating compounds, which makes the entire coil moisture proof and practically indestructible.

The armature core is made up of soft steel punchings, carefully annealed and tested, built up on a cast-iron spider. Air ducts are provided between the punchings, which connect with ventilating spaces in the spider; this arrangement provides an excellent circulation of air, resulting in a uniform temperature, which is the best condition for the radiation of heat. The armature is wound with machine-formed coils, carefully insulated and embedded in the slots. They are held in place by fish-paper wedges, forced in between V-shaped grooves near the top of each slot, and also by band wires. Canvas caps are fitted over the front and rear ends of the coils, so that the entire winding is protected from any dust or dirt from the street or other sources. On the pinion end of the armature spider is a bell-shaped flange, upon which the windings rest.

The commutator is of the straight-bar type, without neck. The wearing surface is 10¼ inches in diameter by 4 11-16 inches long, and the wearing depth is about seven-eighths inch. There are 135 bars of hard-drawn copper, insulated with specially prepared soft mica, and built up and clamped on a cast-steel bushing. The commutator bushing is then forced on the armature spider, and securely keyed to it. This arrangement prevents any vibration between commutator and armature core, which so often causes broken leads and short-circuits; it also allows the shaft to be removed if necessary without disturbing the connections or relative position of armature core and commutator.

Sliding-type brush holders are used with shunts. Two cast-brass arms, well insulated with treated fullerboard, are fastened by insulated bolts to the upper frame. The arms are arranged for radial adjustment to allow for wear of the commutator. Each arm carries two spiral phosphor-bronze brush springs, each of which bears upon a brush, the two brushes being placed side by side in the slot, each extending half way across the commutator. This arrangement reduces the inertia of each moving element and allows it to follow the surface of the commutator very closely, avoiding any sparking due to "chattering."

Bearings for the armature shaft consist of solid cast-iron shells lined with babbitt metal. The bearings are carried in housings of cast iron which are of cylindrical form and are held between the halves of the frame. The housings have finished flanges on their inner ends, which are clamped between finished surfaces on the field frames; they are held from turning by tap bolts in both the upper and lower frames. The method of lubrication is by means of oil and waste. The bearing housings contain oil and waste reservoirs, which extend around one side and below the armature shaft and allow the saturated waste to come in contact with the shaft through large openings in the low-pressure side of the bearings. Separate oil wells are provided, so that oil can be added in quantities to the bottom of the waste.

A rectangular suspension bar supported on the truck frame is bolted to special lugs on the front corners of the upper field frame. The pinion is of forged steel, with machine-cut teeth, and is taper-bored to fit the shaft. It is held in place on a tapered seat by a special 2½-inch nut and lock washer, and is secured by a steel key. The pinion is countersunk to receive the lock washer, so that the end is flush. The gear is of cast steel, in two parts, which are bolted together and keyed to the axle. The face is five inches wide. Gear ratios of 16:71 to 30:57 may be used; 16:71, 19:18, 24:63 and 30:57 are standard. The gear case is made of malleable iron in two castings, divided in a plane passing through the axes of armature shaft and axle.

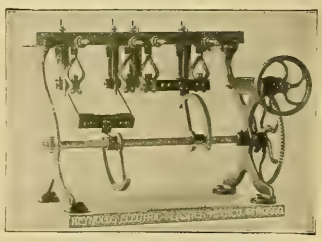
Every part of each motor is rigidly tested for faulty material or workmanship while in process of manufacture. After being assembled, a run under full load is made on every motor, as well as a breakdown test of the insulation, at an alternating potential of 3,000 volts.

The approximate weights are as follows: Motor, without gears and gear case, 2,975 pounds; motor, complete with gears and gear case, 3,335 pounds; armature, complete, with commutator and shaft, 1,005 pounds. The approximate weight of a two-motor equipment with two controllers and the usual details is 7,870 pounds. A corresponding equipment of four motors, controllers, etc., will weigh approximately 15,940 pounds.

## Sign Flasher with Double-pole Switches.

After many years of experimenting the Reynolds Electric Flasher Manufacturing Company of Chicago has placed on the market an electric sign flasher for controlling circuits of from 10 to 100 amperes, which operates satisfactorily. It is made with one, two, three, four, five, six or more double-pole switches having a capacity of 15, 35, 50, 75 or 100 amperes each. Thus from 50 to 500 four-candlepower lamps may be flashed on and off with one switch, and as many switches can be added as desired.

The switches are controlled by cams, which close them automatically in any desired manner, producing any combination or flashing effect. With this flasher electric signs can be flashed as a whole;



SIGN FLASHER WITH DOUBLE-POLE SWITCH.

double-face signs may be flashed alternately, each side as a whole; in signs containing a number of words or lines each word or line can be flashed separately, then all at once.

The construction avoids a multiplicity of circuits running through the flasher, as the division of circuits can be made at a cut-out box located in the circuit between the sign and flasher. The switch jaws are provided with lubricators in the shape of grease cups or pockets, as seen in the accompanying illustration, which holds sufficient grease to keep the sliding contacts clean and well lubricated for weeks without refilling. The switch blades drop from the jaws by gravity action as soon as they are released by the cams, thus insuring an instantaneous break and avoiding undue arcing.

The Reco flashers, as they are called, are easily connected to signs. They require but one lead from each side of the sign and one return wire, or one positive and one negative from each word or line, besides two or three mains from the service, according to the system. In other words, the flashers are simply cut in between the sign and the service and can be quickly installed to signs that are already up.

## Portable Wattmeter Calibrator.

Modern methods of conducting the business of a central station selling electrical energy through integrating wattmeters include periodic calibrations of customers' meters with an assuredly accurate standard. This is as much in justice to the customer as it is to the company, as is recognized full well by progressive central-station managers. Calibration is not a complete test, but simply a comparison of the characteristic by which the relative accuracy of two or more meters can be determined. The device

device than the ringing calibrator, but is much more restricted in its adaptability.

the meter frame. Two adjusting screws are provided on the bottom of the frame for leveling it for use, the third [illegible] The [illegible] projects through the case at the bottom so that the shaft can be raised or lowered without removing the case, which can be sealed and the adjustment of the standard protected from outside disturbances.

The calibrator terminals can be reached by removing the terminal cap. Line connections are made the same as with the ringing calibrator, and are shown in Fig. 4, the current leads going into the large binding posts and the voltage leads into the small posts. In use the calibrator is leveled by a small level placed on a milled surface on the top

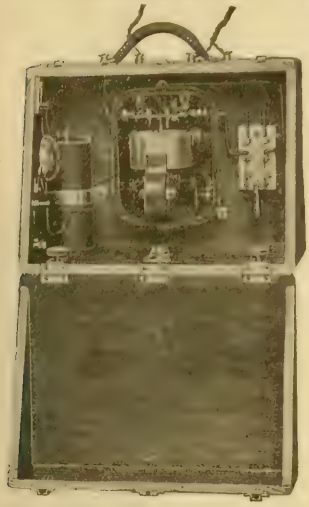


Fig. 1. Ringing Calibrator.

Fig. 2. Registering Calibrator.

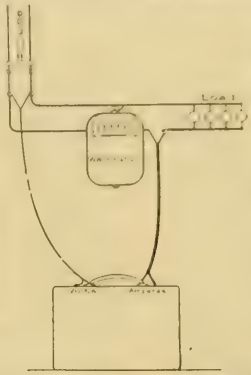


Fig. 3. Connections of Ringing Calibrator.

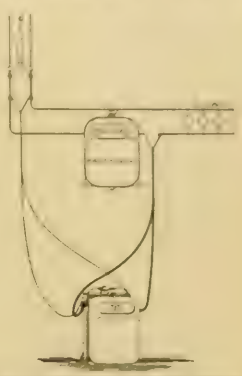


Fig. 4. [illegible]

PORTABLE WATTMETER CALIBRATOR.

method of calibration is a comparison of speeds under the same conditions of operation.

The Fort Wayne Electric Works of Fort Wayne, Ind., have developed a portable wattmeter calibrator for calibrating meters without removing them from service. These calibrators are made in two forms, one known as the ringing calibrator (Fig. 1) and the other as the registering calibrator (Fig. 2).

In the ringing calibrator a standard wattmeter of proper capacity, voltage and frequency, but without registering mechanism, is mounted on the inside of a wooden carrying case. The case is provided with leveling screws and a small spirit level set into the base. In the case, besides the meter, is a double-pole, double-throw switch, by means of which the series coils of the standard can be connected either in multiple or in series for double or normal rated current.

For normal calibration of five-ampere meters with switch down the coils are in series; for double this current, or 10-ampere meters, the switch is thrown up. This prepares the calibrator for use with five and 10-ampere meters by direct comparison without a speed constant, the change in connections making no change in total ampere turns or speed.

The scope of the calibrator is further magnified by using a speed constant of two for calibrating 15, 20 and 25-ampere meters. To calibrate 15, 20 or 25-ampere meters the series coils of the calibrator are connected in multiple by throwing the switch up, in which case the calibrator will run twice as fast as these meters when it is in calibration. The calibrator will be accurate under these conditions up to 15 amperes' load.

For comparing the speeds of the two meters a bell circuit is connected with the standard through a two-segment commutator on its armature shaft in place of the registering train. At every revolution of the standard armature the bell circuit is closed through a dry-cell battery mounted on the left side of the case, thus ringing the bell. This bell circuit may be permanently opened when not in use by a two-point switch to prevent leakage of battery current should the armature come to rest with the commutator closed.

In calibrating a wattmeter the calibrator should be carefully leveled. The various binding posts are plainly marked "volts" and "amperes" for the pressure and current leads respectively. These connections are shown in Fig. 3. With a heavy load the meter should be adjusted in step with the standard by means of its permanent magnet so the spot on the meter cup will always come to a certain point every time the standard bell rings for five or 10-ampere meters or every other time for 15, 20 or 25-ampere meters. If the meter is slow, the magnet should be lowered; if fast, it should be raised. For light load or one lamp the adjustment is made with the starting coil arm.

The registering calibrator has the regular registering train replaced by a double-reduction train and of the base. The shaft is then lowered to the jewel. After the connections are made and the proper direction of rotation verified through the dial window the calibrator is ready for operation.

The dials of the calibrator will register 110 revolutions, which is equivalent to nearly three minutes running at full load. Therefore, if the revolutions of the meter to be tested are counted and compared with the difference in calibrator readings before and after counting an exact comparison of speeds is obtained. This can be done very handily by one man. For first approximation one-half minute counting is sufficient, but for final accurate adjustment the duration of comparison should be increased to 2½ minutes.

## Receptacle for Temporary Decorative Wiring.

Illustrated herewith is a new receptacle intended for temporary decorative wiring that has just been

RECEPTACLE FOR TEMPORARY DECORATIVE WIRING.

placed on the market by Pass & Seymour of Solvay, N. Y.

This is a simple receptacle, and it is not necessary to take the device apart to wire it up, or to remove or in any way affect the insulation of the wire. By inspecting the illustration it will be noticed that an unusually simple method of wiring is made possible. The device is designed for an Edison base only, and is to be used on standard stranded wire.

The receptacle is carried in stock by Pass & Seymour, at all of their branches, and in addition to

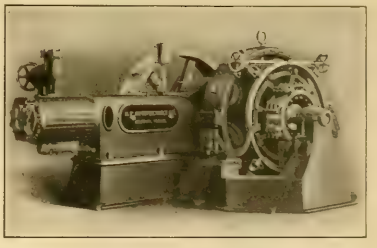
## Horizontal Center-Crank Generating Set.

[illegible] load to no load, and by a modification of the Marshall valve gear an adjustment of the cut-off from zero to 70 per cent. is attained. The main body of the engine is enclosed on both sides by removable plates, as may be seen from the picture, and the crank webs are enclosed by a cast-iron hood having two holes with removable covers, one for the purpose of cleaning the crank-pin box while it is in motion and the other for removing the box without taking off the large hood.

There are two oiling systems for this type of engine, the gravity or tank system, and that by forced pump lubrication.

The generator is of the eight-pole type, and is capable of carrying momentary overloads of 50 per cent, without any shifting of brushes or flashing of the commutator and an overload of 25 per cent. for a period of two hours without undue heating. After a continuous run of 10 hours at full load, the increase in temperature above that of the surrounding air does not exceed 40° C. upon the armature and field coils, and 45° C. upon the commutator. The average temperature rise is about 33 to 35° C. Before being shipped, the generator is given a breakdown test of 1,500 volts, alternating, for 60 seconds between the conductors and the frame of the machine to test the insulation.

The magnet frame is of the best grade of cast iron, split horizontally. The pole pieces are of wrought iron, with cast-iron shoes or horns, and



HORIZONTAL CENTER-CRANK GENERATING SET.

are secured to the magnet frame by through bolts. Any of the pole pieces may thus be removed to repair the field coils. The latter are wound up in two sections, with an air space between the shunt and series coils. The shunt winding is of double cotton-covered magnet wire of highest conductivity, thoroughly insulated and so treated as to be practically waterproof. The series winding is of solid copper bars, insulated in the same manner as the shunt coil.

The armature is of the ironclad, form-wound, ven-

tilated, drum type, having a core built up of charcoal-iron plates, which plates, after being thoroughly japanned, are mounted upon a cast-iron spider and securely held in position by end flanges. No bolts pass through the armature laminations. The armature spider has an extension, upon which is mounted the commutator, making the armature and commutator one unit.

Armature conductors are solid copper bars, without joints except at the commutator end. When these bars are formed they are insulated by material not perceptibly affected by heat or ordinary atmospheric moisture.

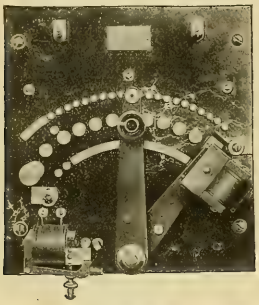
In the construction of the commutator only drop-forged or drawn segments are used, these being secured in a cast-iron shell of spider construction and clamped in place with a steel ring. No cast segments of any nature whatever are used. The segments are insulated with the best quality of carefully selected mica of a degree of hardness to allow the mica and segment to wear uniformly, obviating trouble from high mica. The end insulation consists of micanite rings, and the whole commutator is assembled while hot, under great pressure.

Carbon brushes only are used, the commutator being so proportioned and the brushes of such size as to allow at least one square inch of brush area to every 30 amperes carried. These brushes are carried in holders of the most approved construction, each mounted upon a self-contained brush rigging, so arranged that the entire set of brushes may be rotated completely around the commutator.

Hand wheels are furnished for adjusting the brushes in position, these hand wheels being so located that the brushes may be adjusted from either side of the generator.

## Compound Starting and Regulating Rheostat.

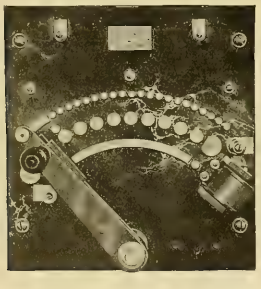
The type of controller here illustrated is intended for the operation of machine tools or similar apparatus, in which the operator is within reach of the



OPERATIVE POSITION OF STARTING AND REGULATING RHEOSTAT.

controlling handle, the speed regulation being effected entirely by means of shunt-field control. The objects sought in design were the provision of a large number of field-regulating points, the elimination of possibility of the motor starting on weakened field, the operation of the device with a single lever in a simple and natural manner and the returning of all parts to the starting position automatically under conditions necessitating this action.

The apparatus consists of a motor starter of ap-



"OFF" POSITION OF STARTING AND REGULATING RHEOSTAT.

proximately standard construction, and a series of field buttons controlled by a field-resistance lever mounted on the same hub post as the starter lever and co-operating therewith.

In operation, the motor is started and brought to speed by moving the handle to the right, this handle being attached to the field regulator lever, which is mechanically connected to the starter lever so as to move them as one piece in starting the motor. During this operation of starting the field resistance is short-circuited by an auxiliary contact mounted on the starter lever and a curved sector located just below the armature contacts. When the two levers have been moved to the position in which all resistance is cut out of the armature circuit, a keeper on the starter lever is attracted by the retaining magnet, and the starter lever is held in this position. At this time also the auxiliary contact above referred to has left the curved sector, thus removing the short-circuit from the field resistance. The field lever is now free for movement over the field-rheostat buttons at the will of the operator, and may be left at any desired point, thus regulating the speed of the motor as desired. If the retaining magnet is de-energized either by failure of voltage or by operation of overload-release devices, the starter lever is released and returns to the starting position, carrying with it the field-rheostat lever.

These rheostats are manufactured by the Cutler-Hammer Manufacturing Company of Milwaukee.

## American Association for the Advancement of Science.

More than 1,000 scientists from all over the country were in Philadelphia last week attending the fifty-fourth annual meeting of the American Association for the Advancement of Science and the meeting of the American Physical Society. During the entire "convocation week," from December 26, 1904, to January 2, 1905, the various meetings were in progress. On the first day the business session of the association was held at the Hotel Walton, at which the best means for increasing the association's membership in the various colleges and universities was discussed. After the meeting luncheon was served by Provost Harrison and the trustees of the University of Pennsylvania, at which place the subsequent meetings were held. On taking up the programme the convention resolved itself into 34 separate meetings or sections, each being of one of the societies which comprise the association or those affiliated with it. At these meetings many papers on a broad list of scientific subjects were read.

The general convention was held in College Hall Chapel and was opened by the retiring president, Mr. Carroll D. Wright, who introduced the newly elected president, Prof. William G. Farlow of Harvard University. Provost Harrison made the address of welcome on behalf of the local committee, of which he is chairman, calling attention to the former meetings of the association in Philadelphia and the names of famous scientists, now dead, who made Philadelphia their home. A short address was made by Professor Farlow, in which he thanked the members for the honor conferred upon him. In the evening at the gymnasium Mr. Wright made his farewell address on "Science and Economics." He called attention to the great change in the attitude of religion toward science, the latter being no longer a menace to the former, as it was considered some years ago. He took up the relation which science bears to everyday life, calling attention to the great progress made by modern people through its influence and calling attention to the constant effort of science to overcome natural laws as well as apply them.

The newly elected heads of the various councils composing the association are: Prof. Alexander Ziwet, University of Michigan; Prof. W. F. Magie, Princeton; Prof. L. P. Kinnicult, Worcester Polytechnic Institute; Prof. D. A. Jacobus, Stevens Institute; Prof. Eugene A. Smith, University of Alabama; Prof. C. Hart Merriam, United States Department of Agriculture; Prof. B. L. Robinson, Harvard; Dr. Walter Hough, United States National Museum; Prof. Martin A. Knapp, United States Interstate Commerce Commission; Prof. H. P. Bowditch, Harvard.

The association covers every branch of science and at the meeting matters of the latest developments in all branches were discussed. In the case of the members of the Mechanical Science and Engineering Section the programme was varied with a series of visits to the principal mechanical plants in the city. The high-pressure fire-service station, the Philadelphia Electric Company's new power plant, the League Island Navy Yard, the Belmont filtration plant and the Rapid Transit Company's subway were all inspected. In the evening the new features of some of these plants were explained in lectures delivered by Chief Hill of the bureau of filtration, Chief Engineer Twining of the Rapid Transit Company, and Chief Webster of the bureau of surveys.

Chung Hui Wang, a Chinese student at the Yale Law School, made an address before the Society of Social and Economic Science on the "Present Status of Railroading in China." He said that he confidently believed that the present method of railroading in China constituted one of the prime factors in the shaping of the future destiny of the country.

Among the papers read were the following of especial interest to electrical men: "Experimental Study of the Use of Weston Instruments for Ballistic Magnetic Testing," A. F. Ganz, Stevens Institute of Technology; "Explanation and Demonstration of the Poulsen Telegraphone," Z. B. Babbitt, New York city; "Electric Double Refraction in Liquids Under Low Electric Stresses, and also at the Boiling Point," D. B. Brace, G. W. Elmen and L. B. Morse, University of Nebraska; "The Electromagnetic Theory and the Velocity of Light," Henry T. Eddy, University of Minnesota; "A Tentative Theory of Thermo-electric Action," address by Edwin H. Hall of Harvard University, retiring vice-president of Section B; "The Distribution of Energy in the Visible Spectrum," Edward L. Nichols, Cornell University; "Objective Method for Showing Distribution of Nuclei Produced by X-Rays or Other Radiation," C. Barus, Brown University; "Experiments on Resonance in Wireless-telegraph Circuits," G. W. Pierce, Harvard University; "The Ratio of Electrical to Gravitational Forces," Bergen Davis, Columbia University; "A Measurement of the Thomson Thermo-electric Effect in Iron," Edwin H. Hall, Harvard University; "A Contribution to the Theory of Thermo-electromotive Force," C. B. Thwing, Syracuse University; "New Phenomena of Fluorescence," Harry W. Morse, Harvard University; "The Tuning of Thermo-electric Receivers for Electric Waves," A. D. Cole, Ohio State University; "The Capacity and Resistance of Aluminum Anode Films," C. McC. Gordon, Central University; "The Chemical Combination of Oxygen and Hydrogen Under the Action of Radium Rays," Bergen Davis and C. W. Edwards, Columbia University; "Use of Sensitive Quadrant Electrometers," J. C. McLennan, University of Toronto; "Decay of the Excited Radioactivity from Natural Causes," Miss L. B. Johnson; "Secondary Radiation Excited in Metals by the Gamma Rays from Radium," H. F. Dawes.

## Street-railway Tunnel under Boston Harbor.

The new tunnel under Boston Harbor, from Scollay Square, in the heart of the city, to Maverick Square, in East Boston, the route from Scollay Square to the water front being under State Street, was formally opened on December 29th, by Gov. John L. Bates and a group of distinguished guests. Regular service by the Boston Elevated railway system, lessee of the tunnel, was inaugurated on Friday. The principal station in Boston has been constructed at the head of State Street, beneath the old historic State House.

East Boston is located on an island, and has been reached hitherto by ferry. The event, therefore, is regarded as an occasion for great jubilation by the residents there. At a banquet in East Boston, following the opening, many prominent men were present. Among others who spoke were George G. Crocker, chairman of the Rapid Transit Commission, and William A. Bancroft, president of the Boston Elevated Railway Company.

The East Boston tunnel was constructed by the Boston Transit Commission, with Howard A. Carson as chief engineer. It cost, approximately, $3,300,000. Work began on May 5, 1900. The length from Maverick Square to Scollay Square is 1.4 miles. The width under the harbor is 23 feet; in the upper part of State Street and in Court Street it is 23.67 feet. The height, from the top of the rail to the roof in the upper part of State and Court Streets, is 14.17 feet; in the lower part of State Street and under the harbor it is 17.3 feet. The depth at the lowest point is 82.3 feet below mean low water, in the middle of the harbor; the top of the rail at that point is 77.3 feet below mean low water. No great obstacles were encountered anywhere. There were no large rocks requiring blasting inside the tunnel, and only one or two small pockets of quicksand. For the most part the material pierced by this tunnel is blue clay, which was easy to work in and safe for the workmen.

The number of passengers who traveled between Boston and East Boston last year by means of the North and South ferries is 12,846,367, and this gives an idea of what will be required of the tunnel service. It will cost one cent, in addition to the regular five-cent fare, to pass through the whole or a part of the tunnel, this toll to be collected at toll offices on the Boston side.

Light may be obtained from four different sources, but at present light comes from one of the Boston Elevated power houses. If that fails it may be taken from another power house, or from the trolley wires, and if all fail the Edison wires will be tapped by automatic action. All through the tunnel there are three lines of lights—one along the middle of the roof and one line on each side. Little shades cover the lights from the side on which the cars come. From one end to the other the tunnel is white, with tilings of a high gloss at the stations.

## Northwestern Electrical Association.

The thirteenth annual convention of the Northwestern Electrical Association will be held in the Hotel Pfister, Milwaukee, on January 18th and 19th. Reports and papers of special interest to central-station and street-railway men will be read and discussed. An attractive entertainment programme is being arranged and a pleasant and profitable time is anticipated. President T. F. Grover of Fond du Lac, Wis., and Secretary Thomas R. Mercein of Milwaukee are putting forth much effort to make the convention a success.

The City Council of Abilene, Texas, has granted a franchise to Fred Cockrell of Dallas and associates to build an electric street-railway system there.

## Telephone News from the Northwest.

Hogeboom & McLane have installed a new telephone system at Rockham, S. D.

The Iowa Telephone Company's exchange and offices at Fort Dodge, Iowa, have been totally destroyed by fire.

The Commercial Telephone Company of Belgrade, Minn., has filed articles of incorporation, with a capitalization of $50,000. T. J. Anderson heads the list of stockholders.

The Sherman House of Appleton, Wis., will install a telephone system of 125 connections, reaching every room.

The City Council of Superior, Wis., has accepted a proposition from the Bell company to furnish 14 connections to the city offices free. The Independent company there has enjoyed a monopoly of the city connections.

The Northwestern Telephone Exchange Company's statement for the year ended November 30th shows earnings of $984,834, on which a three per cent. tax goes to the state.

R. H. Woolfolk, manager of the St. Paul office of the Northwestern Telephone Exchange Company, was presented a handsome gold watch and fob by the office employes.

J. J. Cook, manager of the Sioux Falls, S. D., exchange of the Northwestern Telephone Exchange Company, was presented a handsome Elk charm from the employes of the exchange.

The new telephone line between Deering and Mohall, N. D., is completed and in working order.

The West Hotel in Minneapolis is to have an exchange, installed by the Northwestern Telephone Exchange Company, giving connection with every room.

The local exchange at Clearwater, Minn., has arranged for long-distance connections with the Northwestern Telephone Exchange Company.

The Great Western Telephone Company of Milnor, N. D., has replaced its switchboard, which was recently destroyed by fire.

The Lismore Mutual Telephone Company has been granted a franchise by the council of Lismore, Minn.

The Newburg and Grinnell (Iowa) Telephone Company has been reorganized. J. L. Burroughs was elected president and Thomas Mason secretary.

The Manitowoc (Wis.) National Bank will erect a new exchange building for the Wisconsin Telephone Company.

The Central Telephone Company of Broken Bow, Neb., has increased its capitalization from $35,000 to $100,000.

The recent storm which swept over the Northwest has greatly handicapped the telephone and telegraph companies. Lines are down everywhere and the loss will be large. R.

## Indiana Telephone Items.

The granting of a franchise to the Central Union Telephone Company by the Lebanon City Council aroused opposition to the extent that the council, in order to even up matters, granted a new franchise with equally liberal provisions to the Lebanon Telephone Company at its last meeting. The new franchise contains no restrictions as to rates and is for 20 years. The old franchise, which would not have expired for four years, was canceled.

The Laporte Independent Telephone Company is completing a line to Chicago with the idea of ultimate connection with the automatic system in Chicago. There is also a line being constructed from Kendallville to Goshen to connect with the Toledo line at Kendallville. Such a plan completed there will be a direct connection between Chicago, Toledo, Cleveland, Pittsburg and other eastern points.

The New Long-distance Telephone Company made its patrons a unique Christmas gift in the shape of a free talk over its lines. Many Christmas greetings were exchanged over the wires.

The telephone trouble in Hendricks County continues. George D. Foote, an expert telephone electrician, formerly of New Haven, Conn., has filed a suit in the Circuit Court against the Consolidated Telephone Company and John M. Griest, principal owner of the plant, asking for $2,000 damages for an alleged breach of contract.

The Whitley County Telephone Company has entered into a contract with the Wilmot Mutual Telephone Company, with exchanges and 300 subscribers at Wilmot, North Webster and Cromwell, whereby the subscribers of both companies will have the right to free service with the exchanges at Ætna and vice versa. The Wilmot subscribers will have free communication with the exchanges of Columbia City and Larwell. The companies agree to build trunk lines to accommodate the new service. The Whitley company has also closed a free-communication contract with the company operating at South Whitley, Luther and Beppus.

The commissioners of Marion County have contracted with the New Telephone Company for telephone service during 1905 at a cost of $1,250.

The Farmers' Co-operative Telephone Association of Dearborn County has filed articles of incorporation. The capital stock is $1,000. The company's declared purpose is to establish and operate telephone exchanges and lines in Dearborn, Ripley and [illegible] president. S.

## Telephone Notes from Texas.

[illegible] which is used by some of the lines.

[illegible] for the purpose of establishing a telephone system at [illegible] stock of $20,000. T. E. Pittman is one of the incorporators.

The Gulf and Interstate railroad, which runs from Beaumont, Texas, to Port Bolivar, situated opposite Galveston, uses the telephone in its operation. The distance is 80 miles, and there is quite a heavy traffic over the road. The road has no telegraph service whatever, and the movement of trains is handled entirely by means of the telephone. It is said to be the longest road in the United States to be operated exclusively by telephone. H.

## Bell Telephone Output.

The telephone instrument figures of the American Telephone and Telegraph Company for November and 11 months of the year 1904 make the following comparative exhibit:

| | | | | |
|---|---|---|---|---|
| November | [illegible] | [illegible] | [illegible] | [illegible] |
| Gross output | | | | |
| Returned | | | | |
| Net output | | | | |
| Since January 1 | | | | |
| Gross output | | | | |
| Returned | | | | |
| Net output | | | | |
| Outstanding Nov. 30 | | | | |

The statement for the 11 months ended November 30, 1904, is the best ever issued for a similar period. The Bell system has grown from 583,506 instruments outstanding in 1894 to 4,408,177 on November 30, 1904. The increase in the net earning capacity of the stock of the company, owing to the growth of the system the last year, is said to be over one per cent. on the stock outstanding.

## More Automatic Telephones for New England.

Lewis A. Goudy of Portland, Me., general manager of the Northeastern Telephone Company, is said to have acquired the charter of the Granite State Telephone Company, issued by the New Hampshire Legislature, 10 years ago, but never operated. He has just made contracts, it is said, for an installation of the automatic telephone service in New Hampshire, to begin in the early spring in the capital city of Concord, and to be extended to Manchester and Nashua, thence across the New Hampshire border toward Lowell. Mr. Goudy will be assisted in this enterprise by R. W. D. McKay, an experienced telephone promoter, formerly of the West, now of Manchester. Local capital is to be utilized in the several New Hampshire cities. It is the intention of the projectors to eventually connect with the Northeastern Telephone Company's trunk lines in Maine, and extend through central Massachusetts to connect with New York and the West.

## EXTENSIONS AND IMPROVEMENTS.

A new telephone line has just been inaugurated between the towns of Tlazazalco and Pureparo, state of Michoacan, Mexico.

A telephone line has been built and placed in operation between San Luis Potosi and the town of Villa de Arriaga, Mexico.

The Rocky Mountain Bell Telephone Company's exchange in Ogden, Utah, is to be enlarged and a new switchboard will be installed at a cost of $35,000.

Superintendent Miller of the Rocky Mountain Bell Telephone Company at Helena, Mont., states that work is to be commenced immediately on the construction of a rural system to extend all through the Bitter Root Valley.

The telephone line between Vancouver, B. C., and Victoria, Vancouver Island, has been opened for business. The length of the system is 100 miles of land line and 14 miles of cable. The toll will be 50 cents for one minute's conversation and 10 cents for every additional 15 seconds. The British Columbia Telephone Company built the line.

## GENERAL TELEPHONE NEWS.

[illegible] Tulsa, I. [illegible]

The Colorado Telephone [illegible] its capital stock from $5,000,[illegible] company will add to its [illegible] Denver next spring.

[illegible] Telephone Company of Canton, Ill., on telephone lines to connect with Galesburg, Peoria, Havana and other places in adjoining counties.

The work of a citizens' committee recently appointed for the purpose has resulted in a general reduction of the rates of the Rocky Mountain Bell Telephone Company at Salt Lake City, Utah.

A representative of the Empire Co[illegible] pany of Los Angeles, Cal., has pe[illegible] Council of Portland, Ore., for a fran[illegible] an annual [illegible] bonus of $37,000 for the franchise.

Citizens of Kilbourn, Wis., and neighboring farmers have former a farmers' mutual telephone company, with a capital stock of $5,000. The farmers' line is now into Kilbourn and has about 40 business telephones in sight already. This will give Kilbourn two telephone systems, the Kilbourn Telephone Company already operating a system in the city.

The Pleasant Hill Telephone Company has been incorporated at Pleasant Hill, Ore., for the purpose of constructing a telephone line to connect with the Pacific States line at Springfield and have free connection with Eugene, Ore. The officers of the company are: W. L. Wheeler, president; William Ellis, vice-president; H. H. Ruth, secretary; L. E. Parker, treasurer.

The Board of Trade of Vernon, B. C., has under consideration a proposal from George Williamson to put in a long-distance telephone system connecting Enderby, Armstrong, Vernon and Kelowna. The cost would be about $20,000 or $30,000, and Mr. Williamson will undertake the project as a personal venture if he can secure the support from the requisite number of people in the valley.

A New York telephone company expedites the laying of its cables in street conduits by using a large electric truck which not only transports the spools, but hauls the cables through the conduits from one manhole to another. An iron pulley projects from the frame of the vehicle at the front, over which runs the cable or the rope attached to it, to give a vertical pull, the cable then passing through an aperture in the front of the body to the windlass. Two uprights extending down into the manhole are for the purpose of relieving the strain on the pulley support and upon the springs and axle of the vehicle. A one-horsepower motor is geared to the windlass which performs the work of several men.

## MANUFACTURERS AND DEALERS.

The Vought-Berger Company of La Crosse, Wis., maker of telephones and switchboards, is giving away a handy little souvenir in the form of a celluloid folding pocket rule measuring both in inches and in the metric system and bearing the 1905 calendar on the reverse side.

Two new bulletins come from the North Electric Company of Cleveland, Ohio, and are devoted to "Divided Circuit Two and Four-party Selective Magneto Telephones" and "Cut-in Stations." The four-party selective telephones are equipped with biased ringers, while the two-party telephones have the ordinary alternating ringers. The cut-in station apparatus is used to separate rural or toll lines into sections so that sections may be used independently of each other. At such dividing points it is necessary to use in addition to the telephone a switch and ringer. These are mounted in a neat box and are known as the cut-in station.

## Preservation of Telephone and Telegraph Poles.

For the last two years the bureau of forestry has been co-operating with the American Telephone and Telegraph Company and recently with the Postal Telegraph-cable Company also, in an experimental study to increase the durability of telegraph and telephone poles. The interest in this matter taken by these corporations promises an important forest economy through the possibility of using much smaller trees than are now used for poles. This means a new market for these smaller trees, liberating the larger ones for other uses.

The length of service of a telegraph or telephone pole is determined in a section of the pole not more than a foot or a foot and a half long. In a standing pole this section extends about six or eight inches above and below the top of the ground. This is the universal point of attack upon the life of the poles. Decay sets in at the ground line and reaches both up and down the pole, but only so far as the conditions exist which promote the growth of wood-destroying fungi. A few inches below the ground there is lack of the necessary oxygen and heat, while at the same distance above ground the requisite moisture fails. The exact time at which decay begins its work depends upon the climate, the character of the soil and similar conditions. In a hot, moist climate it ordinarily sets in with great rapidity. But at best, in a very few years after the pole is set, the struggle has commenced. The decay soon girdles the pole and gradually eats into it deeper and deeper, until it is so weakened that it breaks under the weight of its equipment.

The experiments already made by the bureau show conclusively that poles can be subjected to a preservative treatment which insures materially lengthened service. This treatment consists in impregnating the wood with antiseptics which prevent the growth of the fungi that cause decay. The treatment of telephone and telegraph poles, when attempted at all in this country, generally has been applied to the whole pole, requiring the use of air-tight cylinders 100 feet long or more. The poles are subjected to live steam for some time, when a vacuum is created. Creosote is then run in and pressure is applied to force it into the wood. Manifestly this is a laborious process. Yet for telephone and telegraph poles only about one foot of the entire length needs to be made immune from fungus. If this foot at the fatal ground line can be preserved from decay, the rest of the pole can take care of itself. Experiments will now be made in treating the butts of the poles for a distance of eight feet, thus carrying the antiseptics just beyond the zone of decay attack. The creosote method will be used and dead oil of coal tar forced through the butt of the poles.

Antiseptics prevent, for the time of their effectiveness, the starting of the decay, and thus permit at the outset the selection of an eight-inch diameter rather than a 12-inch. The four inches saved represent a great difference in the size and age of trees used for poles. Both the companies and the owners of the forests will be gainers by the economy, with its shortening of the length of time necessary to grow a pole.

Another feature of the co-operative work will be treatment of the cross-arms. The companies have been treating them, but they report too much absorption in some cases and not enough in others. The bureau will more carefully grade the different kinds of wood, and treat each class separately. In this it is expected to secure a more equal absorption and more satisfactory results. These are the main points covered by the contracts, though in addition the bureau will furnish information on the supply of pole timber and such general advice as may be suggested by the co-operative work.

## Unusual Method of Laying Electric Cables.

In the Poplar district in London an unusual method of laying electric cables has been employed in which the cables are laid separately in a corresponding number of light steel pipes instead of being put down in the usual conduits. These pipes are coated upon the exterior with a special preparation in which paraffin wax predominates. They are made in five-foot lengths, and are jointed by ends which screw into one another, leaving a flush surface, until a tube of 200 feet has been formed. This length of tubing is then laid in the trench, and covered all around with a layer of concrete, which is allowed to set. This accomplished, the steel pipes, which only serve as a mandrel on which to form the concrete duct, are withdrawn by the application of steam, which is driven into them under pressure. The heat thus applied melts the preparation around the pipes, and as this also acts as a lubricant, the pipes can be withdrawn quickly and easily by winch and rope. As each five-foot section of piping is withdrawn, it is unscrewed and coated again for further use.

The Independent Telephone Company of Seattle, Wash., has been granted a franchise over the roads of Kings County. The lines will be extended to Kirkland, Port Townsend and Port Angeles.

# CORRESPONDENCE.

## New York.

New York City, December 31.—The proposal to have a municipal-lighting plant was advanced a step yesterday when the Board of Estimate after hearing legal opinions appointed a commission to prepare general plans and specifications. The commissioners will be Nelson P. Lewis, chief engineer of the board; Prof. George G. Sever of Columbia University and Cary T. Hutchinson, consulting electrical engineer. The utilization of the city's waste for boiler purposes will be considered. Much opposition to the proposals is being organized. It is interesting to note that today's New York Tribune contains the substance of the report on lighting which appeared in abstract in the Western Electrician on December 24th.

Lighting Commissioner Oakley, although nominally responsible for the report recommending a municipal plant, has made statements this week which show that he does not endorse the scheme. In particular he maintains that the figures relating to the comparative cost of lighting in other cities refer to so many differing conditions that it is not fair to base any conclusions upon them. He pleads also that he cannot be held responsible for the existing lack of competition. With regard to Mr. Oakley's statements and the opinions of Mayor McClellan, William R. Hearst, who obtained the Supreme Court injunction which has brought the matter to a head in his newspapers, alleges that both these gentlemen are friendly to the local gas interests.

On Thursday Chief Engineer W. B. Parsons, on the eve of his retirement, presented to the Rapid Transit commissioners an elaborate report on a large scheme of additional subways. The total estimated cost for the carrying out of all Mr. Parsons' recommendations is $40,000,000, and provision is made so that there would be real competition among rival bidders for the franchises. The chief competitors would probably be the Interborough, Metropolitan, Brooklyn Rapid Transit and Hudson Tunnel companies.

The subway now carries from 300,000 to 350,000 persons daily. It is estimated that 150,000 of this total come from the older systems of the elevated and surface cars. Frank Hedley, general manager of the Interborough company, believes that the 200,000 additional riders are people who have now been induced to ride for the first time because they find the new system so convenient.

May 1st is the date set for the opening of the subway under the Harlem River. Both tunnels have been completed and rails have been laid through them most of the way.

If the grant of $300,000 is made by the Board of Estimates for New York city, Bridge Commissioner Best will be able to complete the plans for running 360 cars an hour over the Brooklyn Bridge in time for next season's summer traffic.

The Bush Terminal Railroad Company has made application to the Board of Aldermen for a grant of a franchise to construct a double-track railway operated by the overhead system of electricity on the site of property which this and an allied company, the Bush Company, Ltd., own in the neighborhood of the water front between Fortieth Street and Second Avenue, Brooklyn.

Alderman Ware has introduced an ordinance for the granting of a franchise to the Manhattan and Bronx Electric Company to construct wires and other conductors with the necessary poles, pipes and fixtures in and under the streets and public places in Manhattan for conducting and distributing electricity. The franchise is asked for 25 years, with the right of renewal for another 25 years on a fair revaluation.

The General Electric Company announces that it has received an order from the New York Central and Hudson River railroad to furnish the company with Curtis steam turbo-alternators consisting of eight units of 7,500 horsepower each, with a total of 60,000 horsepower. This will be the first large steam-turbine installation used for supplying the motive power over nearly 300 miles of track, now operated by steam locomotives.

The New York Edison Company and the Brooklyn Edison Company were the only bidders for the lighting of Brooklyn Bridge. The contract is divided in halves—one-half going to Manhattan and the other to Brooklyn. The bids were $130 a lamp a year for the 2,000-candlepower arc lights and $18 for incandescent lamps.

Sixteen electrically lighted Christmas trees were seen in the hospital on North Brother Island at the Christmas celebration. D. W. W.

## Dominion of Canada.

Ottawa, Ont., December 31.—By a vote of 422 to 46, the ratepayers of Calgary, Northwest Territory, have decided in favor of installing a municipal electric-lighting system in the town.

The Montreal Electric Street Railway Company, instead of giving each of its employes a turkey, as in former years, has handed over to the Mutual Benefit Association, existing for the employes, a check for $3,000. This sum makes a handsome addition to the association's capital, which is called upon from time to time for payment of sick benefits to the men.

Navigation on the new Welland Canal being closed, preparations are being made for the improvements which are proposed to be undertaken before the opening next spring. The wiring for the electric lighting of the canal is being proceeded with, and when the canal opens again the new electric-lighting system will be in operation. Lights will be placed every 200 feet along the canal, which is at present illuminated by gas lamps at the locks.

At a meeting of the shareholders of the Hamilton, Ancaster and Brantford Electric Railway Company, held in Hamilton, Ont., the contract for building the road was let to Haines Bros. of New York, who are to accept the stock and bonds of the company, amounting to $500,000, in payment. The new road will be operated with power from the Cataract Power Company and will run into the city of Hamilton on existing tracks. The road is 23 miles long.

Montreal capitalists will undertake to supply the towns of Fort William and Port Arthur, Ont., with electric power and lighting. The sum of $50,000 has been deposited with the town of Fort William as a guarantee. F. W. Thompson, vice-president of the Ogilvie Flour Mills Company, in company with H. S. Holt, president of the Montreal Light, Heat and Power Company, inspected the Kakabeka Falls waterpower, which was recently secured, and is impressed with the magnitude and availability of the power. W.

## New England.

Boston, December 31.—The Massachusetts railroad commissioners have authorized the consolidation of the Worcester and Southbridge, the Southbridge and Sturbridge and the Worcester, Rochdale and Charlton Depot street-railway companies, all of which are owned by the New York, New Haven and Hartford railroad. The Worcester and Southbridge will be the operating company.

The Pittsfield Street Railway Company is to erect a new power house. The Pittsfield Electric Company furnishes the railway's motive power at present, but the system's growth causes the directors to believe that their best plan will be to erect a plant of their own.

The fact that Charles F. Choate—who is president of the Old Colony steam railroad, which is leased to the New York, New Haven and Hartford railroad, Mr. Choate being a director also of the latter—is at the head of the syndicate which purchased the Middleboro, Wareham and Buzzard's Bay and the Bristol County electric railways, is taken to mean that the steam road intends to utilize the trolley lines in Southeastern Massachusetts for feeders just as it has acquired and used Western Massachusetts and Connecticut lines in that manner. Further acquisitions are anticipated in the same territory now that a beginning has been made.

J. B. Judge has been appointed superintendent of the entire Consolidated Street Railway Company's system in Connecticut, succeeding T. R. Hull, resigned. The same order, issued by General Manager J. K. Punderford at New Haven, creates two new positions under the title of official dispatchers, and M. W. Gaffney and F. P. Landey are assigned to the new duties. B.

## Ohio.

Cleveland, December 31.—Plans had about been completed by the Cleveland Electric Railway Company to give the three-cent-fare plan a trial on certain lines in the city when a hitch occurred between Mayor Johnson and General Manager Andrews. Mr. Andrews expressed himself as of the opinion that a railroad cannot be operated in Cleveland on a three-cent fare, but was willing to give it a trial of two weeks on lines that pass through the most densely populated sections of the city with a view to ascertaining whether the travel would increase in the proportion claimed by Mayor Johnson.

It is said that arrangements are being made to close up the gap between Pittsburg and Bellaire, so that a through trolley service may be had. From Bellaire to Zanesville the Appleyard people have the Bellaire, Zanesville and Western, which is to be operated as a trolley line. At Zanesville connection will be made with the Appleyard lines through Columbus to Springfield and Dayton, and from there to Cincinnati the Cincinnati, Dayton and Toledo will take passengers. Other roads in the system are the United Power Company of East Liverpool, the Steubenville and Ohio Valley Traction Company, the Beaver Valley Traction Company of Beaver, Pa., and the Pittsburg Railway Company.

During the last year the Columbus Railway and Light Company collected 36,000,000 tickets. It is estimated that transfers were issued on one-sixth of these. The receipts will be between $1,450,000 and $1,500,000, an increase of about 8 per cent. over the year before. When the receipts reach $1,750,000, the company will give eight tickets for twenty-five cents, and it is estimated that that amount will be received in 1907. The company has made good profits at the rate of seven tickets for a quarter, and the officers are perfectly satisfied with the results.

The Lake Shore (steam) has completed a spur between Elyria and the steel works at Lorain, and it is announced that a passenger train will be put

on to compete with the Lorain Street [illegible] pany.

It has been reported that Mayor [illegible] of Cleveland has invented a device [illegible] that does away with wheels. The [illegible] is said to be magnetic, and the [illegible] on slide along a system of track. [illegible] been said of the plans of the [illegible] time it is impossible to say anything [illegible] them.

Charles R. Cory has been appointed [illegible] the books, account and collection [illegible] lumbus Electric Light Company. The [illegible] not affected by the move.

Cars have been placed in operation on [illegible] field, South Charleston, Washington and Chillicothe line between Springfield and South Charleston.

Fire damaged the Western Union telegraph office in Cleveland to some extent a few days ago.

A committee of the City Council of [illegible] been appointed to co-operate with the companies using overhead wires in the city to formulate a plan to put them in conduits, so they could be out of the way in case of fires. The firemen were greatly hindered in their work at the last fire by the network of wires along High Street. [illegible]

## Indiana.

Indianapolis, December 31.—The Indianapolis Light and Power Company and the Marion Gauge Hot Water Heating Company have merged and united into a single corporation. The capital stock is $1,000,000. The new company will be known as the Indianapolis Light and Heat Company.

Professor Esterline, with a force of 20 students from Purdue University, made a 48 hour test of the Crawfordsville electric-light plant last week. The coal was carefully weighed and the water metered. By knowing the capacity of the boilers, the amount of energy in the form of steam was readily computed. After the current was generated it was recorded. Instruments registered both voltage and amperage. All these records were kept for 48 hours.

An electric-light plant will be installed in Zionsville. The power will be furnished by the Indianapolis and Northwestern Traction Company.

The Kokomo Electric Construction Company has filed articles of incorporation. The principal office will be in Kokomo. G. W. Norwood, C. O. Scott and G. H. Martgolf are the incorporators.

The Ft. Wayne and Northern Traction Company has filed articles of incorporation with the secretary of state. The capital stock is $100,000. The corporation proposes to construct, purchase, rent or acquire lines and systems of street and interurban railroads in and connecting Ft. Wayne, Auburn, Garrett, Butler, Waterloo and Angolia. The principal office will be in Ft. Wayne. F. H. Cutshall, H. E. Vondermask, J. W. Wessell and T. H. Schmidt are the officials.

At a recent meeting of the directors and stockholders of the Consolidated Traction Company the capital stock was increased from $300,000 to $1,500,000. The company will complete its road between Indianapolis and Crawfordsville at once, and is now in the market for rolling stock. It was also decided to extend the road west to Covington and Danville and build a branch to Almo into the coal fields nearby. W. H. Hawkins is secretary, with office in the Indiana Trust Building.

The rumor emanating from Cleveland, Ohio, to the effect that the Elkins-Widener syndicate, which is largely interested in Indianapolis and Cincinnati street-railway lines and in Ohio and Indiana traction lines, has brought about a plan to unite the interurban companies operating in western Ohio and eastern Indiana, thereby bringing hundreds of miles of electric railway under one management and in one system, is strenuously denied by the Indiana interurban men supposed to be parties to the arrangement.

J. H. Larimer, president of the Indianapolis and Ohio Valley Traction Company, incorporated last week, with office in Indianapolis, is now contracting for the right-of-way for a line from Indianapolis to Rockport. The first link built will be between Rockport and Grandview.

The Ft. Wayne and Wabash Valley electric traction line, announces that it has arranged for a through car service between Ft. Wayne and Indianapolis. The cars will run over the Indiana Union Traction lines from Wabash and will reach Indianapolis via Marion, Alexandria and Anderson. This line is going after the freight, in competition with the Wabash steam road. Spurs are being built from the main line to warehouses and factories. An official of this road is authority for the statement that the line would be built between Logansport and Lafayette early in the spring. S. S.

## Northwestern States.

Minneapolis, December 31.—The Hennepin County commissioners have released the Minnesota Power and Trolley Company from its bond guaranteeing the construction of an electric railway from Minneapolis to Anoka, Minn. The company will use a private right-of-way instead of the county roads. J. L. Kiichli, general manager of the company, declares that the road will be completed within a year.

[illegible]

for a municipal electric-light plant.

The Central Construction Company may apply for a lighting and power franchise at Oshkosh, Wis.

The ordinance authorizing the Twin City Rapid Transit Company to construct an extensive new loop system in the business section of Minneapolis has been passed by the City Council, and it is thought that it will be signed by the mayor shortly. Construction work will be started as early in the spring as the weather will permit. R.

## Rocky Mountain States.

Salt Lake City, Utah, December 29.—Barney Mahler, chief promoter of the proposed interurban line between Logan and Payson, Utah, has returned to Salt Lake, after an extended eastern trip made in the interests of the enterprise. He is now actively at work negotiating for a franchise for the undertaking.

The Washoe Power and Development Company's electric plant at Reno, Nev., is rapidly nearing completion, and the management expects to be furnishing power for electric lighting and other purposes within the next three or four months.

Plans have been completed for the installation of an electric power plant at Fort Douglas, Utah, at an estimated cost of $40,000.

As soon as weather conditions are favorable, the Utah Light and Railway Company of Salt Lake City will commence work on important extensions of its electric-railway system, including branch lines to the towns of Sandy and Bingham Junction.

The Ox Bow Tunnel Company of Boise, Idaho, has completed arrangements for the installation of its electrical equipment and will place an order for machinery within the next few weeks.

A special election, at which the citizens of Payson, Utah, will determine upon the proposed bonding of the city for $12,000 for the improvement of its electric-light system, will be held on January 21st.

The Union Gold Dredging Company of Centerville, Idaho, is making arrangements to commence work on the installation of a power plant on the Payette River, to furnish energy for that and other mining companies.

The Glendive and Lower Valley Transit Company has submitted to the board of county commissioners at Glendive, Mont., a petition asking for a franchise for the construction of an electric railroad from that city to Buford, N. D., a distance of 80 miles. The proposed line will traverse the celebrated Lower Yellowstone Valley. The capitalization of the company is $1,000,000.

Articles of incorporation of the Amador Railway Company, with a capitalization of $1,000,000, have been filed with the secretary of state at Helena, Mont. Besides other branches of business, the new incorporation is authorized to operate a telephone and telegraph system. G.

## Pacific Slope.

San Francisco, December 30.—A. G. Wishon, representing the Fresno Traction Company, has received information from Vice-president Kerckhoff to the effect that the Fresno-Yosemite electric road will be built. The surveys are almost completed. It is expected that the actual work of construction will begin in a few months.

The city of Azusa, Cal., has purchased the franchises, lighting plant and property of the Azusa Electric Light and Power Company at Azusa for $2,300.

The Charles C. Moore Company of San Francisco has been awarded the contract for furnishing a new engine for the municipal electric plant at Alameda, Cal., for $7,719. The same firm will also be given the contract for providing the plant with a generator to cost $4,888.

The interests of E. W. Haines and others in the electric-light plant at Forest Grove, Ore., have been taken over by the Haines Electric Power Company,

[illegible]

new line will traver[illegible]

Crystal City and Reardon.

[illegible]

rated the Spokane and Interurban Company for the purpose of building an electric line from Spokane to [illegible]

## PERSONAL.

J. E. Hendricks, who [illegible] Fort Worth, Texas, of the Southwestern Telegraph and Telephone Company, has been made superintendent of that division.

Sidney R. Sheldon, professor of electrical engineering at the University of Idaho, [illegible] transferred from associate to full membership in the American Institute of Electrical Engineers at the recent directors' meeting in New York.

On the afternoon of the day before Christmas, at its Chicago office, Worcester Haughton, H. H. Haughton of the Bryan-Marsh Company was given a surprise of a very gratifying nature, resulting from the presentation by his staff of a gold watchchain for attachment to fob. This Christmas gift from the Bryan-Marsh salesmen and the office employes in appreciation of Mr. Haughton's many kindnesses to his employes was presented by Miss Jacobs, Mr. Haughton's chief assistant.

E. H. Keating has severed his connection with the Toronto (Canada) Railway Company and has gone to Mexico, having been appointed consulting engineer for several extensive works in which William Mackenzie and other directors of the Toronto Railway Company are financially interested. It is in connection with the concessions for electric and steam railways, electric power, light and heat which the Mackenzie and Mann interests have recently secured in Mexico that Mr. Keating has gone to that country.

Louis R. Swift, toll manager of the Chicago Telephone Company, [illegible] of the gang at [illegible] was Dakin Street, Irving Park, on December 31st. Mr. Swift was born in 1858 at Baton Rouge, La. He was for some years in the service of the Chicago and Eastern Illinois railroad, and when he left he had charge of all of its telegraph lines. He came to Chicago 10 years ago and filled the position of toll manager of the Chicago Telephone Company and held that position until his death. Mr. Swift is survived by a widow and one child, and by his parents, three brothers and one sister.

A dinner was recently given in honor of Mr. S. M. Keeble of St. Louis at the Missouri Athletic Club, by the electrical fraternity of that city. The banquet was a tribute to Mr. Keeble, for the high esteem in which he was held by his many friends, and was occasioned by the fact that he will shortly leave the Frank Adam Electric Company, with which he was connected as chief of switchboard and electrical department, to take up his duties as general sales manager of the Cutter company, manufacturer of the I.T.E. circuit-breakers. He carries with him the best wishes of all with whom he has been connected in business. He [illegible]

and chain by the Adam company and a diamond-studded Masonic emblem by other friends.

Elmer M. White of Hartford, Conn., has been selected by a committee of the Street Railway Accountants' Association to the position of secretary. It will be remembered that at the St. Louis convention last October Mr. Walter B. Brockway, who has faithfully performed the duties of the office for seven years, accepted re-election only with the understanding that a successor be appointed before the first of the year.

E. S. Lea, who is widely known as an authority on the subjects of turbines and centrifugal pumps, has resigned his position as sales manager for the De Laval Steam Turbine Company and has opened an office in New York as a consulting engineer. Mr. Lea, prior to his four years' connection with the De Laval company, had a wide experience in the designing and construction of power plants and waterworks and in the manufacture of general machinery.

## ELECTRIC LIGHTING.

The Mineral Wells (Texas) Light, Power and Heating Company has been incorporated with a capital stock of $50,000.

A committee headed by J. F. Johnson is investigating the proposition to install an electric-light plant at Canadian, Texas.

Cassville, Wis., has voted to put in a new electric-lighting plant. The contract was let to the Galena Iron Works at $4,310.

The Choctaw Cotton and Power Company of Caddo, I. T., has been succeeded in business by the Caddo Light and Power Company.

John Riley and F. H. Springer have succeeded to the electric-light plant of the Davenport Machinery Company, Davenport, Wash.

The Pathfinder Electric and Water Power Company of Lincoln, Neb., has been incorporated to build an $85,000 plant near Gering, Neb.

R. B. Cunningham, J. A. McGillivary and others have incorporated the Cadott Light and Power Company of Cadott, Wis., with a capital of $4,000.

The Consolidated Electric Light Company of Waterloo, Wis., has been incorporated, with a capital of $75,000. Alexander Archie is president. president.

Bonds to the amount of $80,000 have been authorized by the City Council of Aberdeen, Miss., for the construction of an electric-light plant and a system of waterworks and sewers.

The Saugatuck Light and Power Company is to be incorporated by Charles A. Floyd and B. Van Raulto of Holland, Mich., to establish an electric-light and gas plant at Saugatuck, Mich.

Heise Bros. & Co. of Orleans, Ind., have been granted a franchise to construct and maintain an electric-light plant in the town of Orleans. They propose to begin operation at once and have the plant in operation by April 1st.

## ELECTRIC RAILWAYS.

President E. S. Babcock announces that the San Diego and Lajolla (Cal.) railroad will be changed from steam to electric power.

A recent fire destroyed the repair shops of the Chicago Union Traction Company, inflicting a loss of $50,000. Two firemen lost their lives and several others were injured by a falling wall. Capt. Paul Ditt of Engine Company No. 67, who was killed, was one of the 21 surviving firemen of the Chicago fire of 1871.

Frank Jay Gould, who now controls the entire railway and lighting properties in Richmond and Petersburg, Va., and the interurban line between the cities, will invest about $5,000,000 more in a trolley line from Richmond to Ashland, on the Richmond, Fredericksburg and Potomac railroad, and thence through the fertile and remote territory to the northeast, stretching to the Chesapeake.

The lease of the Adamstown and Mohnsville electric railway to the United Traction Company of Reading, Pa., was placed on record recently. The lease is for 999 years from January 1, 1905, and provides that the lessee is to pay quarterly to the lessor 37½ per cent. of the gross receipts until the annual gross earnings shall reach $25,000, all over that amount to be retained by the lessee. When the lease expires the lessee shall have the option to purchase the road for $75,000, subject to the mortgage bonds then outstanding.

Receivers have been appointed by the Circuit Court at Cincinnati, Ohio, for the Central Market Street Railway Company of Columbus, the Dayton, Springfield and Urbana Electric Railway Company and the Columbus, London and Springfield Railway Company, all of Ohio. Jacob H. Schmidlapp, president of the Cincinnati Union Trust Company, and Myron H. Wilson, treasurer of the Cleveland Trust Company, were named. Preliminary to the application for receivers was the filing of a suit against each of the roads and the entry of immediate judgment with the consent of the representatives of the roads.

Members of the state Legislature of Tennessee from Shelby County have decided to urge the passage of a law compelling street-railway companies to provide separate cars for the races in Shelby County, which includes Memphis. The street-railway people of Memphis are opposed to the plan.

It is stated that M. D. Watson and J. R. Bickerdike of Chicago are making good progress with their plans for building an electric railroad from the Rosa Amarilla copper mines, which they own, to the port of Manzanillo, Mexico. It is the intention of the promoters of this enterprise to also extend the road east and north from the mines into rich agricultural districts. The road is to be operated with electric power, which is to be obtained by constructing a large generating plant on the Cusalpa River.

## POWER TRANSMISSION.

The Victor Fuel Company of Florence, Colo., is building a transmission line to carry electric power from Canyon City, Colo., to the new Radiant coal mines, where it will use electric power exclusively.

The annual meeting of the Mexican Light, Heat and Power Company, held in Montreal, recently, showed that steady and satisfactory progress had been made toward the completion of the plant in Mexico, and that it was expected that the company will be producing 20,000 horsepower by the middle of next summer.

The United Gold and Platinum Company, which has claims on the rim of Cataract Canyon in the Grand Canyon neighborhood west of Bright Angel, Ariz., has located for power purposes the Falls of Cataract Creek, and proposes to secure from them power for developing electricity for a railway line into the Canyon from a connection with the Grand Canyon line of the Santa Fe company. H. J. Beemer of New York is interested in the enterprise.

The contracts for the electric and hydraulic machinery in the new plant to be built by the Washington Water Power Company at Post Falls, Idaho, have been awarded. The electrical work is to be done by the General Electric Company. The main work will be commenced about February. The cost of machinery, warehouses and mills will be about $500,000. The immediate installation will be about 9,000 horsepower, with a capacity for 18,000 horsepower.

## SOCIETIES AND SCHOOLS.

The annual meeting of the Michigan Engineering Society will be held in Lansing, Mich., on January 11th, 12th and 13th. A good programme has been arranged and the papers and discussions promise much of interest.

The proceedings of the seventh annual meeting of the Kansas Gas, Water and Electric Light Association, held in Leavenworth, Kan., in October last, have been published by the association. The book contains 58 pages and has several papers of interest to central-station men.

## PUBLICATIONS.

A number of loose-leaf bulletins from the Cutler-Hammer Manufacturing Company of Milwaukee describe numerous forms of starting rheostats and controllers, together with list prices and ratings and an index of the company's various publications.

The Railway and Engineering Review of Chicago has issued an elaborate World's Fair Souvenir number with 200 pages of reading matter, devoted to the industrial features of the Exposition, which are of especial interest to engineers. The work is well executed and is a credit to all concerned in it.

A large wall card from the Speer Carbon Company, St. Marys, Pa., is especially neat and attractive. The representation of a high-grade Speer brush in a lower corner of the hanger is not so large as to detract from the striking grace of the beautiful woman in artistic pose and yet serves its purpose as a neat advertisement.

The Westinghouse Electric and Manufacturing Company has issued in pamphlet form three of the papers read at the Sandusky meeting of the Ohio Electric Light Association last August, prepared by engineers of the company. The papers are: "Points for Consideration when Purchasing Series Alternating-current Arc Lamps," by G. Brewer Griffin; "Notes on Incandescent Street Lighting," by K. C. Randall, and "Instrument Equipment of a Testing Department," by F. Conrad.

In accordance with its custom, the Indiana Rubber and Insulated Wire Company of Jonesboro, Ind., is distributing an exceedingly tasteful and richly colored hanger that is highly artistic. This company has in the past sent out some high-class work in this line and the fortunate recipients of their newest efforts will appreciate its artistic merits. The printed matter, which consists of the name and address only, is unobtrusive and detracts in no way from the value of the picture.

An interesting and handsome little catalogue treating of Fremco incandescent lamps manufactured by the Franklin Electric Manufacturing Company of Hartford, Conn., is being sent out by the company. In addition to the regular type of reflector lamp, two new types are illustrated in the catalogue. One of these embodies a lamp equipped with a detachable opalescent shade which produces a diffused and softened light. The other type is especially adapted for use where strong reflected light is desired, such as at the cornices of rooms, and is equipped with a special form of base, permitting the lamp to be inserted so that the reflecting surface may be placed in any desired position. To some of its friends and customers the Franklin company is sending out little tokens of the season, among them being a neat vest-pocket cigar case.

The H. W. Johns-Manville Company of New York has ready for the trade a new catalogue of Sachs Noark fuses and fuse devices, for all voltages. Enclosed fuse devices having established themselves as permanent and important elements in electrical construction, this company has felt that the time is opportune for the publication of more than the ordinary list of prices, accompanied by the usual meager descriptions. It has endeavored, in this new catalogue, to classify the fuses and fittings for the various voltages and types in such a manner as greatly to facilitate the selection of a device to fill the existing requirements. It will be found that all commercial and technical data pertaining to the articles listed can be obtained with very slight effort. Each particular form of fuse or fuse device is shown on a separate chart, on which the catalogue number, code word, standard package, carton quantities and list prices are given; also general information for their use. The chart also shows in red print all the dimensional information descriptive of the charted devices. Particular attention is drawn to the complete line of National Electric Code standard fuses and fuse devices.

## CALENDARS.

The enterprising Electric Light and Water Works of Chillicothe, Ill., sends out a particularly dainty little calendar, which should serve to keep recipients in mind of the giver throughout the year.

A calendar card for January, February and March has been issued by the Crocker-Wheeler Company of Ampere, N. J., and announces that this is the seventeenth year of the company's experience in building electrical machinery.

## MISCELLANEOUS.

The annual report of the State Board of Labor Statistics shows that the coal output of Illinois for the year ended June 30, 1904, was 37,077,879 tons, produced from 932 mines, an increase over the year of 1903. The total number of tons shipped was 31,778,260.

A colonial exposition will be held in Marseille in 1906, for which preparations are being made with great energy. A site has been selected, and 1,500,000 francs ($289,500) has been voted by the department, city, and chamber of commerce. The various French colonies have already appropriated 5,000,000 francs ($965,000) to meet their expenses in this exposition, and further financial aid is expected.

At Grenoble, in France, the local chamber of commerce has opened an industrial museum or permanent exposition of the special products and diverse industries of this region. This is to be supplemented later by an agricultural museum and bourse to show the progress of science as applied to soil cultivation and the best implements for field work, and to facilitate business transactions on the part of farmers and cultivators.

A course in a new culinary system—cooking by electricity—is about to be opened by the School of Domestic Arts and Science in Chicago. A complete electric cooking outfit, consisting of ovens, broilers, saucepans, frying pans, vegetable kettles, portable plate warmers, etc., will be available. The ovens are provided with switches whereby three different degrees of warmth can be utilized. The apparatus is to be installed by the Chicago Edison Company.

Major George O. Squier of the United States Signal Corps is said to have discovered that trees may be utilized in space telegrapay to take the place of the usual antennæ, and that the trunks while acting as the natural towers serve also to collect the etheric waves as would an ordinary wire. The healthier the tree, the better it serves as a conductor. At Fort Mason, Cal., Major Squier attached his telegraphic apparatus to the trees and communicated with the wireless station on Alcatraz Island, about two miles distant. It is thought the "tree system" will be of advantage in army field operations.

## TRADE NEWS.

The Southern Electric Company of Wilmington, N. C., has been incorporated by J. O. Brock, J. M. Hall, L. E. Hall and others. The capital is $25,000.

A petition in bankruptcy was filed on December 28th, at Syracuse, N. Y., against the W. H. Gough Electric Company by the E. G. Wyckoff Company, the Davis Electric Manufacturing Company of New

York and the J. H. White Manufacturing Company. The nominal assets are $11,000, and the liabilities, $15,000.

The Department of the Interior, through the bureau of Indian affairs, is inviting sealed proposals until January 24th for constructing the extension of the electric light system at the Riverside (Cal.) Indian school. Full information will be furnished on application to Harwood Hall, superintendent, Riverside, Cal.

The Tray Plate Battery Company of Binghamton, N. Y., has acquired by purchase the equipment, patents, rights, franchises, etc., of the Smith Storage Battery Company. The company, with a largely increased capital and factory plant, is now prepared to fill promptly all orders on Tray Plate storage batteries and also the cell-type battery.

The Allis-Chalmers Company opened new sales offices in Philadelphia on January 1st in the Land Title Building. The offices heretofore maintained by the electrical department of the company, the Bullock Electric Manufacturing Company, in the North American Building, have been removed also to the Land Title Building, where they have been consolidated with those of the parent company. The new offices are under the charge of Mr. W. A. Wood, who will look after each of the interests of the company. These interests include the power department, the electrical department, pumping-engine department, hydraulic department, sawmill-machinery department, flour-mill-machinery department, and others which produce rock-crushing machinery, cement-making machinery, wood-preserving machines and plants, mine hoists and machinery of all other kinds for mining and recovering gold, silver, copper and other metals.

Turbo-generator contracts closed by the Westinghouse Electric and Manufacturing Company during the last week of 1904 included two 1,000-kilowatt outfits for the Haverhill (Mass.) Electric Company, to be used in lighting and power work in that city; two 1,500-kilowatt outfits for the Rochester, Syracuse and Eastern railroad, and one 1,000-kilowatt outfit with exciter for the Springfield Electric Light Company, Springfield, Mass.; also a 300-kilowatt turbo-generator with exciter for the Northern Electric and Manufacturing Company of Montreal. The Westinghouse company has also closed a contract with the Ontario Power Company for an alternating-current generator, with a rated output of 10,000 [illegible] tion to waterwheels; they generate three-phase current [illegible]

[illegible] continuing the business at the same location, 1300 Old Colony Building, Chicago. The management of the company is under the direct supervision of Mr. George P. Benton, who says that the firm is better prepared than ever to furnish the needs of cedar-pole users.

The Cutler-Hammer Manufacturing Company of Milwaukee, referring to litigation between it and the Union Electric Manufacturing Company in relation to the Blades starting-box patent, desires to correct what it believes may be a false impression in relation to a recent decision. Following is the Cutler-Hammer statement: "Some time ago the court issued an injunction restraining the Union Electric Company from infringing our Blades starting-box patent; whereupon they made a slight change in the design of their starter and continued to market the same. An application was then made by us that they be adjudged in contempt of court for having violated the injunctional order. This the court refused, on the ground that it has not yet been proved that the Union Electric Company's present form of starter infringes the Blades patent, and that, therefore, the entire matter must be left for final hearing. It is needless to say that the suit will be pushed to an issue as rapidly as possible."

## BUSINESS.

A satisfactory year in the several lines of its manufacture is reported by the Albert and J. M. Anderson Manufacturing Company of Boston.

The leather specialties, such as nail heads, linemen's belts, safety and climber straps, manufactured by Otto Bunge, 1130 St. Peter Street, Indianapolis, Ind., are becoming widely known and are in growing demand by the electrical trade. Attention is called to the strength and lasting qualities of the belts, to [illegible] the g[illegible]

[illegible] the president of the company. Seal-skin caps, gloves, [illegible] Dickerson built for the company for its St. Louis exhibit.

United States Consul F. B. Keene at Florence, Italy, says that energetic and practical American mechanics or engineers are wanted in Italy to explain how to move and to use engines fit for different purposes, so as to impress upon the Italian mind the superiority of the genuine American machinery. That result can easily be attained, he says, by the co-operation of several manufacturers of the same city or state, or producers of the same line of goods. "More results could be had through a few months of activity here by two competent Americans than through a dozen general European agents or 10 years of advertising. The local commission agents, who may represent several firms of different nationalities, do not seem to exert themselves much in advancing the interests of the firms they represent."

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued (United States Patent Office) December 27, 1904.*

778,222. Automatic Current Regulator for Electric Motors. Alexander Churchward, New York, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 16, 1903.

An overwound series electric motor has a shunt around the field coils, the shunt being adapted to increase its resistance automatically when the current exceeds a predetermined value.

778,238. Electric Brake. Edwin R. Gill, New York, N. Y., assignor to the Invention Developing Company. Application filed October 6, 1900.

An electromagnetic clutch has one member fixed to a car axle and the other member loosely sleeved thereon, the members always operating without actual contact. A mechanical connection between the loose member and the brake gear completes the apparatus.

778,242. Electrical Controlling Apparatus. George H. Hill, Glenridge, N. J., assignor to the Sprague Electric Company. Application filed June 27, 1902.

Successively operating magnets are connected with a controlling circuit by a master switch. Means effect automatic progression of the magnets. A checking device out of the controlled circuit acts with the successive magnets and is adapted to check temporarily, at least, the operation of the succeeding magnet whereby control at the master switch of the extent of progression of the group of magnets is secured.

778,252. Gas-burner Attachment. William Kohn, Brooklyn, N. Y. Application filed January 19, 1904.

An electromagnet in a circuit controls the valve and a thermostat arranged near the flame expands when the jet is burning to control the circuit of the valve-opening mechanism. If the flame is extinguished a counterweight falls and the circuit is oppositely effected, closing the valve.

778,256. Electric Railway. Joseph de la Mar, New York, N. Y., assignor of one-half to Mathias A. Lazareff, New York, N. Y. Application filed March 8, 1904.

In an electric railway are combined a hollow contact rail having a rigid top, the conductor extending longitudinally within it. Laterally moving switch arms engage the conductor and switch the current through the top of the contact rail.

778,269. Process of Electric Welding. Adolph F. Rietzel, Lynn, Mass., assignor to the Thomson Electric Welding Company, Lynn, Mass. Original application filed October 15, 1903. Divided and this application filed February 6, 1904.

Improvement in welding links or other endless forms by an electric welding process applied to one side of the link, consist in drawing out the welded side to remove the stress developed in the bended side by the pressure applied to effect the weld. (See cut.)

778,270. Production of Metallic Magnesium. Isaiah L. Roberts, New York, N. Y., assignor of one-half to James Turner Morehead, New York, N. Y. Application filed May 31, 1904.

A method of producing metallic magnesium consists in electrolyzing a fused bath of magnesium fluoride containing a chloride of an alkali.

778,280. Incandescent Lamp Socket. Clarence C. Sibley, Perth Amboy, N. J., and George A. Lutz, New York, N. Y. Application filed November 24, 1902.

A frame for an incandescent lamp socket key shaft comprises two sides connected by strips respectively bent in opposite directions, forming a bearing for the key shaft.

NO. 778,269.—ELECTRIC-WELDING PROCESS.

778,281. Incandescent Lamp Socket. Clarence C. Sibley, Perth Amboy, N. J., and George A. Lutz, New York, N. Y. Application filed December 11, 1902.

Mechanical features are described.

778,286. Manipulation of Refractory Material. Elihu Thomson, Swampscott, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 28, 1902.

A method of forming articles from quartz in a divided state consists in partially surrounding a highly refractory conducting body with the quartz, generating heat electrically in the conducting body such as to produce fusion of the quartz in contact therewith, then allowing the mass to cool and when cold separating the fused mass from the conducting body without destroying the form imparted to the mass by the conducting body.

778,297. Composite System Duplex Telegraph Circuits. William E. Athearn, New York, N. Y., assignor to the American Telephone and Telegraph Company. Application filed May 13, 1904.

In a system of composite or conjoint telegraphy and telephony are [illegible] cricuit and two single-conductor earth-completed telegraphic circuits having [illegible] the two conductors, respectively, of the telephone [illegible] Bridge-duplex connections are supplied for one of the telegraphic circuits and an electromagnetic resistance or reaction device having a coil in each of the station arms or branches of the bridge is arranged to offer greater impedance to incoming than to outgoing current.

778,305. Coin-controlled Circuit-making-and-breaking Apparatus for Phonographs. Arthur W. Cole, West Hoboken, N. J. Application filed April 26, 1904.

A rocking device with the circuit-closing terminals dipping into mercury cups when the device is operated by the weight of a coin is described.

778,308. Therapeutic Electrode. George H. Day and Frank J. Stein, Louisville, Ky. Application filed July 13, 1904.

Therapeutic electrodes of a receptacle, preferably of glass, are shaped at one end so as to fit neatly against the body. A conducting rod carries a disk having projecting points from which the electric currents are discharged and to which may be attached absorbent material completes the apparatus.

778,322. Telephone Circuit. John W. H. Maclagan, Park Ridge, N. J. Application filed June 23, 1900.

Telephonic apparatus as described in the patent embodies a transmitting circuit including a low-wound primary coil, a secondary coil connected to the line and to a low-wound coil forming part of a receiver and in a shunt around the primary coil in the transmitter circuit. The resistance of the receiver coil is approximately equal to that of the primary coil.

778,333. Electric-current Governor. Walter J. Richards, Milwaukee, Wis. Application filed April 11, 1903.

In an electric-current governor [illegible] a switch, a laminated field provided with coils, a plunger or armature movable axially in the coils and connected with the movable part of the switch, and a primary switch controlling the supply of current to the coils.

778,343. Automatic Train-stopping System. Charles M. Underwood, London, Canada. Application filed July 24, 1903.

In an automatic train-stopping system are a track circuit, a car circuit, with mechanism in the car circuit for sounding an alarm, operating the air brakes, the whistle and the steam throttle of the motive.

778,356. Railway Signal. Frank L. Fuller and Charles S. Banghart, New York, N. Y. Application filed March 21, 1904.

A grounded track block, a section of one rail at one end of the block being insulated, is operated from a source of electricity grounded on one side. A circuit including a circuit controller and connected at one end with the source and at the other with the insulated rail section permits the circuit to be closed through the wheels and axles of [illegible]

controller and a second insulated track section is at the opposite end of the block, with means controlled thereby whereby a train having first operated the signal will then reverse it.

778,376. Trolley Harp and Guard. Stephen G. Reynolds, Easton, Pa., assignor of one-half to Nathan Freeman, Easton, Pa. Application filed June 29, 1903.

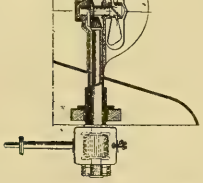
A U-shaped yoke on the trolley harp serves to keep the wire in place.

778,383. Incandescent Electric-light Socket. Luttrell H. Stuart, Chicago, Ill., assignor of one-half to Necter Rousseau, Sr., Chicago, Ill. Application filed August 14, 1903.

Details are described.

778,400. Electric Motor. James H. Bryson, St. Louis, Mo., assignor to the Wagner Electric Manufacturing Company, St. Louis, Mo. Application filed April 21, 1904.

One member has a circuit locally closed and operative at starting, a second circuit for the member being inoperative at starting. Means are supplied for rendering the second circuit operative and for short-circuiting the first-named circuit after the motor has started.



NO. 778,435.—MOTOR-DRIVEN BOAT PROPELLER.

778,409. Telephone Apparatus. Oscar M. Frykman, St. Paul, Minn. Application filed April 20, 1903.

A diaphragm is associated with two relatively stationary electrodes and an intermediate electrode. A mechanical connection unites the diaphragm and the intermediate electrode and a tube of insulating material surrounds the intermediate electrode and at its ends has screw-threaded engagement with the relatively stationary electrodes.

778,418. Railway Block-signal System. Rector E. Land, Mount Washington, Mo. Application filed April 25, 1904.

Opposite track rails are divided into blocks insulated from each other, opposite rails of each block being adapted to be electrically connected by the wheels and axles of the cars. Branch conductors connect, respectively, opposite rails of each block with opposite feed conductors.

778,435. Boat Propeller. George F. Atwood, Wakefield, Mass., assignor, by mesne assignments, of one-half to Herbert C. Hall, trustee. Application filed March 11, 1904.

An electric motor is carried on the end of a vertical shaft above the propeller and drives the screw by means of a bevel gear. (See cut.)

778,444. Electric Cigar Lighter. William P. Carstarphen, Jr., Denver, Colo. Application filed April 4, 1904.

An exposed incandescent lighter is centrally located in a casing with reference to a transparent plate on one side. An incandescent lamp is concealed by the casing and a movable device is connected with the casing and adapted when actuated to close the circuit in which the lighting device and lamp are located.

778,489. Electric-arc Lamp. Albert W. Hendricks, Pittsburg, Pa. Application filed March 30, 1901.

In an electric-arc lamp are a fixed upper carbon, a movable lower carbon, a rod on which the lower carbon is suspended, a base in which the rod is slidably mounted and a spring arranged to move the lower carbon rod upwardly. A suspended solenoid, a downwardly depending solenoid core, a lever connected to the solenoid core, a clutch mechanism arranged to one side of the solenoid and connected to the lever and means connected to the lever for retarding the upper movement of the carbon rod are the other parts.

778,507. Insulating and Suspending Device. Joseph Saces, Hartford, Conn., assignor to the Johns-Pratt Company, Hartford, Conn. Application filed March 16, 1904.

A hook of the suspension device is insulated from the carrying member.

778,520. Trolley. John S. Weckman, Carnegie, Pa. Application filed September 22, 1904.

Spaced plates to hold the trolley on the wire are pivotally attached to the trolley head.

778,529. Insulating Material and Process of Producing Same. Frederick H. Bruening, Pittsburg, Pa. Application filed November 1, 1904.

A process for producing insulating material consists in subjecting cork or cork wood to sufficient heat to drive off the volatile matter, then incorporating it in a cement or coalescing material comprising pitch or tar boiled or subjected to heat, flint, comminuted or ground clay, ground feldspar, oil of rosin and litharge thoroughly mixed in the presence of heat sufficient to reduce the compound to a fluid condition, and finally pouring the compound into molds.

778,531. Electric-fuse Switch Box. Louis W. Downes, Providence, R. I., assignor to the D. & W. Fuse Company, Providence, R. I. Application filed May 20, 1904.

An electric switch or fuse switch box contains two separable members. Circuit-terminal contacts are placed on one member and a fuse having projecting terminals adapted to engage the circuit terminals when the members are together and to be disengaged therefrom by separation of the members co-operate with means on the other member engaging the projecting fuse terminals to removably secure the fuse to its member in accurate co-operative relation to the terminal contacts on the other member.

778,560. Supporting and Shifting Battery for Automobiles. Allan H. Whiting, Orange, N. J. Application filed September 19, 1903.

A shifting support for the automobile battery is described.

778,569. Supervisory Apparatus for Telephone Systems. William W. Dean, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed July 7, 1902.

A source of current connected with the plug circuit is controlled by means at the sub-station of one of the lines for determining the flow of current. A coil of low resistance and self-induction is included in the plug circuit in the path of current. A magnet in the field in which the coil is mounted is excited by means controlled by connection of the plug circuit with a line. A mounting for the coil permits it to move relatively to the pole piece of the magnet under the influence of current traversing the coil. A supervisory signal is controlled by the movement of the coil. (See cut.)

778,575. Quick-break High-tension Electric Switch. Henry K. Gardner, Providence, R. I. Application filed December 21, 1903.

An intermittingly revoluble quick-break high-tension electric switch having a normally stationary spring-pressed escapement wheel movable in unison with the switch contacts embodies also an escapement lever in engagement with the wheel member and manually controlled mechanism through which the yoke is actuated to release the wheel and permit a partial revolution of the switch.

778,599. Telephone-exchange Switchboard Apparatus. James L. McQuarrie, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed February 1, 1902.

A line relay is adapted when actuated to provide a local circuit through to temporarily short-circuit or shunt the line. A cut-off relay of the cord circuit is adapted to be connected in series, the relay being also adapted to act as a switch when actuated, to throw current on to the line.

778,602. Electric Lamp and Shadeholder. Louis H. Perkins, Meriden, Conn., assignor to Edward Miller & Co., Meriden, Conn. Application filed May 18, 1904.

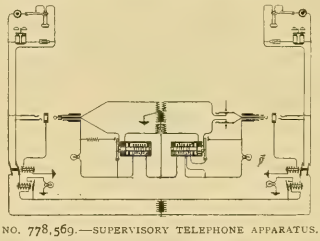
Details are described.

778,618. Means for Supporting Electric Lamps and Energizing and Lighting Same. William H. Wilkinson, Boston, Mass. Application filed April 29, 1904.

In a device for illuminating the pressure gauges of an automobile are an electric lamp, a lamp support provided with means for attaching it to the support of the gauges, a socket to removably receive the lamp and a shield to reflect a light upon the gauges and shield it from the eyes of the operator.

778,681. Electrical Connector. Hubert Krantz and Ernest W. Müller, Brooklyn, N. Y., assignors to the H. Krantz Manufacturing Company, Brooklyn, N. Y. Application filed March 15, 1904.

An interconnection strip for electrical conductors comprises an insulated strip, a line of binding posts thereon, a number plate connected to each binding post, the plate and strip having openings through them, a wire passing from the back of the strip through the strip and plate and connected to the binding post and an outgoing wire also connected to the binding post.



NO. 778,569.—SUPERVISORY TELEPHONE APPARATUS.

778,693. Electrical Outlet Box. Ernest W. Müller, Brooklyn, N. Y., assignor to Hubert Krantz, Brooklyn, N. Y. Application filed April 23, 1903.

An outlet box having a flaring rim and a cover with beveled edge to fit therein is provided with means for carrying a bracket on the cover.

778,707. Igniting Device for Internal-combustion Engines. Fritz Reichenbach, Charlottenburg, Germany. Application filed February 26, 1904.

A rotatable magnet having its poles arranged at diametrically opposite points and separated from each other has a stationary wound armature embraced by the magnet. End pieces formed on the armature are long enough to completely bridge the spaces between the ends of the armature poles during the rotation of the magnet so that no air gap occurs during the rotation of the magnet.

778,714. Electric Compensator. Edmund O. Schweitzer, Chicago, Ill., assignor of one-half to John J. Schayer, Chicago, Ill. Application filed December 14, 1903.

An electric compensator comprises two members, one of excessively variable resistance and the other of adjusted fixed resistance, arranged in parallel in the instrument circuit and whose summative conductivity is reversely responsive to changes of temperature to the extent of the detrimental temperature-induced resistance. (See cut.)

778,729. Brake-operated Signal or Tail Light. Samuel N. Wilcoxson, Collinwood, Ohio. Application filed June 7, 1904.

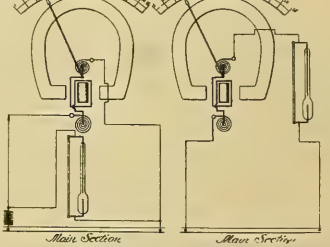
Electric lamps are arranged to be thrown into circuit by the movement of the car-brake lever.

778,771. Electromechanical Apparatus for Vibratory Massage. Charles Adams-Randall, New York, N. Y., assignor to the Randall & Carey Vibral-massage Machine Company. Application filed February 9, 1904.

Vibratory-massage apparatus comprises a rotary electric motor, an eccentric fixed on the armature shaft of the motor and an oscillatory lever pivoted at one end to one side of the armature shaft and provided at its other end with a massage pad or contact piece. The lever intermediate its ends is formed with an elongated collar to snugly receive the eccentric.

778,779. Thermostat. Albert Goldstein, New York, N. Y., and Horace E. Rice, Philadelphia, Pa. Application filed May 23, 1903.

A thermostat provided with circuit interrupters of varying sensitiveness to heat, relatively to each other, is combined with a circuit in which the interrupters are arranged in series.




NO. 778,714.—COMPENSATOR.

778,784. Safety Device for Gas Pressure. Charles Holmok, Cleveland, Ohio, assignor to John Mathew O'Connell, Cleveland, Ohio. Application filed December 26, 1903.

An electric bell alarm is the electrical feature of the invention.

778,793. Self-oiling Trolley Wheel. Elijah D. McDonald, Los Angeles, Cal., assignor of one-fourth to Laurin Dewey Clark, Los Angeles, Cal. Application filed December 8, 1903.

The lubricating device of the wheel is described.

778,803. Stereopticon. Albert Schweitzer, Pittsburg, Pa., assignor to the Automatic Illuminating Advertising and Manufacturing Company, Pittsburg, Pa. Application filed January 5, 1903. Renewed May 10, 1904.

Electromagnets operate the mechanism by means of ratchet wheels.

778,825. System of Motor Control. George H. Hill, Schenectady, N. Y., assignor to the Sprague Electric Company. Original application filed June 27, 1902. Divided and this application filed July 25, 1904.

In a system of electric control, a series of circuit-governing electromagnets and a master switch provided with an independent connection to each electromagnet, the energization of certain of the electromagnets being dependent upon the energization of another of the electromagnets, are the principal parts.

778,832. Electric Traction. Henry B. Greenwood, Buenos Ayres, Argentina. Application filed July 16, 1904.

Combined with a main conductor are a succession of separated conductor sections having parts for engagement with a contact carried by a railway car. A cable comprising a succession of links lies upon the main conductor and out of contact with the sections and liftable into contact with the latter by a magnet upon the car. Each link has the form of an S and hooks into the adjoining link.

## EXPIRING PATENTS.

Following is a list of electrical patents issued by the United States Patent Office) that expired on January 3, 1905:

375,727. Electrical Synchronous Movement. H. C. Bridger, New York, N. Y.

375,749. Permanent Magnet for Electrical Apparatus. W. Humans, Cambridge, Mass.

375,750. Armature for Magneto-electric Machines. W. Humans, Cambridge, Mass.

375,751. Magneto-electric Machine. W. Humans, Cambridge, Mass.

375,766. Telegraph Register. J. G. Noyes, New York, N. Y.

375,784. Apparatus for Electric Welding. E. Thompson, Lynn, Mass.

375,835. Electric Exercising Machine. E. W. Robinson, C. H. O'Brien and H. M. Breen, Portland, Me.

375,876. Conduit for Electric Conductors and Power Cables. I. La Rue Johnson, Washington, D. C.

375,898. Duplex Telegraphy. C. Selden, Baltimore, Md.

375,910. Regulating Alternate-current Electric Generators. K. Zipernowsky, Buda-Pesth, and M. Peri, Vienna, Austria-Hungary.

375,915. Electrical Heater. J. P. Barrett and J. F. Mehren, Chicago, Ill.

375,925. Telephone System. J. Crawford, Reading and J. B. Ker, Harrisburg, Pa.

375,952. Covered or Insulated Wire or Conductor. L. F. Requa, New York, N. Y.

376,007. Electric Arc Lamp. W. H. Miller, New York, N. Y.

376,018. Electric Therapeutic Device. E. R. Whitney, St. Johnsbury, Vt.

376,019. Mold for Forming Pieces of Carbon for Electric Purposes. C. H. Wilder, Natick, Mass.

# WESTERN ELECTRICIAN

**EVERY SATURDAY**

Vol. XXXVI. CHICAGO, JANUARY 14, 1905

## Electrical Plant of the Brooklyn Eagle.

The last of the five new sextuple perfecting presses of the Brooklyn Eagle was started on December 31st at midnight. These presses are electrically operated, and, in the opinion of Sir Alfred Harmsworth, are the finest in the world. They have a combined capacity of 120,000 24-page papers, or 360,000 eight-page papers an hour, all folded and counted ready for distribution, and with the rest of the equipment of the plant are of much interest.

Each of these presses (one of which is illustrated in Fig. 2) is driven by a 50-horsepower main motor, and has a 10-horsepower slow-speed motor for starting purposes. The slow-speed motors are geared to attain the greatest starting pull with the lowest

at a time, to the main floor, by a compressed air lift. The lift is entirely automatic, and the moment the man steps off of it, the plate falls back again ready for use. There are six of these lifts operated by a motor-driven air compressor.

The presses are controlled by the Kohler push-button system. Attached to each press are a number of sets of special switches. On each switch a white button is used when the power is on, a black button when the power is off, and a special red button, used for emergencies, stops the machinery instantaneously in event of accident. There are also two safety buttons, which are used by the pressmen when they are oiling the bearings. When one of these buttons is pressed, the current is entirely cut

on the eighth floor. Each of the 30 linotype machines on this floor has its individual motor, a few of the newer machines being direct driven. The autoplate

and the linotype machines is a Lamson "pick-up" carrier, driven by a Holtzer-Cabot motor.

The editorial department is on the seventh floor.

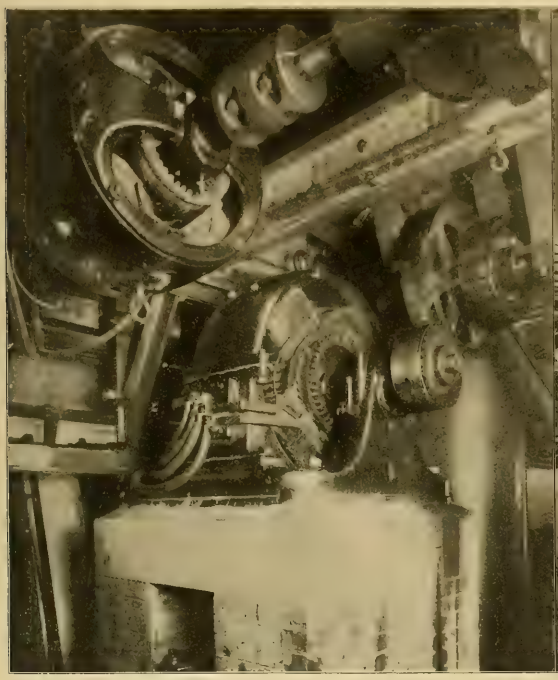


Fig. 1. Method of Mounting Press Motors.

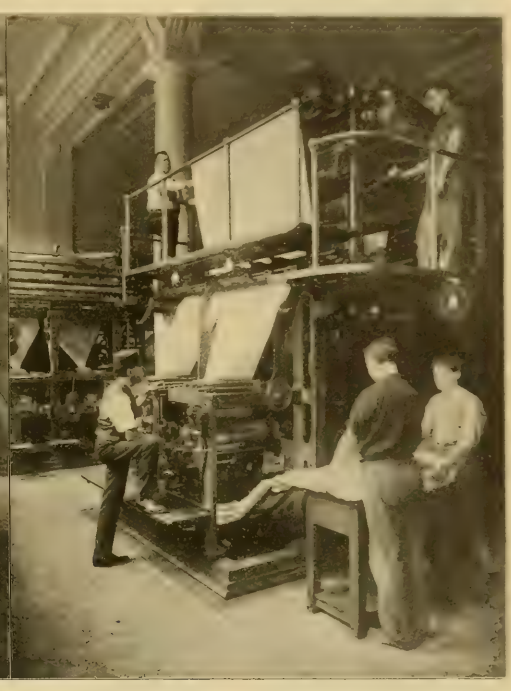


Fig. 2. Large Sextuple Perfecting Press with Push-button Control

ELECTRICAL PLANT OF THE BROOKLYN EAGLE.

possible consumption of current, and to move the press slowly, in order not to break the web. Three subsidiary motors are attached to each press for various purposes. The motors are stowed away beneath each press in the manner shown in Fig. 1. Each press is also equipped with an ingenious paper feed, which is an innovation in newspaper practice. In the ordinary way, the press has to be stopped to insert a new roll of paper, but in the Eagle office the paper feed is in the basement beneath each press, and so arranged that when a roll is exhausted a new roll can be fed while the press is slowed down, but not actually stopped. Each individual paper feed accommodates three rolls of paper, so attached that the new roll can be moved into position by means of a one-horsepower motor when the time comes to use it. The end of the new roll is ingeniously cut with a zigzag streak and prepared with paste, and, by the mere operation of a switch, the new roll is brought into contact with the exhausted roller and the web is caught up and carried through the press. This method is a great time-saver, the five presses equipped with this new paper feed being able to do the work of six under former conditions.

Sliding poles, similar to those used for fire-engine houses, enable the pressmen to drop down into the basement, and they come back again by stepping on a plate which automatically shoots them up, one off from the motors, and it is impossible for anyone to start the machine until this particular button has been released. When the press is brought to the desired speed for threading paper the "safe" switch can be pushed and as long as on "safe" it is impossible to increase the speed, thus reducing the liability of accident to the pressmen. The safe switch can also be used to prevent an increase above any desired speed, as, for instance, a moderate speed for color work, but it is always possible to decrease the speed or stop. It is impossible, no matter how the pressman may push the button, to start or stop the press with a jerk. The time required to bring the press from standstill up to maximum speed or from maximum speed to standstill can be adjusted to suit the pressman; the usual time is 20 seconds.

Each piece of machinery on each of the nine floors of the building is driven or controlled by electricity, the total number of motors exceeding 250. More than 200 of these were installed by the Milwaukee Electric Company. All motors are series-wound. In most cases the motors are belt-connected, to save the expense of attaching them direct, many of the machines having been previously driven by belting. Considerable economies were thus effected. To attach a motor direct to a linotype composing machine, for instance, involves an outlay of $150, but by placing the motor on the floor, at some convenient between which and the composing room is a push-button elevator, capable of carrying three persons. This elevator is operated by compressed air from a 15-horsepower motor. The fifth and sixth floors constitute the job-printing department, where there are a large number of flat-bed and other presses, bookbinding machines, folding machines, paper cutters, etc.

In the basement are pumps of the standard triplex outside-plunger pocket type for circulation, fire protection and for the heating and boiler feed. These are all motor driven. The steam from the heating boilers is the only steam employed in the building.

A five-horsepower motor in the basement operates a machine for baling waste paper. The main air compressor (Fig. 5) is also in the basement, and is driven by a 25-horsepower Crocker-Wheeler motor. Beneath the floor is a tank built to hold 20 barrels of ink. The ink is forced by air pressure to the press fountains, and there is an ingenious filtering arrangement which can be cleansed without cutting off the air pressure. There is also used a system of piping to distribute throughout the building two kinds of oil, for lubricating and for washing rollers.

For passengers there are five elevators, all motor-driven and electrically controlled by the usual

method. Four are of the Otis type, and the fifth was put in by the Marine Engine Machinery Company of Harrison, N. J. There is also a system of lifts for conveying paper and plates throughout the building, worked on a 15-pound air pressure. Pneumatic tubes worked at a two-pound pressure convey "copy" from floor to floor where needed. Throughout the building there are 42 clocks, all indicating precisely the same time. These are controlled by a series of electric wires leading from a standard clock in a cabinet in the basement.

The building is wired for 5,000 lights. Current

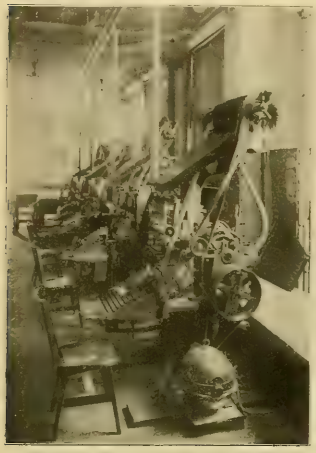


FIG. 3. MOTOR-DRIVEN LINOTYPE MACHINES OF THE BROOKLYN EAGLE.

is supplied for the entire building from the mains of the Brooklyn Edison Company. There are two separate connections, working through two double-throw switches. Current is taken on the three-wire system at 110 and 220 volts. In the basement also are two Wright engines, which were put in as recently as 1889, and which at that time drove all the shafting in the old building. These engines, and the method of power distribution by shafts and pulleys from floor to floor, were adopted 13 years ago as the acme of perfection, but today they are out of use and regarded as hopelessly antiquated.

D. W. W.

## A Slight Difference.

An amusing correction was printed in the Chicago Daily Tribune of recent date. It was in the form of the following note, dated December 12th, from Albert J. Atkins, M. D., of San Francisco: "In the Associated Press news of December 8th of your paper you have quoted me as registering in the wall of the human stomach 10,000,000 volts of electricity, when it should have read 10 milli-volts. This is unfortunate, and I hope that it may be corrected."

The Jefferson City Electric Light Company will rebuild its plant at Jefferson City, Ky., recently damaged by fire.

## Electrical Equipment of the Navy.

Many facts and figures of interest to the electrical fraternity are contained in the annual report of H. N. Manney, chief of the bureau of equipment, with accompanying subordinate reports, which has just been made to the secretary of the navy. Among other things it is stated that the work of the office of inspector of electrical appliances has greatly increased, and a larger force is considered necessary for the satisfactory performance of the duties devolving upon it. For alterations, additions and repairs to vessels the sum of $379,618 has been expended during the year. One or two searchlights of 60-inch diameter will probably be installed in battleships and armored cruisers now under construction. Conduit is now generally used in place of molding, as it fulfills the requirement on shipboard more satisfactorily. Large dynamos driven by steam turbines are installed in many shore plants and operating successfully. Various types of telephones will soon be tested with a view to installing on shipboard such types as meet the demands of the service. It is recommended that a corps of warrant electricians be established.

The work of installing space-telegraph stations on shore and on ships has continued during the year until a total of 58 has been established. In addition contract has been made for the installation of two lightships, which relieve each other on Nantucket shoal, and the work of installation is under way. It is intended to communicate from the lightship on its station directly to the torpedo station at Newport, R. I. Material has been assembled at Mare Island for the equipment of a station at the Farallon Islands, off the Golden Gate, California. The apparatus for establishing wireless stations at Cavite, P. I., and Cabra Island, P. I., has been forwarded, and it is probable that the former station is now in operation. Masts have been forwarded to Honolulu and Guam for the establishment of stations. A contract has been entered into providing for the conversion of the stations at Pensacola and Key West into long-distance stations. The same contract provides for the establishment of long-distance stations, with a maximum range of communication of about 1,000 miles at the following places, viz., Porto Rico, the naval reservations at Guantanamo Bay and the Panama Canal zone. The bureau, however, has the option of designating other locations if it is considered advisable. Seven ships on the Asiatic station have been supplied with space-telegraph apparatus. There are 65 ships which it is proposed to equip with space-telegraph apparatus at an early date, and to the list the bureau believes it may be advisable to add colliers, torpedo-boat destroyers and torpedo boats. A long list of shore stations has been proposed for installation, as the requirements of the navy and the merchant service warrant their construction.

During the last summer the space-telegraph board has conducted tests of various systems between the New York navy yard and the Highlands of Navesink and between the latter and a ship at sea. The bureau has awaited the results of this test before purchasing a large supply of apparatus in order that it may be thoroughly conversant with the latest improvements. The bureau has, however, purchased three sets of space-telegraph apparatus from one of the leading manufacturing companies for installation in the Newport-Nantucket Shoal lightship, provided the apparatus now installed proves unsuccessful on trial. In case the latter is satisfactory the three sets are to be installed at Cape Cod, Montauk Point and the Highlands of Navesink. The contract guarantees a chain of communication from Cape Elizabeth, Maine, to Cape Cod; thence to Montauk Point, and thence to the Highlands of Navesink without going through intermediate stations. The bureau hopes soon to add one or two additional stations and bring the chain of communication to Washington; also to connect the city in a similar manner with the Southern Atlantic and Gulf coasts of the United States, Porto Rico, Cuba and the Panama Canal.

## Bremer Arc Lamp with Converging Electrodes.

Arc lamps in which the carbons converge or are parallel, the arc being formed between, have been the subject of considerable attention by inventors, and numerous types have been developed, the light being yielded for the most part by the arc as distinguished from the incandescent crater of the carbon. Mr. Hugo Bremer of Neheim, Germany, whose work in the line of arc-lamp development is well recognized, has recently patented a lamp of the class described above, which is intended to be used with electrodes of a particular kind which were the subject of earlier patents by Mr. Bremer. The accompanying illustration is a diagram showing the general relation of the various parts of the apparatus.

Referring to the diagram, (1) and (2) represent electrode tubes designed to receive the electrodes and guide them in their proper relations to each other. When the lamp is used as a continuous-current lamp the tube (1) may be regarded as the positive tube—that is to say, for containing the positive electrode—and the tube (2) the negative.

For convenience of description the lamp will be described more particularly as adapted for use in a continuous-current circuit, although the various features are also applicable for use in an alternating-current lamp.

The positive binding post (3) is connected by a conductor with one coil, of an electromagnet (6). A conductor (7) leading from the coil (5) is connected with the positive carbon rod. A second coil (8) is wound upon the magnet in a reverse direction from the coil (5), one terminal of the latter coil being connected with the conductor (4) and the remaining terminal through the coils of an electromagnet (10), thence by a conductor through a resistance (12), with the conductor (13), leading to the negative binding post of the lamp. The poles of the magnet (6) are provided with soft-iron extensions, which extend below a baseplate and partially embrace a reflector within which the arc is formed. These poles serve as a magnetic regulator for controlling the position of the arc and aiding in causing it to be of the desired length and steadiness. The coil (5), which may be conveniently termed the series coil, tends to give to the poles a degree of magnetization varying directly with the amount of current flowing from one electrode to the other, while the coil (8) connected in shunt acts in opposition to the coil (5). In a constant-potential circuit the tendency would be for the coil (8) to have an approximately constant effect, which may, if desired, be superior to that of the coil (5), so that the resulting magnetism exhibited at the extensions will be diminished with increments of current through the arc, and vice versa.

The magnet (10) has a polar extension (20) projecting downward toward the points of the electrodes, the effect of which is to project the arc downward away from the points of the electrodes and in conjunction with the extensions on magnet (6) to regulate and steady the arc. Should the arc become too long by reason of the burning away of

Fig. 1. Autoplate Machine.

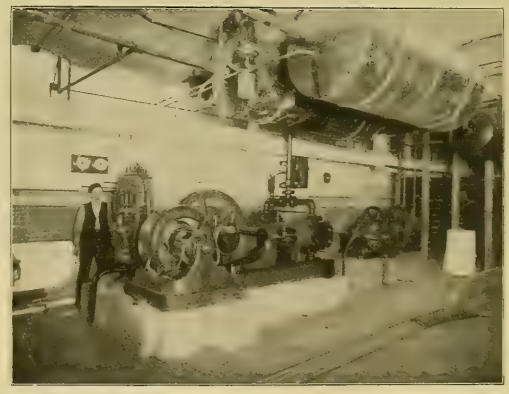
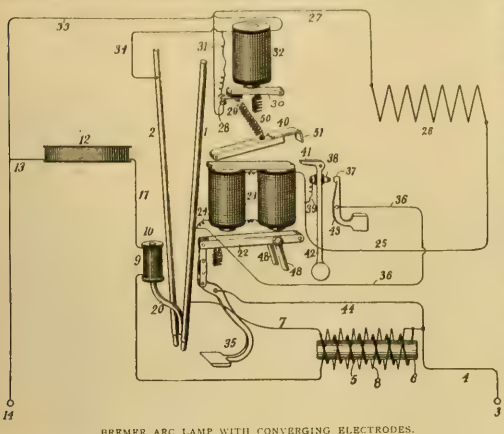


Fig. 2. Air Compressor.

ELECTRICAL PLANT OF THE BROOKLYN EAGLE.

the lower ends of the electrodes, the effect of the polar extension (29) will be to aid in rupturing the arc and thus preventing injury to the metal of the electrode tubes. The resistance (12) is of sufficient quantity to prevent an excess of current from traversing the coil of the magnet (10).

The electrodes descending through the electrode tubes are held by clutches, which are controlled by the armature (22) of a magnet (23), the coil of which are connected in a shunt circuit around the electrodes. For this purpose a conductor (24) leads from the conductor (7) through the coils of the magnet to a conductor (25), which is connected to a resistance (26), the remaining terminal of which resistance is connected by a conductor with a contact point (28). An armature (30), having a contact point (29), is employed for making and breaking the connections of this shunt circuit, the point (29) being connected by a conductor with one terminal of an electromagnet (32), the other terminal of which is connected by a conductor with the conductor (13) leading to the negative pole of the lamp. The magnet (32) is employed for operating the armature, and when it is vitalized separates the points (29) and (28), thus interrupting the connections of the magnet (23). When the magnet is thus demagnetized the armature falls away, permitting the clutches to engage their respective electrodes and hold them in position.



BREMER ARC LAMP WITH CONVERGING ELECTRODES.

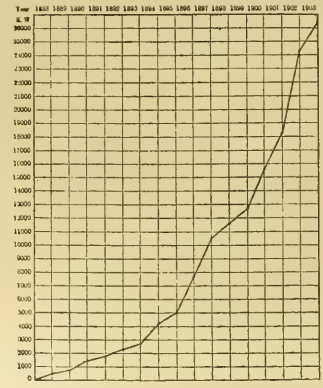
The current traversing the arc to the electrode tube (2) passes through a conductor (34), thence through the magnet (32) and by way of conductor (33) to the negative terminal of the lamp, so that when the lamp is in normal operation the circuit through the magnet (23) is interrupted at (28). When, however, the resistance of the arc has exceeded a predetermined amount the current flowing through the conductor (34) and the magnet (32) will diminish sufficiently to allow the armature (30) to fall away, thus closing the circuit through the magnet (23), which thereupon attracts its armature and releases the clutches, thus permitting the electrodes in the tubes to feed forward and come into closer proximity. As soon as contact is made at the point (28) the lamp terminals are connected through a circuit including the resistance (26), which is thus thrown into the circuit. In this way all disturbance of the other lamps in the circuit during the feeding and regulating operation of a given lamp is avoided. It is also true that the resistance is in circuit when no current is on the line, whereby provision is made for the starting of the circuit of every lamp in the line without difficulty.

In order to prevent the electrodes from descending too far and also for the purpose of insuring the presence of an arc between the two, an arc-striking arm (35) is connected with the armature (22) in such a manner as to be thrust forward beneath the ends of the electrodes when the armature is drawn toward its magnet and to thus be in position to arrest the further motion of the electrodes and to close a short-circuit between them.

The connections of the armature (22) with the clutches (21) and the arc-striking arm (35), respectively, are such that the arm accomplishes all or the major portion of its movement before the clutches completely release the electrodes, by reason of which fact the end of the arm (35) is always sure to have passed the electrode points before they descend into their proper position upon the electromagnet (23) being energized the magnet (23) deenergized the armature (40) released and the striking arm (35) drawn forward by the action of a spring or other means. Should to any reason the arc not be reestablished in the manner described, as for instance, by a failure of the electrodes to feed forward then other means should be provided for withdrawing the arm (35) and causing it to be repeated. For the purpose a shunt circuit is provided to the magnet (23), consisting of a conductor leading from the conductor (13) to a contact (37), the corresponding contact point being connected by a conductor with a conductor (39). A second armature is applied to the magnet (23), adapted to respond slowly to the action of that magnet and in so doing to strike an arm of a pendulum (42), carrying the contact point (38). The point (37) may also be mounted upon a weighted arm so as to yield when struck by the contact point (38). It will be seen, therefore, that if the magnet (23) remains energized for any predetermined period the armature (40) will respond, thereby short-circuiting the magnet (23), causing the arm (35) to be drawn away, when the operation will be repeated. For better insuring the striking of the arc the arm (35) may be connected by a conductor with the conductor (4), so that the arm (35) is in electrical connection with the positive side of the lamp. Contact, therefore, with the negative electrode will insure an arc being started as the armature (35) draws away, and this arc is transferred from the arm (35) to the positive electrode during the further movement of the arm.

## Growth of Central-station Lighting in Japan.

The growth of central-station lighting in Japan since 1888, as shown by statistics compiled by the Nippon Denk Kiokwai, the Japanese Electric Light Association, has been almost phenomenal. This



CENTRAL-STATION LIGHTING IN JAPAN.

growth is well illustrated by the accompanying curve reproduced from the Electrical Engineer of London.

The association was founded in 1892 for the purpose of investigating and reporting on matters of importance to the electric-light industry, to represent the industry before the government and to popularize electricity and maintain in Tokio a permanent electrical exposition. Only members of the association are allowed to exhibit their goods at the exhibition. All expense connected with the arrangement of exhibits for special electric lighting or for operating machinery is borne by exhibitors. A library is also maintained in the building for the benefit of members of the association. In case of applications for purchase, the authorities in charge of the building offer every facility toward bringing the purchaser in communication with the seller. The total area occupied by one exhibit is not allowed to exceed three cubic feet, and the total weight cannot be over one ton.

## Electromagnetic Valve.

valve can be held in th

taining current in the coil. F

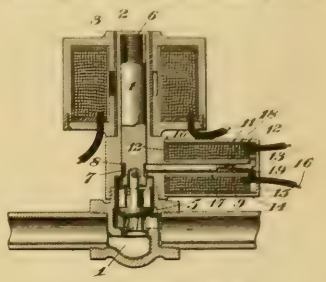
it to seat itself.

showing the valve raised and locked. The valve

from a

its core (4) connected to the valve (5). To insure perfect and quick seating of the valve a pressure spring (6) is employed within the shell (2) and bearing on the upper end of the core, and an annular groove (7) is provided on the core which defines a shoulder (8).

Projecting into the



ELECTROMAGNETIC VALVE.

the shell is a tube (9), at whose base is a stationary circular flanged disk (10). A coil (11), provided with suitable heads (12) and wound on a brass tube, is fitted over the tube (9) and seated at one end against the disk (10). The coil is enclosed by an iron shell (14), closed at its outer end (15) and having its inner end fitted against the disk (10), within the flange. This shell can be held by fastenings, if desired, or by frictional contact only. The shell (14) increases the magnetic action of the coil (11). The wires (16) from the coil are led out through suitable openings in the end of the shell (14).

Movable within the tube (9) is a core or armature (17), whose end is positioned to project into the groove (7) and engage the shoulder (8) and hold the valve raised off its seat after the core (4) has been drawn upwardly on sending a current through the coil or magnet (3). To accomplish the projection of the core (17) for this purpose, a spring (18) is provided, interposed between the end of the core and ascrew (19), which is threaded into the end of the tube (9). The head of the screw bears on the outer head of the coil and keeps it on the tube.

The wires of the coil or magnet (3) can be included in any suitable electric circuit and the wires of coil (11) in any other circuit.

A temporary current of electricity having been sent through coil (3) the core is attracted and the valve opened, whereupon the core (17) is projected by its spring into engagement with shoulder (8), and though the current in coil (3) has ceased the core (4) is held up and the valve is open. Whenever current is sent through coil (11), its core is retracted, and the core (4) and valve drop assisted by the pressure of spring (6). Thus it becomes unnecessary to maintain a current in coil (3) in order to keep the valve open.

## Electric Lighting near Pittsburg.

J. G. Splane, president of the Pittsburg and Allegheny Telephone Company; Shirley P. Austin and George K. Anderson have formed a syndicate which secured charters from the state of Pennsylvania for the furnishing of light, heat and power by electricity to five towns in Allegheny County. The companies which will be controlled by the syndicate are: Fremont Light Company, Allegheny, capital $5,000; Wilkinsburg Light Company, Wilkinsburg, capital $5,000; Colonial Light Company, Braddock, capital $5,000; Tube City Light Company, McKeesport, capital $5,000; Home Light Company, Homestead, capital $5,000.

## Electric Railways and Telegraphs in Cuba.

A recent consular report from United States Consul-general Steinhart of Havana, Cuba, briefly reviews some of the public utilities in Cuba. The following interesting notes are taken from the report.

The Havana Electric Railway Company operates a mileage of 48.22 and gives an excellent street-car service. The company is operating 161 closed motor cars, and is now building in its shops nine open motor cars and has 15 freight cars. The employes of this company number 1,100. They are principally natives of Cuba, and their neat appearance and politeness are so apparent as to cause complimentary remarks on the part of every tourist visiting Havana. The Americans employed by the company are heads of departments. This company has purchased in the United States practically all of the materials used in the construction and maintenance of its road, and has expended for construction $4,233,786. The yearly purchase of materials in the United States for maintenance is $70,000. The gross receipts of the company for the year ended June 30, 1904, amounted to $1,161,295 United States currency. G. F. Greenwood is general manager of the company.

It is the intention of the board of directors of this company to proceed with the building and equipment of the insular railway. The Insular Railway Company is a subsidiary company of the Havana Electric Railway Company, chartered under the railway laws of Cuba, to extend its lines through the province of Havana for about 100 miles. So far, about 5½ miles have been built and have been in operation since November 15, 1903, and the company now contemplates making an extension of possibly 30 or 40 miles in the direction, most likely, of Guanajay, thus passing through the center of the pineapple-growing district. The lines of the Insular Railway Company will be built in accordance with the specifications of a first-class interurban railway of the United States. The company will endeavor to use American materials and machinery throughout.

It is said that a considerable portion of the woodwork of the cars sent from the United States to Cuba deteriorates very rapidly, and it has been found necessary to adopt the native woods of Cuba in place of the woods of the United States. The American wood that apparently lasts longest in Cuba is the long-leaf yellow pine, which costs considerably less than Cuban woods, the prices being about $35 per thousand feet for first-quality long-leaf yellow pine and $70 per thousand feet for first-quality Cuban hard woods.

Commercial telegraph messages are accepted for transmission over the government lines at the rates of from two to five cents a word for exchange between the various provinces. A message of less than 10 words is rated and charged as a 10-word message, and the address and signature are included. When a message passes first over a local line, second over a foreign line and third over a local line, two local rates will be charged.

Concessions were granted during the Spanish dominion to the International Ocean Telegraph and Cable Company, the French Cable Company, the Cuba Submarine Telegraph Company and the United States and Haiti Telegraph and Cable Company. The International Ocean Telegraph and Cable Company maintains and operates a cable between the United States and Cuba and claims the exclusive right of telegraphic communication between the two countries until January, 1906, by virtue of a concession from the Spanish government dated December 5, 1866, and May 13, 1867.

The French Cable Company maintains and operates a cable from Haiti to Cuba, landing at Santiago de Cuba, under a concession granted by the Spanish government April 1, 1887. The Cuba Submarine Telegraph Company maintains and operates a submarine cable along the southern coast of Cuba, reaching from Santiago de Cuba to Cienfuegos and connecting with Havana by land line. The United States and Haiti Telegraph and Cable Company maintains and operates a cable from New York city to Haiti, and messages between Santiago and New York can be sent via the French Cable Company to Haiti, and from thence via the United States and Haiti Telegraph and Cable Company to New York, or vice versa.

Permits have been granted for the erection of experimental stations to several space-telegraph companies, including the Marconi, the De Forest and the Fessenden. The De Forest company has erected a station at El Vedado, a suburb of the city of Havana; the Marconi company has imported material for the erection of a station, and the Fessenden company is now completing arrangements for the installation of stations.

In the larger towns and cities telephone systems are in operations, and permits are granted from time to time for the construction of private-telephone lines connecting plantations, etc., with railroad stations, stations of the rural guard, nearest city hall, or adjoining plantations.

## Dissipation of Fog by Electricity.

Sir Oliver Lodge has written an interesting letter to the London Times on the question of the electrical dissipation of fog. He points out that an electrical method of dissipation is not the right remedy for this artificially intensified evil, though it is a hopeful and proper method of attacking natural mist in places where it interferes with navigation or commerce. The proper remedy, Sir Oliver remarks, is the removal of the cause, which is imperfect methods of combustion and the habitual employment of crude fuel. But, although it is not the right remedy, any more than free meals and free doles are a sound remedy for the problem of poverty, yet, like them, it may have to be used as a temporary palliative. The cost of applying such a method to a whole city is probably prohibitive, but there are important centers where any means of mitigating the nuisance would seem to be legitimate. Sir Oliver offers to show his method at work in Birmingham to any deputation of municipal or other engineers with a view to experiments being tried on an adequate scale. The necessary expenditure resolves itself into initial equipment and maintenance, the actual running expense being only occasional, and, moreover, quite insignificant compared with the power already expended in artificial illumination during daylight fog. Sir Oliver refrains from expressing an opinion as to whether it is worth while for any municipality to try the experiment; but, he adds, it is within the scope of the electrical engineering profession, and his assistants are competent to give the specific supervision and advice necessary to insure its being tried properly, if any authority chose to attempt it.

An agreement to submit to arbitration all disputes which may arise between the company and the union has been signed by the Chicago City Railway Company and representatives of its train-service employes. The men are members of the Amalgamated Association of Street and Electric Railway Employes of America. The agreement expires April 30, 1906, and during the period no change is to be made in wages.

## Characteristic Plants of Germany and Russia.

By Frank C. Perkins.

Many of the central stations in Europe operated under municipal ownership as well as by private corporations supply current not only for light and power service in their respective cities but generate current for operating electric street railways in the suburbs as well as within the city limits. In many cases alternating current is supplied, and transformer stations are required at various points for changing the current for use in direct-current motors which are mostly used for railway service.

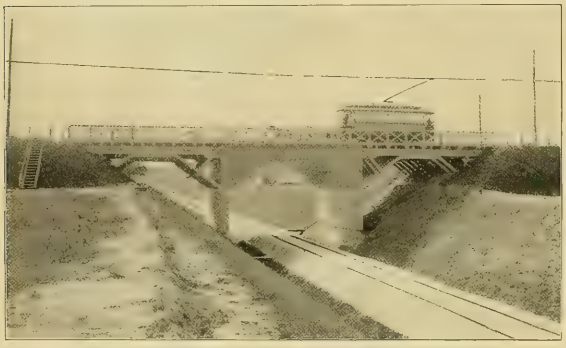


Fig. 1. Bridge on the Line of the Kieff-Swjatoschin Electric Railway.

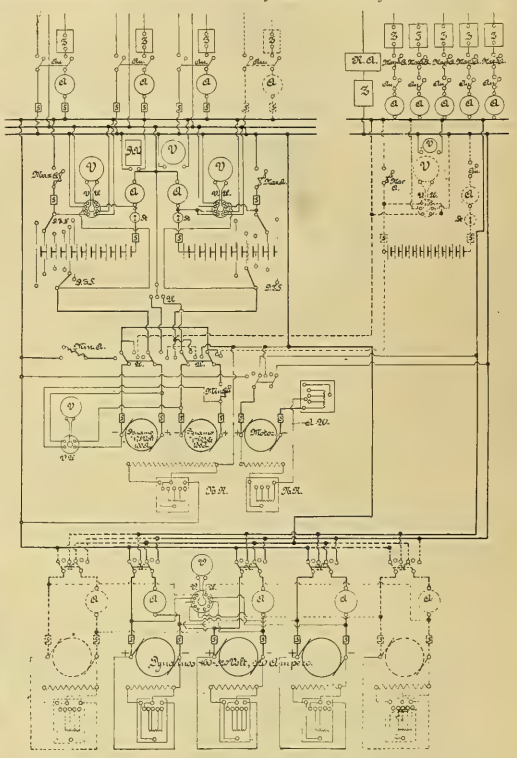


Fig. 2. Diagram of Connections of the Central Station at Landsberg, Germany.

CHARACTERISTIC PLANTS OF GERMANY AND RUSSIA.

Motor-generator sets at the sub-station at Düsseldorf, Germany, consist of three-phase induction motors directly coupled to multipolar generators constructed by the Helios Company of Cologne. Düsseldorf has a population of about 200,000 and is served by four electric-railway systems, including the municipal lines, the Bergische Kleinbahnen, the Rheinische Bahngesellschaft and the Düsseldorf-Duisburg road, the total length of tracks being respectively 83.25 kilometers, 34.21 kilometers, 60.4 kilometers and 24.59 kilometers, the current being supplied by power plants at Rath, Benrath and Obercassel.

At the chief generating plant of the city of Düsseldorf one of the units include two multipolar direct-current generators connected to a cross-compound horizontal engine with a heavy flywheel mounted between the armatures of the two dynamos. The total output of this station for lighting and power is 4,820 kilowatts with a storage-battery installation having a capacity of 1,008 kilowatts. The lighting service includes 5,684 incandescent lamps of 50 watts and 1,977 10-ampere arc lamps, while the power circuits supply current for a large number of small motors having a total capacity of 1,330 horsepower. The three-phase current is transmitted at a pressure of 5,500 volts to the sub-stations, where it is transformed to a direct current for use on the trolley lines.

At Landsberg on the Warthe the central station not only supplies current for the lighting and power service but also the street-railway service and is operated by a local company. The plant serves a population of about 40,000 with current for about 6,000 incandescent lamps and about 100 arc lamps

as well as motors having a total capacity of 165 horsepower. The station has a total output of 900 kilowatts and is provided with a storage battery for reserve and regulation of 60 kilowatts. The engines are of the vertical-compound type directly coupled to direct-current machines installed by the Helios company. The three units have each a capacity of 120 horsepower at nine atmospheres steam pressure, the steam being provided by three boilers, each having 750 square meters heating surface. The high pressure cylinders of the engine measure 350 millimeters in diameter and the low-pressure cylinders 570 millimeters, while the stroke is 350 millimeters in length. Fig. 2 is a diagram of the connections of this station.

In Russia many American cars are in operation, the motor equipments, trolley poles and track construction being almost identical with American practice. As shown in the accompanying illustration of the Kieff-Swjatoschin electric railway (Fig. 1), a somewhat unusual form of bridge construction is found near Swjatoschin. The central stations in Russia are largely of the alternating current sys-

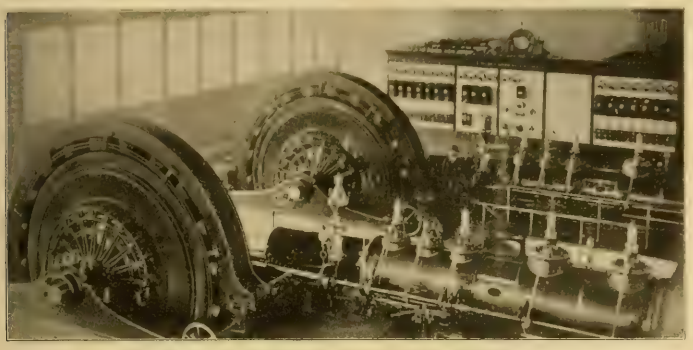


FIG. 3. DIRECT-CURRENT MACHINES IN WITKOWITZ POWER PLANT IN RUSSIA.

tems, motor-generators being required for transforming current to direct current where required for operating motors for street-railway service and operating motors for industrial purposes. At the St. Petersburg central station (Fig. 4) there are in operation seven alternating-current generators of the Helios type, each directly coupled to a 1,000-horsepower tandem-compound steam engine. Large direct-current machines are also utilized, however, even without additional flywheel for regulation, as noted in the accompanying illustration (Fig. 3) of the power plant at Witkowitz in an important Russian plant.

Electric railways are rapidly being constructed throughout Russia and there is reason to believe that the electrical industry will shortly receive a great impetus in that country.

## Financial Troubles of the Appleyard Railways in Ohio.

Cleveland, January 7.—Not much surprise was occasioned by the troubles which overtook the Appleyard companies a few days ago, as there had been vague rumors in the air for some time. The closing of two banks in Buffalo some weeks ago that held about $600,000 of A. E. Appleyard's paper caused still further surmises, as well as a suit brought by an insurance company for premiums, through which an attachment was issued on the depot of the Dayton, Springfield and Urbana road at Springfield.

The receivership resulted from suits brought to collect judgments that had been entered in the courts at Columbus, the petitions being filed by Horace W. Porter and the General Electric Company. Mr. Porter's suit is against the Dayton, Springfield and Urbana for $10,000 on a promissory note, while the General Electric Company asks for the collection of $5,982 from the Columbus, London and Springfield, and $10,000 from the Central Market Street Railway Company of Columbus. In all, six suits were filed with Judge A. C. Thompson of the United States Circuit Court in Cincinnati. The latter has additional suits pending in the courts at Columbus for $38,000, $33,000, $45,000 and $1,044 for unpaid contracts against several of the companies.

While the Columbus, Grove City and Southwestern, the Springfield and Western, the Kenton and Southern and the Urbana, Bellefontaine and Northern are all either owned or leased by the Dayton, Springfield and Urbana and the Columbus, London and Springfield, the receivership does not directly affect them, nor does it reach several others in which Mr. Appleyard is interested. It is said by some that the profits from the Columbus, London and Springfield and the Dayton, Springfield and Urbana went to [illegible] had not yet [illegible] had something to do with the [illegible] Stebbins is reported [illegible] were too big, [illegible] for handling freight.

J. G. Schmidlapp of the Union Trust Company of Cincinnati and Myron H. Wilson of the Cleveland Trust Company, [illegible] ceivers by Judge Thompson. Both men are experienced in the traction business. Theodore Stebbins, who has been the general manager of the roads for some time under Mr. Appleyard, has been continued in the position by the receivers. He says that he has already made all the reduction possible in the operating expenses, and the properties can be run on an economical basis.

The receivership is primarily for the protection of eastern creditors and bondholders, it is said, and there is a probability of a new syndicate or corporation taking over the entire list of Appleyard roads. The lines included in the receivership have all made money, and the plans of Mr. Appleyard are considered good if they could have been entirely consummated.

It is said that but a small amount of the [illegible] and bonds are held in Columbus or Cleveland. People of Dayton have about $200,000, and there is some in Cincinnati, but not a large amount. Measures will be taken to protect the local investors as far as possible, but it is said that most of them will be glad to see a reorganization. There seems to have been some dissatisfaction over the manner in which the small investors were treated.

The bonded indebtedness of the Dayton, Springfield and Urbana is $750,000. Under a 99-year lease it operates the Urbana, Bellefontaine and Northern, which has a bonded indebtedness of $500,000. The Springfield and Western, which is operated by the Dayton line, has an indebtedness of $250,000. Bonds of the Columbus, London and Springfield amount to $1,500,000, and there is a floating debt of $100,000. The Central Market Street Railway Company is bonded for $500,000. Altogether the debts amount to $3,500,000. The securities held by eastern capitalists amount to about $2,000,000.

Negotiations had been under way by which the Columbus Railway and Light Company might have taken over the Central Market lines, it is said. This is the only competitor of the city lines. Dr. J. E. Lowes of the Dayton and Northern Railroad Company had been negotiating for the Dayton, Springfield and Urbana, and had not the receivership come at this time a deal might have been made. There

[illegible]

[illegible] interests.

[illegible] weight of the other new and unfinished lines. Well posted men say that the trouble came through no fault of the roads that have been in operation for some time. All are good properties and have been doing well. C.

## Middleboro's Experience.

Referring to Middleboro, Mass., a news item published in the Boston Herald last month is to the following effect: "The investigations made by the Business Men's Club into the condition of the municipal-lighting plant and the report of the special committee [illegible] up the whole question of street lighting and commercial lighting here as it has not been done before since the town went into the business of making light for its own use and for sale to the public. The estimates given show that if the town today abandoned gas-making and electric lighting it would have cost the town nearly $150,000 for its outfit, together with the expense attached since it has begun to operate by the municipality. Men of good judgment think that it would be difficult to find a purchaser for the plant as it stands at $50,000, and it would require not less than $20,000, it is estimated, to place it on a basis to do effectual work in accordance with the demands of the day in street and commercial lighting. It has been a very costly plaything for Middleboro and promises to become more so rather than less."

## Bay Counties Plant Damaged by Landslide.

In a landslide at Colgate, Cal., on December 29th, a part of the big hydro-electric plant of the Bay Counties company was put out of commission. One big pipe line that supplies the water was destroyed and others were damaged below the point where they connect with the penstock. The machine shop was wrecked, and debris was piled over the ground about the plant to a depth of 10 feet, carrying away the wires of the two power lines. It will require several weeks to repair the damage. The big stone building where the machinery is housed withstood the force of the slide and was not damaged materially. The plants in other places are helping to supply power for the bay cities.

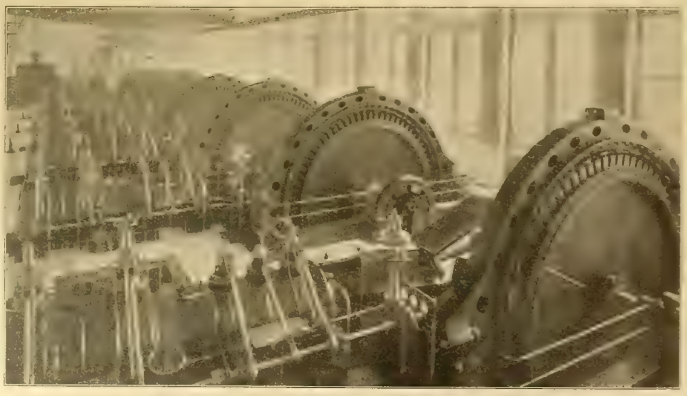


FIG. 4. SEVEN 1000-HORSEPOWER ALTERNATING UNITS IN ST. PETERSBURG STATION.

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Nebraska State Independent Telephone Association (annual meeting), Lincoln, Neb., January 18th and 19th.

Northwestern Electrical Association (annual convention), Hotel Pfister, Milwaukee, Wis., January 18th and 19th.

Independent Telephone Association of Wisconsin (annual convention), Hotel Pfister, Milwaukee, January 25th and 26th.

American Institute of Electrical Engineers (annual dinner), ballroom of the Waldorf-Astoria, New York city, February 8th.

Ohio Independent Telephone Association, Columbus, Ohio, March, 1905.

National Electric Light Association (annual convention), Denver, June 6th, 7th and 8th, and Colorado Springs, June 9th, 10th and 11th.

Ohio Electric Light Association, Hotel Victory, Put-in-Bay, August 16th to 18th.

THE city of New York should consider well before it embarks on the uncertainties of a municipal electric-lighting plant. By conciliation on both sides it should be arranged to have the street lighting continued by the local company, which is the better arrangement.

BY A typographical error in the introduction to the table published last week giving the Western Electrician's Estimates of the Value of Electrical and Auxiliary Manufactures in the United States it was stated that "the demand for electrical heating appliances exhibits an interesting decrease." "Decrease" should read "increase," as the figures in the table show.

SOME finicky people object to the almost universal use of the word "hello" as a telephone salutation. Says a recent critic: "It is not a pretty word for indiscriminate use, but that is the sort of use it gets from most of us—over the telephone, though nowhere else. A name can commonly be substituted at the beginning of a telephonic conversation, and in case the connection is broken and then made again, as so often happens, it would be well to imitate the English custom, which is not to repeat the too familiar 'Hello,' but to ask, 'Are you there?'"

This is simply zoilism. "Hello" is well established in the telephone vocabulary; it serves a useful purpose and it is well-nigh indispensable. It is used in a strictly impersonal, conventional and technical sense and with no thought of familiarity. It is round and mellow, easy to speak, pleasing to the ear when gently uttered, as it should be, with rising inflection, and coming distinct over the wire. What word or phrase could take its place? Certainly not the three-word sentence "Are you there?" Three words for one would be an almost criminal waste of time over the congested telephone wire. Again, contrast the mellifluous "Hello! Hello! Hello!" like the murmuring of a mother's lullaby, with the proposed "Are you there? Are you there? Are you there?"—a staccato from which one is tempted to run in dismay, with fingers in ears. No, no. "Hello" is the right word in the right place. May it ever be spoken softly and with the accents of peace!

BERLIN was the scene on November 22d and 23d last of an interesting electrical celebration—the commemoration of the 25th anniversary of the foundation of the German Electrotechnical Association. Mr. Frank H. Mason, the very efficient consul-general of the United States in Berlin (and, by the way, we hear with regret rumors that Mr. Mason is to be transferred to Paris), furnishes a brief account of the affair. There were meetings, a reception and an exhibition. The last, although gratuitous and open to the public during specified hours of both days, was not arranged as a popular display. It had no commercial organization or purpose, but was simply a collection and display by the members of the society of their latest and most interesting inventions, or so much of them as they were willing to submit to the inspection of their colleagues. Naturally this made up an exposition of much interest for electrical men, and the tastefully decorated exhibition rooms were thronged from morning until night by young engineers from the great electrical manufacturing companies of Germany and by professors and students from the universities and technical schools, all eager to see the latest inventions and to hear the last word in the various branches of electrical science, as apprehended and exemplified by the vigorous intellects of the Fatherland. The exhibits included a steam turbine, measuring and testing instruments, improved arc and incandescent lamps, storage batteries of new types, selenium cells, electrolytic apparatus, photometers, electrical instruments for surgery, a typewriting telegraph and many other electrical appliances.

The German Electrotechnical Association was organized by Dr. Werner von Siemens and Heinrich Stephan—then postmaster-general of Germany—in November, 1879, the same year in which Messrs. Siemens and Halske exhibited the first electric street-railway motor and train—a tiny affair, which was yet of great historical interest. The recent meeting was entirely successful. Alexander Siemens represented the British Institution of Electrical Engineers, but we are not informed whether any other foreign societies were represented.

It is interesting to note "in this connection," as the newspapers say, that the American Institute of Electrical Engineers was founded in 1884, and is therefore in its 21st year. This society has already done something in the way of exhibitions, and it is quite within bounds to suppose that it might return to the idea, taking a leaf out of the German association's book, and give a pure exhibition of American electrical advancement on a more elaborate scale than anything it has yet attempted. But whether this is undertaken or no, we are sure all American electrical engineers will extend hearty congratulations to their German professional brethren on the success of their anniversary celebration.

MR. S. E. FEDDEN is the city electrician of Sheffield, England, which recently erected at Neepsend a steam-turbine generating station having at present a capacity of 3,000 kilowatts. This plant was described and illustrated in the Western Electrician four months ago. After some discussion, Mr. Fedden was deputed by the municipality by which he is employed to join the party of British electrical engineers which attended the St. Louis International Electrical Congress of last September and made the flying "circular tour" of a number of American and Canadian cities. Mr. Fedden has now made his report, and it is of some interest. After alluding to the great increase in the size of generators and engines, as well as the extended employment of electric motors for the driving of all kinds of machinery, and the large number of engineers engaged in experimenting with new forms of lamps for use on electric circuits, all tending to decrease the cost of consumption, Mr. Fedden remarks: "Our own work has made such strides in the last few years that today we need fear no comparison with American methods in point of scientific development, and although in the nature of things most of our undertakings are on a smaller scale, there is undoubtedly a high average of excellence to be found in English practice, and greater consideration for the comfort and safety of the general public. Much of the work to be seen in the States is obviously designed to meet as cheaply as possible the demands of the moment."

The last sentence is so obviously a generalization, based on the observations of a hurried tour of perhaps a month's duration, that it might well have been omitted, or at least qualified, by a thoughtful engineer. It would have been more pertinent half a dozen years ago than now. American managers and American engineers face problems of a character different from those met elsewhere, and the demands of a rapidly growing country, without traditions and with few "vested rights" and vested abuses, should be considered in passing judgment on the engineering work exhibited. Ours is a practical nation. The engineer is forced to demonstrate that the results of his work will pay in dollars and cents. We seek essentials rather than non-essentials. Thus, rather than sacrifice the benefits of widely extended electric-railway, electric-lighting and telephone service, we have, in many instances, acceded to construction work that could certainly have been improved by greater capital expenditure. Private enterprise has been allowed a comparatively free hand. But we believe that this policy has made for the greatest good of the greatest number. Is it not so? In a little book very recently published in England, and written by an Englishman well qualified to speak with knowledge, we find this sentence: "In New York, Brooklyn, Boston and Chicago, four cities having approximately an aggregate population and area equal to those of London, there are now in use over 320,000 telephones—more than there are in the whole of Great Britain." Nearly every good-sized village has its electric-light plant, while the electric railway, with its 30,000 miles of track, has become almost a national institution. It is thus that the "demands of the moment" have been filled. If it has been done "as cheaply as possible," we must rest content with the knowledge that the United States possesses the useful advantages of electricity to a far greater degree than any other nation. We may have achieved this pre-eminence by methods and means which were sometimes uncouth and unfinished; but the larger benefits that we sought were attained.

## Dampers for Synchronous Machines.[1]

By E. L. Wilder.

Hunting in a synchronous machine is a periodical variation in the speed above and below synchronous speed. This may occur either between alternators which are working in parallel supplying current to common feeders, or it may occur between an alternator generating power and a rotary converter or synchronous motor to which its power is supplied.

Consider the case of two alternators operating in parallel: When they are in synchronism the electromotive forces in the circuit including their two armatures are in direct phase opposition, and there will be no interchange of current, if the two machines have similar wave forms and the excitation is the same. If, however, one machine lags, a resultant electromotive force will be developed which will cause a current to flow. This current takes power from the machine which is leading and supplies it to the machine which is lagging, the obvious effect of which is to raise the speed of the lagging machine and to lower the speed of the leading machine. If on account of the inertia of the moving parts the machine which was lagging now forges ahead the conditions are reversed, and thus begins an oscillation of current and speed which under certain conditions may become troublesome.

These currents which flow between two machines, thereby holding their average speeds to the same value, are called corrective currents. It is these which react upon the field flux and cause it to shift first in one direction and then in the other. Thus, in Fig. 1, let the full line represent the normal field-flux form. The dotted lines will represent roughly the limiting forms between which the flux will vary as the machine oscillates between a lagging and a leading position. This oscillation in speed may be restricted by the action of copper dampers placed upon the poles. For the sake of simplicity, disregard the presence of the flux set up by the field and assume the armature to be in rotation. When the machine is in synchronism the flux set up by the armature rotates with respect to the armature at the same speed at which the armature is rotating, but in the opposite direction, so that the flux is stationary with reference to the frame of the machine. The armature may then be considered as a stationary electromagnet excited by direct current, whose magnetic circuit is completed through the frame of the machine. When the condition of hunting prevails the armature may be considered as an electromagnet which vibrates from its normal position, changing its strength as it swings back and forth, and becoming strongest when it is farthest removed from its normal position. If now we regard the field of the motor as excited, the resultant field due to field flux and armature flux will still vary since the field flux proper is constant for a given constant field current.

If a copper sheet or copper grid is placed so that

Fig. 1. Fig. 2. Fig. 3. Fig. 4. Fig. 5. Fig. 6.

DAMPERS FOR SYNCHRONOUS MACHINES.

the flux will cut across it, the pumping or vibration will be dampened by the eddy currents set up therein according to Lenz's law. This is the function performed by the copper dampers placed on the poles of alternating-current machines which are intended for parallel operation.

Hunting is very much like the swinging of a pendulum. If there is little friction a small force will keep up the vibration. The addition of the dampers is analogous to immersing the bob of the pendulum in a heavy oil which resists the motion of the pendulum.

One of the earliest forms of dampers is illustrated in Fig. 2. It consisted merely of a heavy copper ring surrounding the pole tip. Its effectiveness as a damper is rather low. A later form is shown in Fig. 3, the copper here being extended under the pole tip in the form of a lip. [illegible] greatly increased the damping effect. [illegible] form is illustrated in Fig. 4, the damper being in the shape of a grid [illegible] the pole face. Fig. 5 [illegible] Fig. 6 shows a very effective damper [illegible] of a heavy copper [illegible] face of the pole. This form can be used [illegible] partially closed armature [illegible] eddy currents which would otherwise be set up, owing to the lack of uniformity in the flux.

The forms illustrated in Figs. 3 and 4 are not much liable to eddy-current losses and are used with open armature slots when a fairly large air-gap is used. The form illustrated in Fig. 5 is set slightly back of the surface of the pole and is but little sub-

DAMPER FITTED TO ROTATING-FIELD ALTERNATOR.

ject to eddy-current losses. The above dampers are used with poles built up of laminated iron. Where solid poles are used the surface of the pole itself acts as a damper, but it is subject to eddy-current losses.

When machines are operated synchronously there is always the liability that oscillations will be set up between the rotating parts. If these are damped out quickly no harm is done. Excessive pumping not only reduces the stability of the system and renders the machines liable to be thrown out of step, but the resulting corrective currents occasion large copper losses. The function of the dampers is to offer a resistance to the oscillations when they first start and thus prevent their growing to the danger point.

1. From The Electric Club Journal.

## Programme of Northwestern Electrical Convention.

On Wednesday, Thursday and Friday, January 18, 19 and 20, 1905, the thirteenth annual convention of the Northwestern Electrical Association will be held in the Hotel Pfister, Milwaukee. Secretary Thomas R. Mercein has prepared carefully for the meeting, as usual, and announces the following programme, which is subject to changes and additions:

Wednesday Morning.

11:30 a. m.—Association called to order. Roll-call. Reading of minutes. President's address. Report of secretary-treasurer.

Wednesday Afternoon.

Appointment of nominating and membership committees. Applications for membership. Reports of all committees except nominating. Miscellaneous business.

Paper—"Alternating-current and Direct-current Distribution," by O. M. Rau, Milwaukee.

Paper—"Successful Joint Utilization of Several Small Waterpowers," by W. B. Jackson, Madison, Wis.

Paper—"Electricity at the St. Louis Exposition," by E. B. Ellicott, Chicago.

Wednesday Evening.

Theater party.

Thursday Morning.

Questions and answers.

Paper—"High-tension Practice," by W. T. Goddard, Victor, N. Y.

Paper—"Single-phase Railways and Their Possibilities," by Clarence Renshaw, Pittsburg.

Paper—"Series Alternating Arc Lamps," by E. P. Warner, Chicago.

Report of nominating committee and election of officers.

[illegible]

Paper [illegible]

Paper [illegible] iams, Madison, Wis.

Paper [illegible] consin University.

[illegible]

Vaudeville smoker.

[illegible]

Unfinished business. Adjournment.

[illegible] dents, George H. Lukes of Evanston, Ill., and F. [illegible] W. H. Schott of Chicago, Prof. D. C. Jackson of Madison, Wis., and Harold Almert of Oak Park, Ill.

The [illegible] ing. Mr. James Wolff, the master of transportation, has arranged [illegible] waukee and St. Paul road, leaving Chicago for Milwaukee [illegible] cago contingent [illegible]

## Chicago Street-railway Situation.

It is reported that there is a new deal in the Chicago traction situation, whereby, instead of the Chicago City Railway Company being bought by the Chicago Union Traction Company, the former company is to buy the North and West Side companies, the underlying properties of the Union Traction company. The carrying out of this plan is said to be the decision reached at a meeting in New York of John J. Mitchell, Marshall Field and P. A. Valentine of Chicago and J. Pierpont Morgan, who, it is said, will head a syndicate which is soon to come into control of the South Side, North and West Side systems.

In the matter of the Union Traction accounting Judge Grosscup this week delivered an oral decision relative to the issuing of a large amount of receivers' certificates. Judge Grosscup said he would authorize the issue of receivers' lien certificates to the amount of $500,000, only on the condition that the Union Traction Company shall make good the amount of $421,000 which represents the deficit of the receivership. Then the court went on to say that to the extent that the receivers had purchased new cars and constructed roadbed, they were entitled to receivers' certificates, subject to the qualification that in the case of reconstruction the certificates should issue only to the extent that such reconstruction represents a betterment over former conditions. He said he was satisfied that such betterment represented 40 per cent. of the cost of reconstruction. For this proportion certificates might therefore be issued, but the remaining 60 per cent. should be charged to operating expenses or maintenance, and to that extent decrease the depreciation fund.

## Hydro-electric Power for Venice.

Reference has been made recently to the use of the waterpower of the River Cellina, in Italy, for electrical purposes. The work is not yet terminated, but the company definitely promises the completion of the dam early in 1905, when the power at Venice will be 7,000 horsepower, while the utilization of the first rapids, which will shortly follow the completion of the dam, will give at Venice 10,000 horsepower and 13,000 at the generating station. The later utilization of the second rapids will, of course, give an added power. At Venice 1,500 horsepower will be used for illuminating, and the remainder for industrial purposes. Along the line of conduit are towns and populated districts where already contracts for supplying power have been made, and others are being undertaken. On the completion of the works, the price for electric energy will be a fraction over 9½ cents per kilowatt-hour.

United States Consul R. W. Bliss at Venice says: "The starting of this plant naturally opens a market for electrical machinery, articles of installation and house fixtures. A carload of catalogues, however, will serve no purpose toward securing the sale of goods. Merchants want to see the article for sale to be convinced that it is better than what the Germans and English are selling; this can only be done by a salesman canvassing the district. The electrical manufactures of the United States, by reason of their excellence, could easily predominate in the market of Italy, where the industry is making rapid advances, and it would be but a neglect of an excellent opportunity should this occasion not be seized by Americans."

## Northwestern Cedarmen's Association.

The Northwestern Cedarmen's Association held its ninth annual convention at the Hotel Pfister, Milwaukee, on Tuesday, January 3d. The meeting proved to be one of the most enthusiastic ever held. The forenoon was devoted to a meeting of the board of directors, meetings of standing committees and mutual greetings and interchange of opinion among the delegates. The formal session was called to order at 2 p. m. in the clubroom by President H. W. Reade of Escanaba.

Secretary John F. Hayden of Minneapolis read the minutes of the last annual meeting, which was held at the Auditorium Hotel, Chicago, on January 6, 1904, and also the minutes of the special meeting held at the Nicollet Hotel, Minneapolis, Tuesday, March 29, 1904. The minutes of both meetings were approved.

President Reade then delivered his annual address, in the course of which he said:

"The past year has not been as prosperous for dealers in cedar products as we anticipated. The invasion of the western timber and curtailment of building operations have had their effect upon the shingle market. It is a hard matter to account for the falling off in the demand for posts during the past season. Although the crops in some sections have not been up to the average, there has been no widespread crop failure, and the great majority of farmers in the agricultural districts where we find our market for posts are in good financial condition. The farmer has, therefore, been in a position to buy posts provided he needed them, which brings us to the conclusion that the farmers in the older farming states now have their farms fairly well fenced. I think that farmers in the older localities have their farms fairly well fenced, but they still require an immense number of posts for renewals and extensions, and there is an endless demand for posts in the newer agricultural districts.

"The trade in poles has not been as active nor prices as firm as in the past few years, but stocks of short poles, 20-foot in particular, are pretty well cleaned up.

"Before closing I wish to say a word in regard to the inspection rules adopted by the association some time ago. In the words of the showman, 'This feature alone is well worth the price of admission.' If for nothing else, I am proud of the association for the good work it has done in this line. The most of you will remember the difficulties we had to contend with before these rules were established, and now they are used and recognized as authority from the Atlantic to the Pacific and south to Mississippi and Texas.

"Everything points to a very active and prosperous year in all industrial lines, and it is my hope and belief that all of you may and will benefit by the general revival of business, and when we meet again at our next annual gathering you can report your measure of prosperity as full, heaped up and running over."

In the course of his annual report Secretary Hayden said that the membership was 68. He also said, among other things: "In July your secretary received a communication from the secretary of the Northwestern Lumbermen's Association stating that some of his members were complaining that producers of white cedar were filling out cars of poles with posts, or shipping full cars of posts to the rural telephone lines. He claimed that posts are a regular part of the stock of the retail dealer and urged that our members be asked to desist, or to charge prices for the posts that would enable them to recompense the retail dealers for their loss of trade. You are all familiar with the circular the directors of this association authorized the secretary to send to the members. As stated in that circular, and also to the secretary of the retailers' association, the members of this organization have no desire to act contrary to any of the so-called rules of trade ethics, but at the same time we do expect in return that the retail trade shall buy supplies from those who are regularly engaged in the wholesaling of white cedar, and shall not go up into the woods and secure white cedar posts and shingles from the small jobbers who do not pretend to be carrying on a regular business of that character. During the year the secretary received from a member of the association a communication inquiring the meaning of the rule that admits of 10 per cent. of butt rot in poles. The rule states distinctly that rot to the extent of 10 per cent. of the area of the butt is allowable, but the question was as to what is the diameter of such an amount of rot. On inquiry the secretary found that controversy over this matter was not uncommon. Of course a geometrical solution of the problem is possible at all times and for all sized poles, but for convenience in measurement it might be set down that the diameter of a rot area amounting to 10 per cent. of the area of the butt of any pole is approximately equal to three-tenths of the diameter of the butt.

"In closing this review of a somewhat unsatisfactory year to the producers and wholesalers of white-cedar products, it might be appropriate to say that this association or any similar association cannot hope to have the power to regulate the demand for what it has to sell. And where the members do not constitute the entirety of the producers it is equally impossible to regulate the supply. But there are other functions of the association that can be made of great benefit. Many of these have already been assumed, and it is unnecessary to estimate the value of the classification books, the unity of action on such matters as the terms of sale, the possibilities for securing fair treatment from the railroads in the matter of freights and the handling of claims for overweights and the adoption of uniformity in specifications. Even the official price-list has its value, though it may not at times represent the market. Further than these your secretary would repeat the statement made by your former secretary, that if it were possible to occasionally gather statistics of the amount of stock in the hands of each member and issue this information to all the members, it would do much to establish stability in the market and would serve as a guide to the committee on values.

"While your secretary lays no claims to qualifications as a prophet, he believes that the coming year will not be a repetition of the last. It is not necessary to review the conditions and circumstances that have made the last year a bad one for the cedar trade. You are all familiar with them, for you have been up against them. But you are also familiar with the signs of the times that give bright promise for the new year. A $5,000,000,000 crop raised by the farmers of the country in 1904 will go a long way toward healing the sores that have made you uncomfortable."

M. K. BISSELL, PRESIDENT NORTHWESTERN CEDARMEN'S ASSOCIATION.

Treasurer W. B. Thomas of Manistique, Mich., showed total receipts of $746.06 and disbursements of $441.25

The report of the treasurer was greeted with applause, as it showed a healthy balance in the treasury.

Reports of committees being called for, R. H. Downing, chairman of the post and shingle committee, announced that the members of his committee had concluded after a careful survey of the situation to recommend a list that would be nearer the selling value of cedar products than the old one. The recommendation of the committee was as follows:

CEDAR POSTS.

Price of cedar posts and piling f. o. b. cars at Hermansville, Mich.

| | |
|---|---|
| 7 to 9 inch quarters, 7-foot, 7c. | 4 inch round, 12-foot, 23c. |
| 5 inch halves, 7-foot, 7½c. | 5 inch round, 12-foot, 33c. |
| 7 inch halves, 7-foot, 10c. | 6 inch round, 12-foot, 36c. |
| 6 inch halves, 7-foot, 9c. | 7 inch round, 12-foot, 41c. |
| 3 inch round, 7-foot, 7½c. | 4 inch round, 14-foot, 27c. |
| 4 inch round, 7-foot, 9c. | 5 inch round, 14-foot, 38c. |
| 5 inch round, 7-foot, 11½c. | 6 inch round, 14-foot, 41c. |
| 6 inch round, 7-foot, 15c. | 7 inch round, 14-foot, 48c. |
| 7 inch round, 7-foot, 17c. | 4 inch round, 16-foot, 40c. |
| 8 inch round, 7-foot, 25c. | 5 inch round, 16-foot, 45c. |
| 4 inch round, 8-foot, 13c. | 6 inch round, 16-foot, 50c. |
| 5 inch round, 8-foot, 17c. | 7 inch round, 16-foot, 58c. |
| 6 inch round, 8-foot, 19c. | 4 inch round, 18-foot, 50c. |
| 7 inch round, 8-foot, 25c. | 5 inch round, 18-foot, 60c. |
| 8 inch round, 8-foot, 40c. | 6 inch round, 18-foot, 70c. |
| 4 inch round, 10-foot, 18c. | 7 inch round, 18-foot, 85c. |
| 5 inch round, 10-foot, 28c. | 4 inch round, 20-foot, 55c. |
| 6 inch round, 10-foot, 30c. | 5 inch round, 20-foot, 70c. |
| 7 inch round, 10-foot, 40c. | 6 inch round, 20-foot, 80c. |
| 8 inch round, 10-foot, 65c. | 7 inch round, 20-foot, $1. |

TELEGRAPH POLES.

4 inch round, 25-foot, 70 cents.
5 inch round, 25-foot, 90 cents.
5 inch round, 30-foot, $1.30.

CEDAR PILING.

8 inch top, 12 to 20 foot, 10 cents per foot.
9 inch top, 12 to 20 foot, 11 cents per foot.
8 inch top, 22 to 30 foot, 11 cents per foot.
9 inch top, 22 to 30 foot, 12 cents per foot.
8 inch top, 32 to 40 foot, 13 cents per foot.

In commenting on the report, Chairman Downing said that the list had always been higher than the actual selling prices and that the committee had endeavored to formulate this list in that way. Although slightly higher than present prices, he believed that before the fall trade sets in the full list would be easily obtained.

M. K. Bissell moved that the report be adopted. This being seconded, some discussion ensued, but in the end the report was adopted unanimously.

Secretary W. G. Hollis of the Northwestern Lumbermen's Association, Minneapolis, was given the privilege of the floor to address the members on the question of reciproccity in trade relations. Mr. Hollis went into the subject with his usual clearness and enthusiasm and suggested that a committee be appointed from the Northwestern Cedarmen's Association to meet with the representatives of other associations in considering this question. Mr. Worcester moved that a trade relations committee be appointed by the chair with authority to act. This motion being seconded, discussion ensued, all of which was favorable to the project and the motion was carried unanimously. President Reade appointed as a trade relations committee C. H. Worcester of Chicago, H. S. Gilkey of Minneapolis and R. H. Downing of Minneapolis.

R. H. Downing was appointed as representative of the Northwestern Cedarmen's Association to attend the annual meeting of the Northwestern Lumbermen's Association at Minneapolis, and also the annual meeting of the Illinois Lumber Dealers' Association at Chicago in the same capacity, that of discoursing on the white-cedar business.

The election of officers being in order, the chairman appointed as a nominating committee E. H. Valentine of Chicago, C. H. Worcester of Chicago, F. J. Lang of Hermansville, Mich., M. K. Bissell of Escanaba, Mich., and R. H. Dowling of Minneapolis. The convention took a short recess during the absence of the nominating committee, on whose recommendation these officers were elected:

President—M. K. Bissell of Escanaba.

Vice-president—M. H. Coolidge of Minneapolis.

Treasurer—W. B. Thomas of Manistique, Mich.

Directors—for one year, E. H. Valentine of Chicago and H. S. Gilkey of Minneapolis; for two years, H. W. Reade of Escanaba, Mich., and George Nicholson, Jr., of Manistique.

President Reade at this juncture surrendered the chair to his successor, Mr. Bissell, who, upon assuming his new duties, thanked the members gracefully for his preferment.

It was moved and seconded that the thanks of the Northwestern Cedarmen's Association be extended to ex-President Reade for his efficient services during the last year, which was carried unanimously.

Mr. Gilkey advocated the employment of a paid secretary, who could devote his entire time to the affairs of the association, compile statistics, visit the plants of the members and keep the cedar men thoroughly posted on the condition of the market, stocks and other points of vital interest. After discussion, it being found that the constitution empowered the directors to employ a secretary, fix the salary and virtually make all arrangements necessary, it was moved that the directors retire and endeavor to formulate a proposition for employing a permanent secretary and bring it before the meeting for adoption. This was unanimously agreed to and a short recess was taken while the directors conferred. Upon being called to order again the directors submitted a recommendation for a change in the constitution, raising the initiation fee from $10 to $25 and the annual dues to $75. This was to secure the necessary funds. After some further discussion by Messrs. MacGillis, Gilkey and others, the amendment was put to a vote and carried unanimously.

As there was no further business to come before the meeting the convention, on motion, adjourned.

Daniel MacGillis and T. A. Bruett, representing respectively the MacGillis & Gibbs Lumber Company and the Wilbur Lumber Company, the two Milwaukee members of the association, entertained the delegates at a banquet which was held in the red room of the hotel at eight o'clock in the evening.

MEMBERS AND GUESTS.

Among those in attendance at the meeting were the following-named:

Anthes, H. W., Torrey Cedar Co.....Clintonville, Wis.
Arnold, W. L., Wittenberg Cedar Co.....Wittenberg, Wis.
Bailey, F. M., Sound Waves.....Chicago.
Bissell, M. K., Erickson & Bissell.....Escanaba, Mich.
Bradley, T. P., Duluth Log Co.....Duluth, Minn.
Brooks, Hall L.....Tomahawk, Wis.
Bruett, T. A., Wilbur Lumber Company.....Milwaukee.
Bulgrien, G. H., The R. Connor Co.....Marshfield, Wis.
Clark, E. L., Valentine-Clark Co.....Chicago.
Coolidge, Marshall H., Marshall H. Coolidge Co..Minneapolis.
Dixon, H. M., Cloquet Tie and Post Co.....Cloquet, Minn.
Downing, R. H., Bradley-Watkins Co.....Minneapolis, Minn.
Elmore, Elting, Elmore-Fowler-Jacobs Company..Milwaukee.
Farnsworth, Geo. J., Bay DeNoquet Co.....Nahma, Mich.
Forbrich, C. W., Western Electrician.....Chicago.
Fowler, John H., Elmore-Fowler-Jacobs Co.....Chicago.
Fuller, L. E., The Morgan Company.....Oshkosh, Wis.
Fuller, L. E., American Lumberman.....Chicago.
Genge, R. R., Francis Beidler & Co.....Chicago.
Gerich, J. E., MacGillis and Gibbs Lumber Company.....Milwaukee.
Gilkey, H. S., Pendleton & Gilkey.....Minneapolis.
Graffis, W. H., Telephone Magazine.....Chicago.
Hayden, J. F., Mississippi Valley Lumberman...Minneapolis.
Hollis, W. G., N. W. Lumbermen's Association..Minneapolis.
Hooper, J. R., American Lumberman.....Chicago.
Huebel, C. J., C. J. Huebel Company.....Menominee, Mich.
Lang, F. J., Wisconsin Land and Lumber Company.....Hermansville, Mich.
Leitch, J. G., Francis Beidler & Co.....Escanaba, Mich.
Littman, Max, T. M. Partridge Lumber Co..Minneapolis.
MacGillis, Daniel, MacGillis & Gibbs.....Milwaukee.
MacLeod, M., Bay de Noquet Company.....Chicago.
McDevitt, J. A., Cloquet Tie and Post Co...Cloquet, Minn.
McMeal, H. B., Telephony.....Chicago.
Morse, A. W., American Lumberman.....Chicago.
Mueller, Wm., William Mueller Company.....Chicago.
Naugle, A. T., E. Naugle Tie Company.....Chicago.
Nicholson, George Jr., White Marble Lime Company..Manistique, Mich.
O'Callaghan, Jas., O. C. Lumber Co.....Vulcan, Mich.
Partridge, T. M., T. M. Partridge Lumber Co..Minneapolis.
Perrizo, Paul Jr., Perrizo & Sons.....Daggett, Mich.
Reade, H. W., Pittsburg and Lake Superior Iron Company.....Escanaba, Mich.
Schalck, Frank R., Western Electrician.....Chicago.
Snell, Frank N.....Milwaukee.
Thomas, W. B.....Manistique, Mich.
Valentine, E. H., Valentine-Clark Co.....Chicago.

Wall, Tom R., Torrey Cedar Co. . . . Clintonville, Wis
Wagshiff, W. J. . . . Oshkosh, Wis
Watson, A. D., Rabe & Watson . . . . Chicago
Worcester, C. H., C. H. Worcester Company . . . Chicago

### Convention Notes.

A. T. Naugle of the E. E. Naugle Tie Company of Chicago was on hand. He is one of the most popular men in the pole business.

John H. Fowler, so well known among users of poles and ties, was, of course, a conspicuous figure at the convention, as was also his partner, Elling Elmore.

J. A. McDevitt and H. M. Dixon did the honors for the Cloquet Tie and Post Company of Cloquet, Minn., and did them well. Cloquet interests are old and well-known ones in the cedar line.

W. L. Arnold, manager of the Wittenberg Cedar Company, Wittenberg, Wis., a new member of the association, made his appearance for the first time at the cedarmen's convention and was warmly welcomed.

For the first time in many years H. W. Anthes and Tom R. Wall of the Torrey Cedar Company, Clintonville, Wis., attended the cedarmen's convention. These gentlemen are well known among the cedarmen of the Northwest and received a hearty welcome.

T. M. Partridge, president of the T. M. Partridge Lumber Company, Minneapolis, was among the newcomers at the convention. Though a young man, Mr. Partridge is well known as an energetic worker, and his work has been effective in securing for his company a large trade.

Of course, Hall L. Brooks, the popular "Tomahawk" man, was on hand and mingled with his many friends in the cedar line. Mr. Brooks' popularity is by no means confined to his friends among the cedar dealers, as his customers have found him one of the most genial men in the business.

H. S. Gilkey of Minneapolis, one of the "shining lights" of the association, was warmly greeted by his many co-workers in the cedar line. During last year's convention Mr. Gilkey was seriously ill, and the welcome he received this year demonstrates the high esteem in which he is held by his associates

'No cedarmen's convention would be complete without Marshall H. Coolidge, one of the pioneers in the industry. Mr. Coolidge, who is president of the Marshall H. Coolidge Company of Minneapolis, anticipates a greatly increased trade during the present year, and is making the necessary preparations to meet it.

M. K. Bissell, the newly elected president of the association, is one of its oldest and most highly esteemed members. He is the junior partner of the firm of Erickson & Bissell of Escanaba, Mich., dealers in poles and ties. Mr. Bissell was formerly mayor of Escanaba and his executive ability will no doubt prove useful in the performance of his new duties.

William Mueller of the William Mueller Company, Chicago, good-natured and affable as ever, was as much in demand as usual. Mr. Mueller is one of the best entertainers in the cedar business, and it is safe to say that no more popular man exists in that industry. The William Mueller Company is one of the oldest in the cedar line and enjoys its quota of business.

H. W. Reade, secretary and treasurer of the Pittsburg and Lake Superior Iron Company of Escanaba, Mich., one of the largest concerns in the cedar business, did more than his share in looking after the welfare of the delegates. Mr. Reade received many congratulations for the able manner in which he performed the duties of president of the association, and added greatly to his well-earned laurels.

Among those who are held in the highest esteem by the members of the association is E. H. Valentine, of the Valentine-Clark Company, Chicago. Although not in the best of health, Mr. Valentine would not be denied, and his presence, together with his usual stock of anecdotes and reminiscences, were most welcome. Mr. Valentine was ably assisted by his partner, E. L. Clark, in looking after the company's interests.

Every delegate to the convention was pleased to see C. H. Worcester, president of the C. H. Worcester Company of Chicago. No convention would be complete without the presence of this popular dealer, and his sound advice and wise counsel have been a feature of every meeting held thus far. Though a young man, Mr. Worcester is one of the largest producers of cedar poles, and the success of his company is due to his conscientious treatment of his customers and his untiring efforts.

The Duluth Log Company of Duluth, a new member of the association, but a pioneer in the pole and lumber business, was ably represented by Secretary and Manager T. P. Bradley, who took time to run down from Duluth to look after the interests of his company. Besides exploiting the Duluth Log Company's product in a capable way, it can safely be said that Mr. Bradley went away with a materially increased list of personal friends. Of frank and courteous manner, he is a man whom it is a real pleasure to meet and who easily makes and retains friends. Mr. Bradley distributed a much sought after "capsule" in the shape of a good cigar enclosed in a tran-patent case.

Paul Perrizo of Perrizo & Sons, Daggett, Mich., was among the early arrivals. Mr. Perrizo anticipates a greatly increased business in pole and ties this year and feels confident that the choice stock his company has on hand will enable it to receive a good share of this patronage.

## New Single-phase Integrating Wattmeter.

The newest development in Westinghouse integrating wattmeters is the type-B, for use upon single-phase circuits of 7,200 and 16,000 alternations, which shows improvements in a number of features that

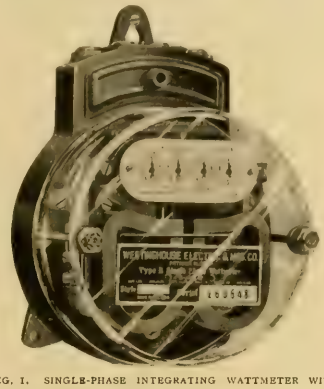



FIG. 1. SINGLE-PHASE INTEGRATING WATTMETER WITH GLASS COVER.

give it an increased efficiency and long-lived calibration. In every essential it follows the Westinghouse standard designs, employing the principle of shunting the greater portion of the field, due to the shunt winding, and allowing only a small portion of it to combine with the series field to produce a torque on the disk. By this means good load-voltage and frequency curves are obtained. By a change in the design of the electromagnet the effect upon the disk is made double that produced in the type A, with the same small shunt loss, the same accuracy upon light work and a minimum amount of variation in performance due to changes in voltage and frequency.

Fig. 1 shows the wattmeter with glass cover, it being also made with a metallic cover. It is compact in form and can be installed in a small space,

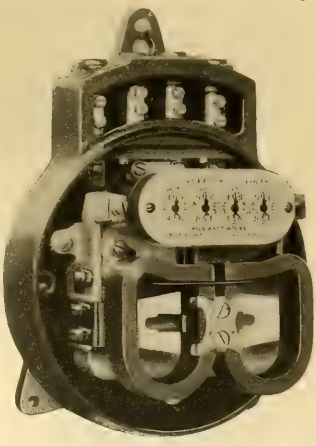


FIG. 2. WORKING PARTS OF SINGLE-PHASE INTERGRATING WATTMETER.

the front connections on the top of the meter case adding materially to the convenience in installation. The fact that it is a sealed meter, with the original calibration preserved under the manufacturer's seal, and requires no adjustment when put into service also reduces the cost and the labor of installation. It is only necessary to fasten the meter securely to its supports by three screws, to connect the line wires to the four terminals and to take the initial reading of the meter, work which an intelligent lineman can do as well as a meter expert. It will be noted that the use of four binding posts and the connecting of both sides of the circuit to the meter prevent its stoppage by removing a shunt lead, without interrupting [illegible] danger of the disk rubbing. Adjustments [illegible] secured to a single casting, as shown in Fig. 2.

The [illegible] tained in the new meter. The lower end of the shaft, upon which the rotating disk is mounted, is fitted with a sapphire jewel, slightly cupped. A corresponding jewel is placed in the end of the adjusting screw, which forms the lower half of the bearing, and into the hollow space between the jewels a hardened steel ball is introduced. The polished steel surface of the ball is slightly less in radius than the jeweled cups, reducing the friction to an inappreciable amount, owing to the smallness of the points of contact.

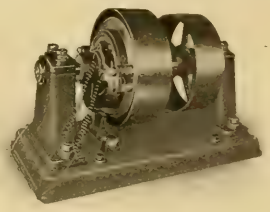
The upper bearing is new and presents some excellent features. The shaft which supports the disk is drilled out at its upper end slightly larger than the pin which is attached to the upper screw. The diameter is reduced at one point in its depth to form a bearing for the pin. At the bottom of the hole is placed a small piece of felt which is impregnated with oil. Capillary attraction causes the lubricant to creep upward, oiling the bearing. Friction is thus reduced to a minimum, decreasing the wear and eliminating noise.

A four-dial counter is employed, its construction and the connection with the disk shaft being so perfect that no friction effects are perceptible. On meters of less than 3.84-kilowatt capacity the first dial reads in the tenths of kilowatt-hour; in larger capacities the first dial records units.

The meter records directly without the use of a constant. The accuracy is not affected by reasonable variation in voltage and it records correctly from two per cent. of full load to 50 per cent. overload, and under all conditions of power factor and wave form.

## Electromagnetic Clutch.

One of the latest entries into the field of electrically operated machinery is the Williams electric clutch, shown herewith, which is made by the Williams Electric Machine Company of Akron, Ohio. The driving principle of the clutch consists in the clamping of a number of disks by magnetic action. The multiplied disks brought in intimate contact



ELECTROMAGNETIC CLUTCH.

by the magnetization give these clutches great driving power as compared with their size, the consumption of current in the energizing coil being almost negligible. A 50-horsepower 100-revolution-per-minute clutch consumes approximately one-half an ampere at 110 volts.

The actuating coil is mounted concentric with the shaft bore of the clutch and is enclosed in an oil and waterproof metallic case, which in turn is enclosed in the clutch proper, which saves it from damage from external sources. This coil is insulated in accordance with the best electrical manufacturing practice, being given a breakdown test of 2,200 volts alternating current for 110 and 220-volt work and 5,000 volts alternating current for 500-volt service.

The objectionable feature often pertaining to magnetic clutches of the residual magnetism causing the clutch to hold for a short period after the current has been cut off, is said to have been entirely overcome, and they will take hold and let go more promptly than any mechanical clutch.

Two types are built—those in which the current is left on while the clutch is in operation and those in which the current is used only to throw the clutch on and off. The same principle is also made use of in a safety device for stopping heavy tools or machines in case of accident to the operator.

The pressing of a button or the least pressure on a safety cord enables the heaviest machinery to be brought to an almost instantaneous standstill in case of a workman being caught, and at the same time it indicates, through an enunciator in superintendent's or manager's office, the machine or section of factory affected.

## OBITUARY.

### C. M. Wilkes.

Charles M. Wilkes, mechanical engineer for D. H. Burnham & Co., architects, Chicago, died in Philadelphia on January 7th while in that city superintending work for his employers. His death came unexpectedly to his many friends, for he had been actively at work up to within a few days of his death. The funeral took place at Joliet, Ill., on January 10th and was attended by the entire office force of the firm and by many prominent men with whom he had business relations.

Mr. Wilkes was born in Connecticut on May 28, 1858, and was a graduate of the Massachusetts Institute of Technology of Boston. Before his connection with the firm of Burnham & Co., which dated from 1891, he had charge of the laying out of the system of sewerage and water supply of the Chicago World's Fair. His executive and engineering ability may be judged from the fact that during all the years of his connection with Burnham & Co. he had the entire charge of the electrical and mechanical work done by his firm upon the many large buildings designed and superintended by the concern, and he was therefore well known to the electrical fraternity, as well as to men in the mechanical field.

Personally he was of a cheerful nature, well liked by his associates; he made friends everywhere. Outside of his work he found time to indulge his natural liking for music, and he was himself a musician. He was a member of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, the American Society of Heating and Ventilating Engineers and the Northwestern Association of the Massachusetts Institute of Technology. He was also prominent socially, belonging to the Apollo, Kenwood and University clubs in Chicago. A wife and two brothers survive him.

### W. H. Baldwin, Jr.

William H. Baldwin, Jr., president of the Long Island Railroad Company, died on January 3d in his summer home at Locust Valley, N. Y. During his presidency the plans for the electrification of the Long Island railroad were brought to completion. The deceased was also president of a number of electric railways which acted as feeders to the Long Island road. Samuel Rea, fourth vice-president of the Pennsylvania railroad, who has charge of the task of building the Pennsylvania tunnels and terminal in New York, is mentioned as a probable successor to Mr. Baldwin.

## New Members of the Institute.

At the directors' meeting of the American Institute of Electrical Engineers in New York city on December 23d, 27 applicants were admitted to associate membership in the Institute, as follows:

Browne, R. J., electrical engineer for the government of India, Calcutta, India.
Cowgill, J. S., Three Rivers Electric Works, Three Rivers, Mich.
Ensign, O. H., Edison Electric Company, Los Angeles, Cal.
Forsythe, W. C., Tallahassee, Fla.
Foster, F. P., superintendent of fire alarm, Corning, N. Y.
Hamner, C. S., General Electric Company, Schenectady, N. Y.
Henderson, J. S., Westinghouse Electric and Manufacturing Company, Pittsburg, Pa.
Heywood, James, Philadelphia Rapid Transit Company, Philadelphia, Pa.
Kent, James, Fort Wayne Electric Works, Boston, Mass.
Kroger, F. H., University of Colorado, Boulder, Colo.
McCullough, Homer, Bismarck Nugget Gulch Mining Company, Sheridan, Mont.
Monjo, D. L., Elizabeth, N. J.
Pahl, A. J., California Gas and Electric Corporation, San Francisco, Cal.
Peck, H. W., Westinghouse Electric and Manufacturing Company, Pittsburg, Pa.
Pope, W. G., Lisbon, Portugal.
Pressey, H. A., Washington, D. C.
Rowe, Norman, Guanajuato Power and Electric Company, Guanajuato, Mexico.
See, P. V. C., Metropolitan West Side Elevated Railway, Chicago, Ill.
Shane, Adolph, Iowa State College, Ames, Iowa.
Specht, H. C., Westinghouse Electric and Manufacturing Company, East Pittsburg, Pa.
Spiegel, A. S., Chicago Telephone Company, Chicago, Ill.
Stitt, F. S., New York city.
Talbott, W. M., Havana, Cuba.
Williams, J. R., Birmingham Equipment Company, Birmingham, Ala.
Woltz, Roscoe, General Electric Company, Lynn, Mass.
Wood, Walter, R. D. Wood & Co., Philadelphia, Pa.

## Waterpowers in New Zealand.

It is reported the government of New Zealand is taking steps to utilize as far as possible all the available waterpower in the islands for the production of electricity. Although the project has not yet taken definite shape, experts from the United States and Switzerland have been invited to come and study the subject. They will have to report on likely hydraulic sources not yet in use, and on their report will depend the government's decision. There will no doubt be large contracts to be undertaken.

## Annual Lecture Series for Western Electric Salesmen.

The second annual series of lectures to the supply department salesmen of the Western Electric Company was held at the Chicago factory on Monday, Tuesday and Wednesday of this week and included talks by representatives of many leading manufacturers and supply dealers upon the various classes of apparatus which the Western Electric salesmen handle, besides lectures by men prominent in their own company upon Western Electric products. Morning and afternoon sessions were held, and the salesmen were given helpful hints in relation to the apparatus by men thoroughly familiar with the details of construction and which will enable them in the future to present the goods to their customers in the most advantageous light.

The meeting was opened on Monday morning with introductory remarks by W. F. Hessel, followed by H. R. King, who talked upon "New Type Motors." "Holophane Glassware," by C. A. Howe, concluded the morning session. In the afternoon arc lamps were discussed by E. P. Warner, one of the Western Electric Company's best authorities on this apparatus. The concluding lecture for the day was by P. T. Ackerson, upon "American Transformers."

Tuesday's session was begun by L. W. Downes upon "D. & W. Specialties," after which J. R. Fletcher alluded to what he thought to be the most important of the various devices listed in his company's catalogue. James I. Ayer of Cambridge, Mass., then gave an interesting lecture upon Simplex electric heating apparatus, and by way of illustration had the various appliances at hand to exhibit. Among the devices shown were electric ovens, broilers, kettles and utensils of various kinds which would do all that could be accomplished upon a kitchen range. Besides these, there were electric flatirons, curling-iron heaters, small water heaters, chafing dishes, table sets, etc. Perhaps one of the most useful and most appreciated electric heating devices shown was a heating pad intended to take the place of a hot-water bag. The pad is made up of a network of insulated resistance wires with connections for attachment to an electric-light fixture. Two thermostats are connected in series with the resistance inside the pad and so arranged as to open the circuit when the temperature reaches 180° F. A soft outer covering is provided for the pad and the whole may be wrapped around the body, applied to the head or feet, and used in many ways for the alleviation of pain or for warmth. When exposed to the air the pad will not reach a temperature above 120° F., but when buttoned inside the clothing or placed in the bed it will reach a temperature of 180° F., which cannot be exceeded on account of the thermostats. This temperature is about as hot as can be comfortably borne.

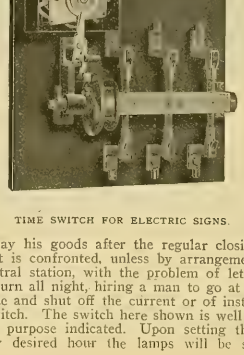
Following the lecture, a well-prepared and substantial luncheon was served to those present, cooked on the spot entirely with Simplex electrical culinary apparatus, and fully demonstrating all the claims made by the speaker.

On Tuesday afternoon four lectures were delivered, as follows: "Gladstone-Lalande Batteries," by J. W. Gladstone; "Cross-arms," by A. K. Crosby; "Westinghouse Details," by W. R. Pinckard, and "Exhaust Fan Motors," by W. Robbins.

Six lectures were delivered on Wednesday, as follows: "Thomas Porcelain," by J. E. Way; "Duncan Wattmeters," by Thomas Duncan; "Stombaugh Guy Anchors," by W. N. Matthews; "Poles," by R. A. Griffin; "Habirshaw Wire," by J. B. Olson, and "Hubbell Specialties," by a representative of the Hubbell company.

## Time Switch for Electric Signs.

The accompanying illustration represents a form of time switch manufactured by the American Electric Sign Company of Boston. The progressive merchant who makes use of electrically lighted signs



TIME SWITCH FOR ELECTRIC SIGNS.

to display his goods after the regular closing time at night is confronted, unless by arrangement with the central station, with the problem of letting the lights burn all night, hiring a man to go at a specified time and shut off the current or of installing a time switch. The switch here shown is well adapted for the purpose indicated. Upon setting the clock for any desired hour the lamps will be shut off even more surely than if a man were detailed for the duty.

The American company is also the builder of many original moving window designs in electric-lighting effects, and Mr. Wilson, who is at the head of this department, is said to have designed and built more moving window pieces than any other man in the country.

## Electricity in the New York Times Building.

Electricity is employed in a great variety and number of uses in the New York Times Building, just completed and occupied in New York city. The building is 362 feet high and sinks 51 feet below city datum. There are 25 stories above the ground and three below, besides two galleries, and a pumping plant 61 feet below the street. The building is located at Forty-second Street and Broadway. In the basement and on several upper floors is located the model printing plant of the Times. The basement also contains the Times Square station of the Rapid Transit Subway.

Electricity operates all the moving machinery in the building from the large 100-ton perfecting printing presses and the elevators to the drop of the annunciators which summons office boys. Current is not generated in the building, and for a large part of the year there is no steam in the building. In the structure are 109 electric motors with 1,175-horsepower capacity, 2,441 outlets for lights, 257 outlets for telephones, and 246 outlets for other purposes. The lighting system consists of 6,205 incandescents, 15 arc lamps and 26 mercury-vapor lamps. Besides these there are vacuum lamps, glower lamps, searchlights, signs, bulletin service, elevator flash, cigar lighters and a carriage call.

It is calculated that the building will use current, supplied by the New York Edison Company, amounting to more than 500,000 kilowatt-hours per annum. The installation has been divided into three distinct parts—practically that of three buildings. Each part is fed from its own service connection supplied from separate feeding stations of the Edison system. Through the medium of specially designed switches on the main switchboard these sections are made interchangeable, which means practically the triplication of the entire service. The important item in the installation, and therefore receiving the greatest thought and consideration, was that the possibility of interruption of service must be absolutely eliminated.

The switchboard, located in the second sub-basement, is 18 feet long and seven feet 10 inches high. It is made of gray Tennessee marble two inches thick and is divided into three principal panels, each panel being connected with approximately one-third of the building; that is, the various floors are divided nearly equally among the three, as are also the various power circuits. Each of the three panels is controlled by a 2,000-ampere switch. Should any one of these services be cut off through an accident or otherwise the switches can be thrown on to either of the other two services. To obtain the utmost advantage of the duplication of the service a special three-throw kiss switch had to be designed, which can be thrown in three directions, and as these switches are of very large size they constitute an interesting study in themselves. They are arranged on an axis which allows them to be swung from one position to another.

The meters are located where the various services enter the building. Separate meter boards are located at these points with large service switches. From each of these meter boards 10 large cables of 800,000 circular mils capacity carry the current to the main switchboard, where it is distributed. Each of these cables has a diameter of about 1¾ inches of solid copper.

All of the lighting circuits in the building are taken from the top of the board, and each lighting circuit is controlled by a laminated three-pole double-coil type circuit-breaker. These circuit-breakers are so arranged that the neutral and one outside leg may be thrown out together, the remaining leg being independent. By this is secured a combination switch and circuit-breaker instrument.

The power circuits in the building are all taken from the bottom of the board and controlled by double-pole knife switches of a substantial pattern and serviceably constructed.

The instruments on the board are all of the recording type, thus furnishing a complete record of the service to the owners of the building.

There are on the switchboard 25 three-pole circuit-breakers for lighting, which are arranged to feed parts of the building. Separate cables supply the sub-basement, basement, first and second floors. Above the second floor each cable supplies two floors —i. e., the third and fourth are on one cable, fifth and sixth on another, and so on up to the fifteenth floor. The fifteenth and sixteenth floors have each a separate feed. The tower floors are provided with three feeders—one supplying the seventeenth, eighteenth and nineteenth floors, the second, the twentieth, twenty-first and twenty-second floors, and the third the twenty-third floor and observatories.

Fig. 1 is a diagram of the switchboard, which is explained as follows: (1) Two-light brackets; (2) to (26), circuit breakers for service on the various

floors and basements; (27), recording voltmeter; (28), recording ammeters, 500 amperes; (29), 2,000 ampere circuit breaker; (29a), No. 1; (29b), 2,000 ampere recording ammeter; (30), push switch; (30), press switch; (32), fifteenth floor power switch; (33), spare switch; (34), press switches; (35), elevator switches; (36), house pump switches; (37), heating apparatus switches; (38), cardlight switch; (39), six switches for two hoists each; (40), vent fan switch; (41), switch for vent motor at roof; (42), switch for exhaust fan; (43), switch for air compressor; (44), switch for paper dumb-waiter; (45), switches for autoplate machines; (46), switches for plate shaver; (47), switches for tail cutter; (48), switches for machine shop; (49), switches for elevators; (50), switches for motor generator (bells); (51), switch for Kenney vacuum sweeping system; (52), switch for matrix heater; (53), switch for molding machine and steam tables; (54), spare switches; (X), Edison service No. 1; (Y), Edison service No. 2; (Z), Edison service No. 3.

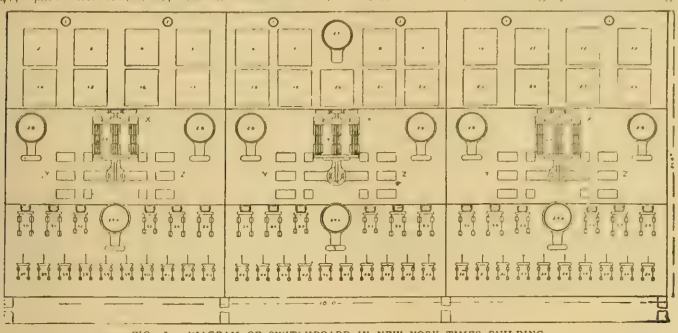


FIG. 1. DIAGRAM OF SWITCHBOARD IN NEW YORK TIMES BUILDING.

In order to supply power for the various bell systems throughout the building there has been installed a motor generator. The motor is run from street current at 220 volts and drives a generator which supplies a low-voltage current suitable for bell work. This motor generator is controlled from a special switchboard located in the motor-generator room. Connected with the motor generator is a storage battery, which supplies a current of similar voltage to the motor generator and which is to be used when the motor generator is shut down. The charging and discharging of the storage battery is controlled through the special motor-generator switchboard mentioned above. This arrangement of generator and storage battery assures the operation of the bell system in a satisfactory manner and entirely does away with the defects due to the local batteries and the consequent trouble and annoyance of charging and cleaning these batteries.

The illumination of the building will attract widespread interest. It will be done by seven kinds of light as follows: Three makes of arc lamp, Edison incandescent lamps, Cooper Hewitt mercury-vapor lamp, Moore vacuum lamps, and Nernst glower lamps. Besides this a cable carries 400 amperes to the top of the tower, where is located one of the largest searchlights in the world. There will be elaborate outside ornamental illumination, but the chief ornamental lighting feature will be the arcades in connection with the subway station.

The Moore vacuum light (Fig. 2), as it is installed in the Times Building basement, consists of a glass tube 100 feet long, which, when in use, has a uniform brilliancy throughout its entire length. The tube has a diameter about the size of one's wrist. It is run near the ceiling and walls, and its general shape conforms to the area lighted. The two ends of the tube extend into a small terminal box, which is supplied with an alternating current. The electricity flows over a minute quantity of a special gas manufactured for this special purpose and contained in the tube. For this light the claim is made that it has perfect color values and that it is artificial daylight, a reproduction of diffused light, which has many characteristics different from artificial light. A 50-foot tube has been operated for 1,800 hours at a commercial brilliancy without any change detectable either in efficiency or color. No lamp renewals are necessary.

The elevators rise to a height of 326 feet and are electrically operated, having all the latest safety devices. Instead of call bells the elevators are fitted with electric lamps placed near the starting lever. These lamps give the proper signal when a button is pressed by a person wishing to use the car.

Four hundred pairs of telephone wires run into the sub-basement. The main cable of the New York Telephone Company under Broadway was tapped at the southeast corner of the Forty-second Street crossing, and from there a special cable was laid into the Times Building's sub-cellar to carry the 800 copper wires. An iron pipe was laid to hold these wires, which are contained in paper-insulated lead-covered cables. In the cellar there is a cross-connecting box from which the wires are run upward through the building in one of the fireproof [illegible] points the ascending wires are tapped for lateral connection with the floor. [illegible] ordered that there may be at least one telephone in every room of the structure from sub-cellar to tower. There are 257 telephone outlets in the building with opportunity for four telephones from each outlet. The group of wires supplying the [illegible] nections are installed so that one group serves the floors from the first to the ninth, another from the tenth to the fifteenth, and a third from the fifteenth upward. All are separate and distinct from lighting and other high-tension wires, and all are protected by fireproof coverings not only in the perpendicular shaft but also as they diverge into the different floors. Each wire into a room is concealed under a cornice or in a partition, so that there are no visible strands to make the rooms or hallways unsightly.

The Western Union's telegraph cable entering the building contains 100 wires. Fifty of these go through fireproof ducts inside the walls to the Times telegraph room. While 24 have been used for the 12 loops of this company, the remaining 13 pairs are ready for immediate connection with instruments if any occasion requires it. The wires are for the exclusive use of the Times, except for two used by the Associated Press in the same room and one for the correspondent of the Philadelphia Public Ledger.

The Postal company has 62 wires running into the sub-cellar. Thirty of them go up to the telegraph room of the Times, and 12 are arranged into six loops ready for six instruments at the start. The sextet table provided by the company is on the opposite side of the room from that of the Western Union, and is equipped with the latest conveniences, including patented extension-arm resonators that may be adjusted in a position several feet away from the table, so that the operators may lean back in their chairs.

A direct wire has been laid by the time-clock

FIG. 2. VACUUM-TUBE LIGHTING IN NEW YORK TIMES BUILDING.

service department of the Western Union Telegraph Company from its headquarters to the Times Building, where it regulates clocks located in the press-room, composing room, stereotype room, news room, publication office and delivery department. At noon each day a signal from the United States Observatory in Washington sets the Western Union's clock. The different clocks in the Times Building will have this direct connection with Washington, and on the stroke of every other hour in the day they will be synchronized from the Western Union headquarters.

The entire wiring of the building has been so arranged that alternating current may be used as well as direct current for the lighting, it being only necessary to change the instruments and circuit-breakers. All wire used throughout the building is of special high-grade rubber-covered make. This wire was tested at a voltage of 5,000 before being installed. Twenty-one miles of conduit run through the building from the main switchboard to the thousands of electrical appliances, through 50 panel boards. Thirty-nine miles of wire carry the current to do its work at 2,248 outlets. From this remarkable electrical community 808 telephone wires [illegible] outside legs together at the switchboard. All of the [illegible]

Owing to the great height of the building it is [illegible] copper [illegible] building [illegible] tenth floors, into which feeder cables are drawn and attached [illegible] the building. The result of this is the removal of all abnormal [illegible] rendered more accessible. Most of the power is in the second sub-basement, and is taken directly from the main switchboard. The remainder of the power is taken from the sixteenth floor, and for this purpose a special feed for the power has been run to the power-panel board, located on the south side of the sixteenth floor. From this board are controlled all of the small machines on the sixteenth floor, these comprising 38 linotype machines, elevator hoist, scorcher, planer and many other devices. The wiring for the various linotype machines runs from the power board to a fused branch block located at each machine, four machines being run on each circuit, but each machine is on a separate fuse located at the machine, thus assuring that trouble with one motor will not interfere with the remaining motors.

The main battery of presses for the Times consists of four octuple Hoe presses which will produce 144,000 papers of 16-page size per hour. There are 12 motors, aggregating 380 horsepower to operate the presses, and eight electric trolley hoists lift the paper rolls into place. The motors are placed beneath the presses, and operation is by push buttons. The Kohler system is used. There are 12 push buttons on each press at convenient points. At each station there is a safety switch which protects the pressman against the sudden starting of the machine. If he pushes that switch to "safe" he locks the press so that no one can move any part of the machine until that particular switch has been turned to "run" position.

By the use of the mercury-vapor lamp all wiring on the presses was avoided. In fact, there are no lights attached to a press except in the pits, where 28 incandescent lamps were installed—seven in each pit, including one portable lamp with wire guard. Over the four presses, as well as suspended in the space between them, are 22 of the vapor lamps. Light penetrates every corner, high or low. The four lights in the stereotyping room make it easy to see each minute contrivance of the wonderful autoplates or plate-casting machines.

Besides the principal electrical features mentioned herewith, there are many others which are of interest, such as the electrical cooking outfit in the restaurant, the equipment for the barber shops and dental offices, press signals, ventilation, controllers for autoplates, etc.

## Municipal Lighting in New York Advocated by Mayor McClellan.

Mayor McClellan, in his New Years message to the Board of Aldermen, advocates the establishment of a municipal lighting plant, not primarily because he is personally in favor of public ownership, but on account of the peculiar local circumstances of the situation in respect to deficient service and lack of competition. He pointed out that the city had the advantage in the option of using many existing conduits free of charge. Last week the mayor introduced at Albany a measure embodying his ideas. Major Woodbury, the street-cleaning commissioner, has reported on the utilization of city refuse for generating purposes, and he makes the astonishing estimate that the city's refuse, which exceeds 5,500 tons a day, would suffice, as fuel, to produce three times as much electrical energy as is needed for street lighting. He contends that there is a large percentage of carbon in the New York refuse.

The lighting question is also being pursued in other directions. A resolution is being prepared for presentation at Albany demanding an investigation into the cost of city lighting, and Comptroller Grout is again calling upon the officials of the lighting companies to reveal details of the cost of gas and electricity. To this end, also, he has arranged for the attendance in New York city of electrical experts from several other cities, including Edward B. Ellicott, city electrician of Chicago. The local companies are being attacked by W. R. Hearst, as well as by a number of bodies of taxpayers.

The Norwegian steamer Atlas reported recently that on her trip up the coast from the West Indies the beam of electric light that is thrown skyward from the deck of the Diamond Shoals lightship was visible for 24 miles. The longest distance previously reported at which the beam was seen is 21 miles.

## Ohio Telephone Notes.

J. B. Hoge of Cleveland, president of the National Independent Telephone Association, takes a very encouraging view of the telephone situation this year. All the large companies in the country made good gains in both the number of new instruments installed and the amount of income. The long-distance companies have completed several lines that were partially constructed and other entirely new ones have been built. This enabled them to increase their income and gave the local companies a better opportunity to originate long-distance business. Many companies have readjusted their rates and are now in a better position to make fair profits. Traffic arrangements have been completed among the long-distance companies and a system of standardizing equipment, rules and accounting has been inaugurated. Failures were fewer in 1904 than the year before. As an evidence of the belief that the movement is on a permanent footing many of the companies are preparing to erect their own buildings.

An agreement has been entered into by the Citizens' Telephone Company of Batavia and the Thomas J. Donald Telephone Company of Felicity for free connections. Half a dozen towns are thus brought into communication without extra cost to the subscribers.

An increase of capital stock from $75,000 to $100,000 has been made by the Belmont Telephone Company of Bridgeport.

T. P. Cagwin of the Bell telephone interests says that the growth of the Bell business in the state has been enormous within the last year. He is especially gratified over the extension of the system to the rural communities and the use of private systems in the hotels of the large cities.

D. C. Miller, V. E. Weaver, G. C. Smith and others have incorporated the New Lebanon Telephone Company of New Lebanon, with a capital stock of $10,000.

A system of telephones will be established by the Cleveland and Pittsburg railway. Between Salineville and Cleveland telephones have already been placed at the ends of the sidings, with wires to the nearest telegraph office. In this way the trainmen may secure communication with Cleveland or any of the stations without trouble and receive orders where there are no telegraph offices.

It is reported that the Hocking Valley railroad has entered into a contact with the Bell telephone company to string a long-distance wire on its poles from Toledo south through Columbus to the river. All the larger stations will be connected with this line and arrangements will be made so that the trainmen may use it to advantage.

The plant of the Collinwood Telephone Company, together with the bonded indebtedness, has been taken over by the Cuyahoga Telephone Company of Cleveland and made a part of its system. The rates will be adjusted to conform to city rates and Collinwood people will get the benefit of the city service.

The Catlettsburg and Ashland Telephone Company, whose lines connect Catlettsburg and Ashland, Ky., has sold its properties to the Southern Bell Telephone Company and the connection will be made in a short time.

It is reported that the Bell interests have abandoned their attempt to purchase and merge the companies about Lima. The owners of the plants at St. Marys and some other towns in that section refused to sell and this so disarranged matters that it would have been little use to take over those that were willing to go.

The Rome Telephone Company of Rome has been incorporated, with a capital stock of $2,000, by S. R. Reeve, A. G. Reynolds and others.

Raymond E. Mattison has accepted the management of the contract and business departments of a company at Lincoln, Neb. He was for three years a special agent of the Cuyahoga Telephone Company of Cleveland. C.

## Telephone News from the Northwest.

The Red Wing (Minn.) Telephone Company has filed articles of incorporation with $150,000 capital. D. M. Neill of Red Wing and E. H. Moulton of Minneapolis, the latter of the Tri-state Telephone and Telegraph Company, are among the incorporators.

The Dakota Central Telephone Company has bought the Western Farm Mortgage Building in Aberdeen, S. D., and will remodel it for its business. The building is three stories high, of brick.

A stock company is being formed in Minnesota Lake, Minn., to install a local exchange and connect with the Northwestern Telephone Exchange Company's long-distance lines.

DeSmet, S. D., has a growing telephone exchange and a larger switchboard will soon be necessary.

The recent change in ownership and reorganization of the Mississippi Valley Telephone Company has resulted in litigation of considerable magnitude. J. C. Hubinger has filed a suit in equity against S. S. Thorpe, J. E. Andrus and Thomas Peebles, asking for an accounting and judgment for $225,000.

J. W. Sherrick has sold his interests in the telephone business at Pine City, Minn., to R. B., W. R. and H. O. Sherrick.

Application has been made for a receiver for the new Citizens' Telephone Company at Sioux Falls, S. D., by F. L. Bills, the heaviest bondholder. Steps are being taken toward a settlement of the differences out of court.

The Tri-state Telephone Company proposes condemnation proceedings at Fargo, N. D., in order to procure a right-of-way through the city for its long-distance line to Grand Forks.

Judge Dibell at Moorhead, Minn., has dissolved the temporary injunction restraining the Tri-state Telephone Company from stringing its wires across the streets of the city. The company arranged for a right-of-way with the Great Northern railroad, but the city held that the wires could not be strung across the streets, although the poles could be set on the railroad property.

The North Star Telephone Company of Comfrey, Minn., will build lines from Mountain Lake, Minn., to Delft, Bergen and Odin; from Butterfield to Darfur and from Darfur into the country.

The Midland Telephone Company has been voted a franchise at Spirit Lake, Iowa.

The Bell Telephone Company will seek admission to Earlham, Iowa. R.

## Indiana Telephone Items.

The city administration of Evansville has decided not to enter into any terms of settlement of the telephone question, but will wait and abide the decision of the Federal Court. The city officials say they are satisfied with the situation, having disproved the claim of the Cumberland company to an alleged perpetual franchise.

The Princeton Telephone Company has ordered plans for a new exchange building two stories high, of brick and stone. The new building will be installed with an additional switchboard and other modern facilities. The company has recently inaugurated a long-distance service with Vincennes and many other cities of Indiana, Illinois, Ohio and Kentucky.

The Majenica Telephone Company is preparing to establish an exchange at Mt. Ætna, the oldest town in Huntington County.

J. K. Johnson, formerly of Louisville, Ky., and a few business associates have leased the plants of the Home Telephone Company, comprising the big exchanges at Goshen and Elkhart and smaller systems at New Paris, Wakarusa and Middlebury. The Home Telephone Company is headed by Messrs. Braley and Barber of Cleveland, who have large telephone interests in Kansas City and other western cities.

Coroner S. M. Voris holds the city of Columbus responsible for the death of John Weed, who was killed recently while attempting to use his telephone, a live wire being permitted to remain on one of the city poles and coming in contact with the telephone wire.

The Spiceland Co-operative Telephone Company is seeking a franchise in Rushville to compete with the local company.

Albert W. Hammer of New Castle has received word from the Patent Office that his application for a patent on a party-line telephone device, submitted some time ago, has been favorably passed upon. The apparatus is designed to prevent the eavesdropping nuisance on party lines. It is understood that an offer of $50,000 has been made for the exclusive right to the patent. Mr. Hammer is a business man in New Castle.

The Macy Telephone Company has increased its capital stock from $2,000 to $10,000. Extensive improvements will be made in the plant. T. Y. Savage is president and E. B. Sutton, secretary.

The Crawford County Telephone Company has filed articles of incorporation. The capital stock is $2,000. The company will construct and operate telephone lines in Crawford and Orange counties, with the principal exchange in Wickleffe. J. T. Zimmerman is president and George W. Flick secretary. S.

## Telephone Fish-shoal Signal.

Under date of November 7, 1904, United States Consul E. Theophilus Liefeld, of Freiburg, Germany, reports that a German patent has been taken out for an electrical apparatus whereby the presence and extent of shoals of fish can be ascertained. A microphone, inclosed in a water-tight case, connected with an electric battery and telephone, is lowered into the water. So long as the telephone hangs free no sound is heard, but on its coming into contact with a shoal of fish, the constant tapping of the fish against the microphone case produces a series of sounds which at once betrays their presence. The rope attached to the microphone is marked, so that the exact depth of the shoal is at once ascertained.

Some sensation has been caused in German medical circles by the announcement in the Clinische Wochenschrift that Dr. Cohn, the celebrated oculist, has succeeded in curing ophthalmia by means of radium. A quantity of radium salt weighing one milligram was inclosed in a glass tube and passed over the eyes of a patient during a period of from 10 to 15 minutes. Three cases are reported as being absolutely cured.

## GENERAL TELEPHONE NEWS.

The Dodge City (Kan.) Telephone Company is extending its line to Bucklin, Kan.

The Central Telephone Company of Broken Bow, Neb., has increased its capital stock to $100,000.

The Windom (Kan.) Rural Telephone Company has been incorporated with a capital stock of $2,000.

The Ash Valley Telephone Company of Larned, Kan., has been incorporated with a capital stock of $2,000.

With a capital of $2,000, the Stockton and Sugar Leaf Telephone Company of Stockton, Kan., has just been incorporated.

The Pacific States Telephone and Telegraph Company will begin work in the spring on a new line from Lind, Wash., to Pasco.

The Pioneer Telephone and Telegraph Company has announced that it will put in a new telephone system at Tulsa, I. T., with a switchboard capacity of 2,200 telephones.

The Independence Telephone Company is preparing to incorporate at Independence, Ore. The capital stock will be $10,000. J. R. Craven is chairman of the board of directors.

The Michigan State Telephone Company has secured a right-of-way from Manistique to Rapid River and the work of construction of the new line will be begun shortly.

Mr. F. C. Toepleman, general manager of the Home Telephone and Telegraph Company, Henderson, N. C., recently received from the employes of the entire system a fine leather-covered easy chair.

The Home Telephone Company of Louisville, Ky., is reported to have secured an option on the People's Independent Telephone Company of Paducah, Ky. It is also stated that the Home company will enter the Paducah section of the state.

At the annual meeting of the Christian Co-operative Telephone Association, at Sunnyside, Wash., the question of extending the line to North Yakima, Wash., was discussed, and A. C. Webber appointed to take the matter up with the residents along the proposed line.

The Mexican government has declared forfeited the concession which was held by J. Woessner of Saltillo, Mexico, for the construction and operation of a system of long-distance telephone lines in northern Mexico. A part of the system was constructed and is in operation.

A recent report states that the Chicago Telephone Company gained 1,520 new subscribers during the month of December. The gain for the year was 16,547 telephones, making an average increase of 1,379 instruments per month. The company now has in service in city and country 117,734 telephones.

T. F. Maguire, general manager of the Mexican Telephone Company, says that the work of placing the telephone cables in the City of Mexico underground will be commenced some time this month. It is stated that the plan of the proposed underground system calls for an ultimate accommodation of 10,000 subscribers. A new switchboard will be installed in the company's headquarters on Calle del Arco de San Agustin, where its entire central plant was recently placed. The switchboard at present in this building is only temporary and will be shipped back to Chicago, where it was obtained, as soon as arrangements have been made for the installation of the new one.

The American Electric Telephone Company of Chicago reports a brisk demand for private branch-exchange switchboards. Four equipments of this kind have recently been shipped to Topeka, Kan., and one equipment to Fort Worth, Texas. Among recent shipments of 100-line exchange switchboards of the magneto type the following destinations are given: Lebanon, Ind.; Berne, Ind.; Atkins, Ark.; Brookville, Kan.; Hamilton, Ga.; Tallahassee, Fla., and Waverly, Ill. The American company has recently shipped an additional section of central-energy switchboard equipment to Jackson, Tenn. The Jackson exchange now has an immediate capacity for 1,260 lines, which represents a 50-per cent. increase over the original installation.

Judges Lurton, Severns and Richards of the United States Circuit Court of Appeals of Cincinnati handed down their opinion on January 3d in the case of the Western Electric Company of Chicago, complainant, vs. the North Electric Company of Cleveland, in favor of the complainant. The case was brought up from the United States Circuit Court of Cleveland, where it had been dismissed by Judge Wing. The suit involved three patents of the Western Electric Company on spring jacks, Nos. 357,538 and 552,729, by Scribner and 488,033 by Scribner and Warner, and in the opinion of the judges these were held infringed by the defendant. Barton & Tanner of Chicago were attorneys for the complainant and A. L. Lawrence of Cleveland for the defendant.

### Philadelphia-New York Electric-railway Project.

The 88 miles between New York and Philadelphia might be known as the "trial track," inasmuch as it has been a sort of proving ground for methods for the annihilation of space from the days of road coaching until the present time. Upon this path the practicability of the relay stage-coach system was demonstrated. Over it Col. Robert L. Stevens constructed one of the earliest steam railroads in 1832 and the first paying electric-telegraph system was operated over this same 88 miles, as was also the first long-distance telephone line connecting large cities. At one terminus of the "trial track" there is now a city of over 3,000,000 inhabitants and at the other one of approximately 1,300,000, with large cities scattered between. Two steam railroads are now carrying yearly 1,500,000 round-trip passengers between New York and Philadelphia, and still the traffic demands are not adequately met.

With the completion of the electric-railway tunnel under the North River at New York another demonstration of the utility of the "trial track" will be made, and it is declared that an electric railway direct between the cities named will be in operation —the New York and Philadelphia Electric Railway. It is hoped that 1,000,000 round trips per annum between the termini of the electric line will be made by its patrons, and though some of this will undoubtedly be traffic diverted from the steam roads, much of it will also be new traffic originated by reduced rates. Much interest attaches to the completion of this road, which, when accomplished, will be the shortest electric line in the world connecting two cities of such magnitude.

### Space Telegraphy for Train Service.

A report is current that the New York Central and Lake Shore railroads are about to establish space-telegraph service for sending and receiving messages from the trains. Preliminary tests have been made and President Newman is said to be satisfied that the scheme will prove practicable.

To provide communication at will with trains in motion is only part of the plan. Experiments have been made with the present automatic block signals in combination with the equipment for space telegraphy, whereby signals of danger have been given in the engine cab. It is believed this system of double warning to engineers will be a valuable safeguard against accidents. There is now in use on some railroads a cab-signal system which notifies an engineer whether the track ahead of him for a certain distance is clear or occupied by another train. The new system is said to be an improvement on the system now in use.

Another object in installing the space-telegraph system is to be independent of the present telegraph system. Storms which blow down telegraph poles cause immense loss to the railroads by delaying train service and increase the risk of accident.

In order to have telegraphic communication with the limited trains, the Lake Shore and New York Central will require tower stations located probably about 200 miles apart. The latest experiments have demonstrated that it is not necessary to have the towers so high and as near together as was formerly believed. Experts now incline to the belief that eventually towers will not be required at all.

### "Mythical Plans and Absurd Inventions."

A Chicago judge recently appointed a receiver for the Whitney Electrical Company, which is capitalized for $56,000,000, to promote the alleged inventions of Albert Gallatin Whitney. The petitioners allege the assets principally consist of "mythical plans and absurd inventions." One of the inventions, it was alleged, consists in "Ejecting or shooting above and beyond the atmosphere of the planet, commonly known as the earth, four brass balls, which are supposed to gently and peaceably remain beyond said atmosphere after once having been shot or thrown up there."

This appears to be the last chapter in the history of a freakish plan for drawing electricity from the upper regions of the atmosphere for power purposes, which attracted the attention of followers of "newspaper science" some time ago.

Edison Light of Boston tells a rather amusing story of a man from that city who, in New York, noticed in a store window a gas stove that kept lighting up and going out, thereby attracting attention. The spectator also noticed that while the gas stove was lighted it did not flicker as gas usually does. Then he found out that the gas stove was not a real gas stove, but an imitation one with a bank of electric lights concealed inside of it.

## CORRESPONDENCE.

### New York.

New York city, January 7.—It is announced that the extension of the subway along Lower Broadway will be opened for traffic on Wednesday next as far south as Fulton Street. Only two tracks will be in operation.

William Barclay Parsons has been retained as chief consulting engineer of the New York, Westchester and Boston railway, which has a franchise for an electric line which is practically a northern extension of the existing subway. This is taken to mean that the Westchester and Interborough people are now hand in glove, and that the Interborough company will have a much stronger reason for bidding for an east-side subway. Another appointment relating to the same project is that of William A. Plait, formerly chief engineer of the Staten Island Rapid Transit Company, who is to be chief engineer for two years to the Westchester company.

The New York City Interborough Railway Company announces a plan for a subway from the One-hundred-and-eighty-first Street station of the Interborough Rapid Transit Company's subway, to proceed northward, and cross the Washington Bridge into the Bronx. The company, which is a part of the Belmont syndicate, has this week placed some of its men on the directorate of the Union Railway Company, which holds at present a monopoly of the Bronx surface traffic. This circumstance makes the coming struggle interesting, for it has hitherto been conceded that there was an intimate understanding between the Union and Metropolitan companies.

The first through car from Manhattan to Brooklyn crossed the Williamsburg Bridge last Saturday with officials of the Metropolitan Street Railway Company on board. Brooklyn Rapid Transit cars have been running from Brooklyn to Manhattan for several weeks, and at the rush hours they are relatively as crowded as those over the older bridge.

Electrical contractors outside the Building Trades Employers' Association have organized as the Independent Electrical Contractors' Association. The president of the new body is J. T. Whitehead, with M. F. Fleck, secretary. These contractors will employ the members of Electrical Workers' Union No. 3, which is now locked out by the Electrical Contractors' Association.

The new building of the National Park Bank at 214 Broadway, will have a very complete electric equipment. The ventilation of the building will be accomplished by means of a blower in the basement driven by a 20-horsepower motor at 150 revolutions a minute. The cleaning of the building will be done on the vacuum system by means of a vacuum pump driven by a 10-horsepower motor.

Specifications call for nearly 18,000 incandescent lamps, and motors aggregating 200 horsepower, for the Hippodrome Building which Thompson & Dundy are putting up on the entire block between Forty-third and Forty-fourth Streets and Sixth Avenue. When finished this will be the largest amusement building in the city.

An electric hoist worked by a 24-horsepower motor and used during the erection of a new building at 37 Liberty Street, lifts 1,800 pounds at the rate of 150 feet per minute. It is claimed to be operated at a cost one-third that of a steam hoist of equal capacity.

The Westinghouse company has just delivered to John Wanamaker two 300-kilowatt direct-current generators as part of the electrical equipment of the new Wanamaker store at Broadway and Ninth Street.

The New York Edison Company has recently organized a special department to deal with orders for electric heating and cooking apparatus, for which there is a growing demand.

The Seaboard Electric Equipment Company of New York city was incorporated on December 31st at Albany with a capital of $50,000. The directors are S. B. Smith, New York; D. H. Patton and D. G. Patton of Yonkers. D. W. W.

### Dominion of Canada.

Ottawa, Ont., January 7.—At the civic elections, held on January 2d, the property owners of the city of Ottawa rejected the proposal to purchase the Ottawa Electric street railway for the sum of $3,000,000. Only about 25 per cent. voted in favor of the proposition.

The receipts of the Toronto Electric Street Railway Company for the year 1904 amounted to $2,411,747. This shows an increase of $257,306 over the total receipts for 1903, and an increase of $599,091 over 1902.

The Grand Trunk Railway Company is again considering the installation of electric motors in Sarnia tunnel, according to information given the Dominion Railway Commission by Mr. McGuigan. The proposed change will necessitate an outlay of between $300,000 and $400,000. There will be required a power plant, storage system, third rail and four electric motors.

The Marconi Wireless Telegraph Company has been awarded a contract by the Dominion government to erect new stations, one at Whittle Rock, on the coast of Labrador, and one at Point Rich, Newfoundland, and it is expected that this new plant will prove successful.

A. P. Caron, C. B. Powell, E. B. Eddy and others [illegible] mingue, near the terminus of the Canadian Pacific [illegible]

An important Canadian electrical trust scheme now mooted in Ottawa, contemplates the amalgamation of [illegible] interests, operating in the Ottawa district. The joint capitalization of the companies to pool their interests approaches $10,000,000. The names of the companies mentioned as likely to form the combine are the Ottawa Electric Company, Ottawa Electric railway, Consumers' Electric Company, Hull Electric Company, the Hull electric street railway, the Capital Power Company of Deschene and the Hull and Ottawa power companies. It is the matter of waterpower that will make the proposed merger an economic move for all concerned, as the scheme involves the development of the waterpower of the Chaudiere. It has been noted of late that competition between these organizations has suddenly become divested of its keenness. The initial step toward amalgamation was taken last session of the Dominion Parliament, when the Ottawa Electric Company sought authority to acquire other electric companies. Its bill was opposed by the city of Ottawa and failed, but at the present session of Parliament this application is to be renewed, and will probably pass.

The Montreal street railway has arranged for the expenditure of $500,000 during the year 1905, in securing and distributing additional electrical power and making improvements over its system. An important project, which will greatly improve the company's power facilities, calls for the erection of three sub-stations at different terminals of the system. Each sub-station will have 1,000 horsepower, thus enabling the company to put any number of cars on all parts of its system at any time during the day.

A project which will ultimately revolutionize manufacturing in Ontario is the marketing of Niagara electric energy. The plans of the Toronto and Niagara company contemplate the delivery of power in Toronto during the last months of 1905. The circulars announcing the sale of this company's bonds stated that satisfactory contracts had been made with the Toronto Railway Company and the Toronto Electric Light Company, which companies have, however, recently added to their plants and will, therefore, not be so urgent in pressing for an early completion of the Niagara company's plant. The changes in plants, which will be necessary, are expected to furnish an extensive demand for electrical appliances. New manufacturing industries are projected for the Niagara district and all along the line of the supply of energy. W.

### New England.

Boston, January 7.—Under the terms of the renewed lease of the property in Head Place, off Boylston Street, this city, occupied by the Edison Electric Illuminating Company of Boston, an eventual sale of the property to the corporation is contemplated. The new lease just filed at the registry of deeds stipulates that the company may, on three months' notice, obtain title to the estate, valued by the assessors at $200,000, by paying $180,000 therefor, or purchase it at the expiration of the new lease, which has five years to run at $7,200 rental annually.

The annual report of the Boston Elevated Railway Company has pleased the stockholders better than the reports of many of the other street-railway properties of this state in which some of them are interested. It shows a well-sustained earning power, excellent management and good prospects. The annual meeting was held on Monday, January 2d, in this city. The board of directors was re-elected, as follows: Frederick Ayer, William A. Bancroft, John J. Bright, Samuel Carr, T. Jefferson Coolidge, Jr., Francis H. Peabody, James Phillips, Jr., James M. Prendergast, Nehemiah W. Rice, Quincy A. Shaw, Jr., William S. Spaulding, Walter S. Swan, Robert Winsor. During the year it was determined to extend the elevated structure from the present terminus on Washington Street, near Guild Street, to Forest Hills. The increase in the total number of revenue passengers for the entire system was about 3½ per cent., as against an increase of five per cent. for the previous year. The operation of the elevated lines was continued with good success. As against a 3½ per cent. increase in total revenue passengers, the receipts at main-line elevated stations, exclusive of subway, increased 9.1 per cent. and at Atlantic Avenue elevated stations 17 per cent. The

receipts at subway stations for elevated service alone increased 7.2 per cent. The extension of the surface tracks amounted to 1.918 miles. The total length of surface tracks controlled by the company, including that leased from the Old Colony Street Railway Company, is now 428.811 miles. This, with the elevated mileage of over 16 miles, makes a total mileage of 444.826 miles. It has added to its equipment during the year 61 surface cars and 24 elevated cars. The gross earnings from operation was $12,391,353, and the operating expenses $8,631,553. The surplus for the year, after paying dividends, taxes, rentals, interest, etc., was $31,772.

The Boston Young Men's Christian Association, which surprised people a while ago by securing the right from the state to confer degrees upon students taking the association's law course, substantially as the colleges are permitted to confer them, has started on another innovation. The School of Applied Electricity is its title, and William L. Puffer of the Massachusetts Institute of Technology, which has its principal buildings right across the street from the association building, is at the head of the school. The term opens January 10th.

Negotiations are under way for the sale of the Medway Electric Light and Power Company's plant to the Medfield Light and Power Company. The mill privilege of the Medway company has been sold, and light and power for Medway will at once be obtained from the adjoining municipality of Medfield.

Judge Shumway of the Superior Court of Connecticut has granted a petition of the East Lyme Street Railway Company for a change of name to New London and East Lyme Street Railway Company. The road is to run between the two places via Waterford and Niantic. B.

## Ohio.

Cleveland, January 7.—A proposition has been submitted to a number of the Ohio traction lines by H. N. Rockwell of Massachusetts for the organization of a central bureau to handle accident claims. It has been considered by the officials of a number of lines and may be given a trial. The plan is to have each of the roads pay into the bureau each quarter 3½ per cent. of its estimated earnings, and from this amount all claims are to be settled. In the case of a particularly heavy accident the bureau may call for 1½ per cent. additional, but no more. Most of the roads now set apart three per cent. for this purpose, and the operation of the bureau would require but little more. Some of them have been able to accumulate quite a fund in this way, while others have used most of it.

Officials of the Cleveland Electric Railway Company have been conducting car-heating experimenting with stoves that will throw out a large amount of heat through a funnel that runs to the top of the car from a Russian-iron covering, and from there it is evenly distributed over the car. It is said all the cars will be equipped with this style of stoves before next winter.

The Springfield and Xenia Railway Company is the new name of the Springfield and Xenia traction line that was recently purchased on foreclosure sale by the bondholders in Cleveland and other financiers.

Edward Hobson of Flushing is interested in a proposed traction line that will connect Canton and Barton, connecting at the latter point with the line from Wheeling, W. Va. The new line will pass through Canal Dover, New Philadelphia, Uhrichsville and a number of other good towns.

The bid of the Cleveland Electric Illuminating Company for furnishing the arc lighting for the city this year is $73.56, or $1.44 per lamp less than last year.

The Marshall Electric Company of Cincinnati has been incorporated with a capital stock of $15,000 by W. L. Kerlin, F. L. Hoffman and others.

The first car from Dayton to Indianapolis made the initial trip a few days ago over the Dayton and Western and the Indianapolis lines. Officers of the companies made the trip and are satisfied with the prospects.

Arrangements are being made by the Northern Ohio Traction and Light Company and the Canton-Akron Company to inaugurate a through Cleveland-Canton service, the cars stopping only at Akron.

There is some probability that the Miami and Erie Canal Transportation property will be sold within a short time and the bondholders will probably purchase it. Claims represented by H. R. Probasco have been settled and he has resigned as counsel for the Cincinnati, Hamilton and Dayton Railway Company.

Fire destroyed the car barns of the Cleveland and Southwestern electric railway at Elyria last Wednesday afternoon, with a loss of about $3,000. Several cars were saved by the barn crew. J. W. Guileman, a motorman, who was asleep in the barn, was badly burned before the others succeeded in getting him out.

John Sherwin and associates have purchased the Washington, Baltimore and Annapolis traction property, which has been partially completed between Washington and Baltimore. The road was promoted by W. H. Lamprecht, Fred T. Pomeroy, Will Christy and others of Cleveland. The deal includes the Washington, Berwyn and Laurel and a steam road that was to be used in connection with it. A company with a capital stock of $3,000,000 will be organized and $3,000,000 bonds will be issued, a part of the proceeds to be used in completing the road and the remainder to be paid to those holding claims and bonds against the various properties.

It is reported that several southern cities have made a bid on the Jewett carworks at Newark and they may be moved if the inducements are great enough. The company received a bonus when the shops were located at Newark and have remained there five years, according to agreement.

The Western Ohio is now selling through and round-trip tickets to Indianapolis by way of its own line, the Dayton and Troy and the Dayton and Western. The trip can be made from Lima with one change of cars.

E. S. Nichols, receiver of the Sandusky Southwestern, has filed a petition in Common Pleas Court asking that an order of sale of the property be issued. A list of claims amounting to $41,000 has been filed. The company owns the roadbed and right-of-way from Wapakoneta to Kenton and from Lima to Bellefontaine, with franchises in several towns.

Promoters of the proposed Canton and Youngstown road have decided to equip it for handling both passengers and freight. Private right-of-way will be used and it is said that active work will begin in the spring. Cars will be run into Toledo over the new entrance line by the Toledo, Bowling Green and Southern within a few days. O. M. C.

## Indiana.

Indianapolis, January 7.—With the interurban electric railways of Indiana the year just closed was one of unexampled prosperity. While the number of new lines placed in operation during the year was not large, the development of the public's inclination to travel on electric lines was remarkable. During the year 1903 2,347,936 passengers were carried into and out of Indianapolis in interurban cars, and this number was increased to 3,500,000 during 1904. Other parts of the state showed proportional growth in the traffic of electric lines. Over 300 cars are now passing daily through the new interurban station and transport passengers over 800 miles of electric railway in Indiana. Important traffic agreements have been made between the Indiana and Ohio interurban lines and through interchangeable mileage tickets are being used with popular success. A number of new lines are being projected and several are nearing completion. The outlook for the present year is very bright.

The Terre Haute and Indiana Southern Railway Company, with a capital stock of $1,500,000, has been chartered to construct and operate an electric line through Vigo, Clay and Sullivan counties, connecting Terre Haute and Jasonville and numerous intermediate towns and cities, and to distribute and supply electricity to persons, firms and corporations for private and public lighting and power. W. H. Schott, Job Freeman, W. H. Crowder and J. R. Riggs are the incorporators.

The Central Electric Traction Company of Indiana has been incorporated, with principal office in Peru. The capital stock is $25,000. The company's declared object is to build and operate an electric line through Miami, Fulton, Marshall and St. Joseph counties, connecting Peru and Rochester and intermediate towns. J. O. Cole, Jerome Herff and H. F. Masters are the incorporators.

The Indianapolis Board of Public Works has imposed the following conditions on the Indianapolis, New Castle and Toledo Electric Traction Company, which is seeking a franchise for an independent entrance to Indianapolis: Contribute $5,000 for grade separation; $500 a year tax for use of streets; furnish eight lights of 125 candlepower; accept regular street-car tickets and furnish transfers to all parts of the city; erect a freight station; stop cars at all crossings for local passengers and construct 15 miles of track from the city outward within 18 months.

The commissioners of Huntington County have granted a franchise to the Interstate Interurban Company, which proposes to build an electric railway to connect Marion, Ind., and Lima, Ohio. The company obligates the completion and operation of the line in two years.

The Rushville City Council refused to grant the Indianapolis and Cincinnati Traction Company an extension of time to February 28th to complete its line under the franchise. To avoid forfeiture, General Manager Henry is running a car through the city every two hours. The new car is the center of attraction.

C. G. Conn of Elkhart, builder and promoter of the Elkhart City Electric Company, has filed a mortgage on all his property in favor of the Western Trust and Savings Bank as surety for a bond issue. Mr. Conn organized his company to oppose the St. Joseph Power and Electric Company and the electric combine of Northern Indiana. While he has been successful, it has proved a very expensive experience.

Two new electric companies have incorporated. The Maier-Oliphant Electric Company of Indianapolis will establish a plant to do all kinds of electrical and mechanical construction, with Frank L. Maier as president. The Tritt Electric Company of South Bend proposes to manufacture automobiles and electric specialties of all kinds. B. E. Tritt, A. M. Calvert and W. B. Pershing are the incorporators.

The friends of the municipal lighting plant at Richmond are greatly encouraged over the December report. The company has had the street lighting since July. For a few months the plant ran behind, but during December the income exceeded the expense by $1,000. It is now believed that the municipal plant will turn $1,000 into the city treasury every month. S. S.

## Northwestern States.

Minneapolis, January 7.—A special election will be held at Escanaba, Mich., to decide whether or not to sell the municipal electric-light plant. The plant cost $70,000, but its value is said to have depreciated.

The North Dakota association of electricians has had a bill prepared which will be presented to the Legislature to establish rules and regulations governing electric-light wiring and insulations.

A new ordinance has been proposed at Burlington, Iowa, providing for the placing of all wires in the business section underground within three years.

Dr. E. C. Swarthout has filed an application for an electric-light and power franchise at La Crosse, Wis. This is the second application within a month for a franchise to compete against the La Crosse Gas and Electric Company.

A new engine and dynamo has been installed in the electric-light plant at Princeton, Minn.

The Cadott (Wis.) Light and Power Company has been incorporated by R. B. Cunningham and others with a capitalization of $4,000.

The Galena (Ill.) Iron Works has received the contract for an electric-light plant at Cassville, Wis. The new plant will cost $4,110.

J. J. Henry of Denver, Colo., has purchased the Black Hills Electric Light Company's plant at Deadwood, S. D., and the Belt Light and Power Company of Lead, S. D. He will consolidate the two under the name of the Black Hills Electric Light and Power Company and will enlarge the system at a cost of $250,000. It is the intention to furnish power for the different mining companies in the district.

A franchise may be granted at South St. Paul, Minn., to the Twin City Suburban Railway Company. The question of electric lighting will also be taken up shortly by the council.

The Minnesota Power and Trolley Company has been granted a franchise at Minneapolis for furnishing electric light and power. The proposition was fought hard by the Minneapolis General Electric Company, which has operated in the city for many years. The city has the right of purchase after 10 years and a bond of $25,000 is required. Within a year $200,000 must be expended and 5,000 horsepower must be available by November 1, 1907. R.

## Mexico.

City of Mexico, January 5.—The work of constructing the new electric-railway system at Guaymas, Mexico, has been commenced.

An American syndicate has obtained a franchise to establish an electric-light and power plant in the town of Fresnillo, Mexico.

Local citizens have taken steps toward the construction of a street railway from the town of Santa Rosalia, Mexico, to the hot springs, a distance of three miles. Paul Ginther of Santa Rosalia is interested in the project.

H. W. Campbell, general manager of the Columbia River and Northern Railway and Steamship Company of Portland, Ore., has been making an investigation of the waterpower afforded by the different streams of Mexico, with the view of establishing electric power plants and manufacturing concerns.

Negotiations which were in progress between a company which proposed to establish an electric-light plant at Progreso, Mexico, and the City Council for lighting the city streets have fallen through. It is stated that the company's rates were too high and that it produced no funds to guarantee the fulfillment of its obligations.

The owners of the San Ildefonso woolen factory, situated near Tlanepantla, Mexico, have applied to the Mexican government for a concession to establish an additional power plant for the operation of its factory. The factory and the Monte Alto railroad are owned by the San Ildefonso Manufacturing Company, which has a capital stock of $3,000,000. H.

## Pacific Slope.

San Francisco, January 6.—A new fire-alarm and police system is to be installed at Sacramento soon.

C. Steger and C. T. Tuttle have opened an electric-supply store at Bakersfield, Cal.

The A. J. Coffee Company is to install a fire-alarm system at Berkeley, Cal., for $1,200.

An electric supply store has been opened at Santa Barbara, Cal., by Bradbury & Howard.

The California Gas and Electric Corporation is reinsulating its power line between Santa Rosa and Napa and hopes to complete the work before the heavy rains set in.

The North Mountain Power Company has the concrete foundations laid for its power house at

Eureka, Cal., and has the engines ready to be put in place.

The electric elevators for the building in course of erection at 576 Mission Street, San Francisco, are being installed by the Moline Elevator Company, of which J. G. Pettitt, 33 Beale Street, is the local agent.

The National Park Electric Power Company has been incorporated at San Jose, Cal., by M. E. Page, W. H. Baugh, G. P. Bull and others. The capital stock is $250,000. The principal place of business is San Jose.

It is understood that the Fortuna Electric Light Company of Fortuna, Cal., will run a wire to Loleta, where it will connect with a line from Eureka by the North Mountain Power Company.

Ninemire & Morgan have applied to the City Council of Aberdeen, Wash., for a franchise to construct and operate an electric-light plant for a period of 15 years.

The County Commissioners of Thurston County, Wash., have granted a franchise to the Olympia Light and Power Company to operate an electric railway over certain portions of Thurston County, providing certain conditions are fulfilled.

L. V. Brewer has turned over the franchise recently granted him by the City Council of Seattle, Wash., to the Seattle Electric Company, which will run a service line into the city and make extensions all over the city. The company is to furnish 2,500 16-candlepower lights within 60 days.

The Pacific Hardware and Steel Company, which is erecting two huge warehouse buildings at Townsend and Seventh Streets, will have two large electric traveling cranes installed to handle the heavy stock as well as five electric freight and one electric passenger elevator.

The constructing quartermaster at Walla Walla, Wash., will receive sealed bids in triplicate up to two p. m. on January 31st for material and labor necessary to install interior conduit and wiring for the electric lighting of two double barracks at Fort Walla Walla, Wash. Noble H. Greager is captain and quartermaster.

In preparation for the furnishing of local consumers with a day-lighting and power service at Monterey, Cal., the principal improvement now under way by the Monterey County Gas and Electric Company is the sectionizing of the plant so that current can be supplied to the different circuits from one or all of the three machines having a combined capacity of 700 horsepower. In case of mishap to any one machine it will then be possible to furnish current from the other two to all parts of the distributing system, which has also been rearranged. Monterey, Del Monte, Pacific Grove and the Presidio have been placed on separate circuits, while the arc street lamps are on still another. The day service will be commenced January 10th. A.

## PERSONAL.

Russell Robb has been admitted to partnership in the widely known firm of Stone & Webster of Boston.

H. M. Littell of Chattanooga, Tenn., has succeeded Reagan Houston as president and general manager of the San Antonio (Texas) Traction Company.

Charles A. Chapman, consulting electrical and mechanical engineer of Chicago, who was recently confined to his bed by a rather severe attack of the grip, has recovered and is again at his desk.

George H. Peirce, the well-known representative of the L. M. Ericsson Telephone Manufacturing Company of Buffalo, was in Chicago last week. Mr. Peirce states that the demand for telephone apparatus is increasing.

Dr. Benjamin W. Frazier, who for 25 years had been professor of mineralogy at Lehigh University, was stricken with apoplexy while returning from New York city recently and died at his home in Bethlehem, Pa., on January 4th. He was 65 years of age and leaves a widow.

The Electric Controller and Supply Company of Cleveland, Ohio, has placed George Magalhaes in charge of its eastern office in New York city. Mr. Magalhaes is a graduate of the Columbia University and has been connected with the engineering department of the company for some time.

Charles R. Morley, general manager of the Stark Electric Railway Company, Canton, Ohio, has started on a four-month trip to Egypt with a party of friends. For three years Mr. Morley has been engaged in superintending the construction of the line which is now operating successfully. The employes presented him a handsome watch before he sailed.

Employes of the Cleveland Electric Railway Company presented George G. Mulhern with a huge floral horseshoe on his induction into the office of sheriff of Cuyahoga County, Ohio. Mr. Mulhern had been superintendent of the city lines for many years and some of the men had been employed under him for 30 years. He accepted the gift with a pleasing address.

Major Montgomery, who for 28 years has been in charge of the telegraph bureau at the White House in Washington, has been transferred to the Pacific Coast on Signal Corps duty. The White House telegraph [illegible] control of the [illegible] new detail from [illegible] fill the vacancy.

Edward B. Ellicott [illegible] left for New York [illegible] expert [illegible] electric-light bills rendered to that city. Mr. Ellicott's thorough electrical training and his experience in the operation of a large public-lighting plant have brought him into prominence in connection with the municipal-lighting question. He went to New York at the request of Controller E. M. Grout of that city, who is conducting the investigation. Mr. Ellicott's wide range of knowledge in the electrical field has been drawn upon from sources outside of Chicago on previous occasions. In December, 1903, it will be remembered, he was chosen to fill the responsible position made vacant by the resignation of Henry Rustin, chief electrical engineer of the St. Louis World's Fair, whose health was unsatisfactory. Mr. Ellicott was also frequently consulted as an electrical expert during the construction of the Chicago World's Fair. He is 38 years old and a native of New York state. Since June, 1897, he has been at the head of the Department of Electricity of the city of Chicago, and at the time of this appointment held the responsible position of superintendent of construction for the Western Electric Company.

EDWARD B. ELLICOTT

## ELECTRIC LIGHTING.

It is reported that J. W. Hale of Fordsville, Ky., is to erect an electric-light plant at Hartford, Ky.

An electric-light plant for Morganfield, Ky., is proposed. Henry Oliver of Fulton, Ky., is promoting the enterprise.

George Armstrong has purchased a site in Fort Worth, Texas, upon which, it is said, he will build an electric-light plant.

The City Council of Lake Charles, La., has under consideration plans for the erection of an electric-light plant to cost about $60,000.

The Waterloo and Cedar Falls Gas and Electric Company of Des Moines, Iowa, has been incorporated with a capital of $595,000.

Work will soon be commenced on the new electric-light plant for the village of Georgetown, Ill. A franchise has been granted to John Searl of Chicago.

The city officials of Appleton City, Mo., are negotiating a franchise with S. J. Culbertson of Vandalia, Mo., whereby Appleton City may have electric lights.

W. B. Head, R. E. Pitts and T. E. Pitman of Grandview, Texas, who recently incorporated as the Grandview Mill, Light and Ice Company, have also incorporated the Head Telephone Company of Grandview, with a capital of $20,000.

Carson, Pirie, Scott & Co. signed a five-year contract with the Chicago Edison Company after taking figures on an electric-lighting and power systemm to be installed in the basement of their new building at State and Madison Streets, Chicago.

The Chicago University is asking for estimates on 2,000-horsepower water-tube boilers, which are required for the enlargement of the present central-heating and power plant on the university campus. Bion J. Arnold is the engineer in charge of the improvement.

Frederick Sargent of Sargent & Lundy, Chicago, was in Cincinnati recently and tested the big engines in the new power house of the Gas and Electric Company. These engines are of 6,000 horsepower each, and with a 50-per cent. overload are said to have worked with entire satisfaction.

The United Electric Light and Power Company of Baltimore has purchased a majority of the stock of the Consolidated Gas Company of Baltimore. This is the first step in the plans which contemplate a consolidation of the United Electric Light and Power Company and the Consolidated Gas Company of Baltimore.

"Electricity Versus Gas" is the title of a pamphlet just issued by the National Electric Light Association for the use of its members who are threatened with Welsbach competition for street lighting. This paper was originally written by Mr. W. F. White for the 1900 meeting of the Ohio Electric Light Association. Mr. White has practically rewritten the paper and has brought it up to date by adding data recently collected from cities and towns all over the country. The pamphlet is illustrated with reproductions from photographs showing graph-[illegible]

[illegible] Haven plant.

[illegible] must either sell out or fight.

Thomas W. [illegible] chise to establish lighting and power plants in those boroughs. The petition was recently presented to the Board of Aldermen [illegible] has not since stated who is behind the enterprise.

The Culiacan Electric Company has been organized in San Francisco with a capital stock of $300,000. The incorporators are I. Gutte, F. G. Brane, H. Hacke, Henry Eichoff and Sidney Sprout. This company has three valuable concessions in the state of Sinaloa, Mexico, and agrees to complete an electric-lighting plant for the city of Culiacan within one year. All of the equipment for this plant will be shipped from San Francisco.

J. W. Mumper of York, Pa., has been awarded the contract for lighting the streets of Hanover, Pa. The Hanover Light, Heat and Power Company offered to light the streets from dusk until midnight for $60 per light. The Welsbach Company of Philadelphia offered gas lamps on an all-night service for $35 per lamp, while the Mumper bid was for 2,000-candlepower electric lights on an all-night service at $64.92, provided he be given a 10-year contract.

The St. James and Pall Mall Electric Light Company of London recently was summoned at Marlborough Street Police Court for permitting water heated to 170° F. to flow into the public sewer. The summonses, 20 in number, covering several dates, were taken on behalf of the London County Council. The magistrate said that the defendant had to work under considerable disadvantage, and under the circumstances a fine of £5 on one summons, a nominal penalty of 1s. on the other 19, and £21 costs would meet the justice of the case.

## ELECTRIC RAILWAYS.

The towns of Fallon and Hazen in Churchill County, Nevada, will soon be connected by an electric railroad. The route of the road has already been surveyed.

The Springfield (Mo.) Traction Company, heretofore principally owned in St. Louis, has been acquired by local capitalists of Springfield. William B. Sanford is interested.

The Amador Railway Company has begun construction work on an electric railway from the point where the Cœur d'Alene branch of the Northern Pacific railroad crosses Cedar Creek to the Amador mines in Montana, a distance of about 20 miles.

The Ballston (N. Y.) terminal railroad, the electric freight line operating between Ballston and Middle Grove, a distance of 12 miles, was sold last month by William E. Butler under foreclosure proceedings. The property was bid in by Thomas F. Barrett, representing A. S. and A. N. Chandler of Philadelphia.

In keeping with its usual custom, the Georgia Railway and Electric Company of Atlanta entertained its 300 electrical employes with a sumptuous New Years dinner. Every man engaged in the electrical department of the company, including practically every official, was present at the plant and enjoyed the dinner.

A local paper at Manteno, Ill., says that a force of Illinois Central railroad surveyors has established headquarters in that city while they are surveying an extra line for the Central from Kankakee to Chicago. It is said that the object of the additional trackage is to prepare for extending the suburban service to Kankakee as a means of competing with a prospective electric road covering the same territory.

On a petition filed in the United States court by H. H. Hall, attorney of the New York Securities Company, the New Orleans Railways Company, comprising all the street railways of New Orleans, was put in the hands of receivers on January 2d. E. C. Foster, president of the company, and Pearl Whyte, one of the largest local stockholders, are appointed the receivers. The New York Securities Company says that there are now more than $400,000 in interest on the bonds of the company, due and

unpaid, that early in this month more than $2,500,000 of bonds will fall due.

M. D. Watson and J. R. Bickerdike, who are interested in the Rosa Amarilla copper mines in the state of Jalisco, Mexico, have applied to the government for a concession to construct an electric railway from the mines to the Pacific Coast; also to operate a telephone and telegraph system in that section. A telephone line will be constructed from the mines to Manzanillo at once. Power is to be obtained from the Cusalpa and Santa Maria Rivers.

Application has been made in Camden, N. J., for the incorporation of the New York-Philadelphia Company, with an authorized capital of $4,000,000. The incorporators are H. D. Long, A. N. Chandler and Norman Grey, the latter of Camden. The purpose of the new company is explained to be the consolidation of electric railways in New Jersey between Camden and New York. A. N. Chandler & Co. have been interested in several country trolley enterprises.

The New York Central engineering commission made a trip through Ohio a few days ago for the purpose of looking over some of the electric railways and large electrical manufacturing plants. The visitors went over the Scioto Valley traction lines and inspected the power plant in order to inspect a third-rail system. At Cincinnati the Bullock plant was visited. The party consisted of J. F. Deems, Edward B. Katté, B. J. Arnold, George Gibbs and Frank J. Sprague.

The Van Buren Electric Railway and Bridge Company of Van Buren, Ark., has been incorporated with a capital stock of $500,000. The company proposes to build a steam-railroad, electric-railway, highway and toll bridge over the Arkansas River and to operate an interurban electric railway between the towns of Van Buren, Alma, Dyer and Mulberry in Crawford County. The officers are National World's Fair Commissioner Phil D. Scott, president; L. H. Southmayd, vice-president; Charles H. Drennan, secretary, and J. S. Dunham, treasurer.

The suit brought some months ago demanding the removal of the Union Elevated Loop structure in Chicago, has been dismissed by Judge Tuley. The proceedings were begun in the name of Attorney-general Hamlin and charged that the frontage consents for the construction of the elevated structure had not been properly obtained. The Northwestern Elevated Railway Company, chief defendant in the suit, made charges that certain property owners and lawyers had started the proceedings as part of a plan to harass the elevated-railway companies.

Traffic on the Chicago elevated railways for December shows a decrease, compared with December, 1903, except the Northwestern, which shows an increase in the daily average of passengers of 2,004. The South Side company had a decrease in the daily average for December of 5,148 passengers, compared with December, 1903, and the Metropolitan shows a decrease of 106 passengers daily for December. The Chicago and Oak Park company experienced a loss in the total number of passengers carried in December, compared with December, 1903, of 5,752 on the main line, but on the whole system there was an increase of 284 passengers. The daily average of passengers for the year 1904, compared with 1903, is as follows: Northwestern—1904, 70,401; 1903, 68,310. Metropolitan—1904, 115,196; 1903, 113,434. South Side—1904, 83,323; 1903, 82,478. Chicago and Oak Park—1904, 43,730; 1903, 44,312.

## AUTOMOBILES.

An international automobile exhibition will be held at Berlin from February 4th to February 19th. The duke of Ratibor will be the president of the exhibition, which will be under the patronage of Prince Henry of Prussia. Terms of entry, a programme and general regulations can be had on application at the Department of State, Washington, D. C.

The annual Chicago automobile show will be held in the Coliseum during the week of February 4th to 11th. Among the attractions this year will be novelties in exhibits, several manufacturers planning to give reproductions of their factories, while workmen will demonstrate the methods employed in the manufacture of parts. Externals and accesories, it is said, will be given the most attention at the coming show. There will probably be no great developments in the treatment of either the motors or running gears of foreign machines, but considerable advancement in accessories and novelties. There is a hopeful outlook in the automobile industry for the coming season. Samuel A. Miles, general manager of the show, said: "Automobile manufacturers are now settling down to a long, steady pull for settled business, with the fad features entirely eliminated."

## POWER TRANSMISSION.

The Commonwealth Electric Company of Philadelphia has been granted a charter and proposes to produce electric light, heat and power. The incorporators are Mark Hyman, R. A. Mackey, H. S. Eville, Graham Sumner, J. H. Ingham, E. D. Oakford and W. M. Clifft. The company desires to obtain a franchise to do an electric-lighting, heating and power business in Philadelphia, and, it is said, will put $10,000,000 into the enterprise if a franchise is granted. George R. Sheldon of New York is said to be one of the men financially interested in the project.

Contracts have been awarded by the Owens River Power Company for the installation of a power plant to provide power for the mines of Tonopah and Goldfield, Nev. Work on the tunnel is already in progress.

The power plant at Milton, Ore., which will have a capacity of 480 horsepower, is almost completed and operations will begin with the arrival of two 24-inch Victor water motors. For the establishment of the plant $15,000 bonds were recently voted by the city.

The Bourbon Gold Mining and Electric Power Company has been incorporated at Tucson, Ariz., by W. E. Howell, J. J. Pollard, Walter N. Brunt and others. The capital stock is $60,000. The principal place of business is Tucson, Ariz., with offices at San Francisco.

The waterpower property at Bluett Falls, on Pee Dee River, about eight miles from Rockingham, N. C., has been purchased by Hugh McRae & Co. of Wilmington, N. C., for $120,000. It is proposed to form a company and build a plant for developing electricity to be transmitted to industries within a radius of 30 miles. About 30,000 horsepower is available.

In connection with the lighting question at Covington, Ga., it is rumored that local capitalists are considering the feasibility of developing the waterpower known as the White's Shoals, on Alcovey River, 10 miles distant, where there is believed to be sufficient power to light nearby towns and furnish power for a large part of the machinery of the section.

## PUBLICATIONS.

A reminder of the new year in the shape of a neat folder comes from the Ewing-Merkle Electric Company of St. Louis. It extends to all a hearty and happy New Year greeting.

A small folder has been issued by the National Carbon Company of Cleveland, Ohio, making announcement of the award of the grand prize for all the company's carbon products, including Columbia enclosed-arc carbons, by the jury of awards of the St. Louis Exposition.

"The Ammeter" is a little pamphlet issued by the Standard Electrical Manufacturing Company of Niles, Ohio, to "boost" the Star lamp, and deserves to be read, for it is full of humorous anecdotes, the lessons from which, it is needless to say, all emphasize the fact that one should buy these lamps. It is published "with the hope that it may while away a moment of your spare time and cause you to see brighter things—Stars."

The bulletin of the Massachusetts Institute of Technology, Boston, has appeared, containing a catalogue of the officers and students together with a statement of the requirements for admission and a description of the courses of instruction. The Institute now offers 13 distinct undergraduate courses of four years' duration. A feature of interest in the curriculum is the prescribed courses of non-professional reading which each student is required to complete during the vacation months.

"The Lewis and Clark Exposition" is the title of an instructive and interesting pamphlet written by Olin D. Wheeler and issued by the Northern Pacific Railway Company. It treats of the expedition of Lewis and Clark and the discoveries in the Northwest Territory, in commemoration of which the Exposition is to be held. Handsome illustrations are scattered throughout the pamphlet, showing the beautiful scenery through which the railroad passes on its way to the coast. The show itself, in some respects, will surpass any other ever held. Probably there was never before such a magnificent natural setting for an exposition as is to be had at Portland, with its beautiful river and magnificent mountain views. The varied products, too, of the great Northwest were probably never exhibited as they will be at the Portland exposition.

Friends of the Westinghouse Electric and Manufacturing Company are indebted to that company for a very convenient and useful vestpocket diary and memorandum book. In addition to blank pages, calendars and the information usually published in books of this character the donor has included about 40 pages of valuable engineering information. There is valuable information in condensed form concerning train resistance, car heating, drop in line and rails, electric motors for driving various machine tools, Nernst lamps, Cooper Hewitt lamps, arc lamps, line losses, alternating-current and other formulas, wire tables, lightning arresters and choke coils, hints on operating electric apparatus, rules for giving first aid to the injured, notes on boilers and various fuels, the performance of gas engines and the performance of steam turbines. There are also tables of the population of various cities, weights and measures, interest laws in different states and similar commercial memoranda. There are also maps of the United States, Cuba, Porto Rico and the Philippines—in all a valuable little book.

## CALENDARS.

The 1905 calendar from McLeod, Ward & Co., New York city, is attached to a large card bearing 15 fine half-tone illustrations of Kinsman and Ward specialties in electric lights.

The John A. Roebling's Sons Company of Trenton, N. J., the well-known manufacturer of wire and wire rope, has issued a useful wall calendar for 1905, ornamented with pictures showing how its products are used in electrical and other work.

An appropriate wall calendar which is being distributed by Charles C. Moore & Co., engineers of San Francisco, Los Angeles, Seattle and Salt Lake, bears a map of the territory embraced by machinery sales and engineering business of the company. As indicated on the map, this territory includes all the Pacific Coast from Alaska to Lower California. In the United States a number of inland states are also covered.

## SOCIETIES AND SCHOOLS.

The Ohio Electric Light Association will hold its next meeting at the Hotel Victory, Put-in-Bay on August 16th, 17th and 18th. The officers and executive committee are planning a complete programme, which will be instructive and entertaining. D. L. Gaskill of Greenville, Ohio, is secretary of the association.

The rapid rise in importance of the engineering profession which has taken place within a comparatively short period has nowhere been more thoroughly appreciated than at the University of Michigan. In the engineering department the attendance rose from 609 in 1902-3 (which was a gain of 120 over that of the preceding year) to 823, an increase of 114. And at this time there is a prospect that at least 1,000 students will be registered in the department for the year 1904-5. If this movement continues for three or four years the number of engineering students will equal, if not surpass, that in the literary department.

At the annual meeting of the Engine Builders' Association, held in New York last month, papers were read as follows: "Costs," by C. M. Lauer; "The Steam Turbine," by F. C. Bates; "Employers' Association," by C. L. Eidlitz, and "Salesmanship as an Applied Science," by R. U. Conger. Following the discussion of the papers, Prof. J. E. Sweet reported for the committee which had been sent to Washington to oppose the adoption of the metric system by the government. The House committee was unable to agree on a report and the matter will probably come up later. Mr. Sweet believed that the arguments of his committee had prevented a favorable report. The officers elected were: President, C. A. Gates (re-elected); vice-president, T. C. Wood; secretary, N. B. Payne; treasurer, A. L. Merriam; council, W. C. Kerr, S. F. Bagg, N. B. Payne, C. A. Bonsall, H. C. Nichols, J. I. Lyle.

The first convention of the Canadian Street Railway Association, the formation of which was announced in the Western Electrician recently, was held in Montreal, beginning December 20th. Following the consideration and adoption of a constitution and by-laws as drafted by W. G. Ross, managing director of the Montreal Street Railway Company, and W. H. Moore of the Toronto Railway Company, several papers and a number of important questions incident to street-railway operation were discussed. Short addresses were made by Messrs. Ross, Brockway, White and Fleming, after which several matters relative to the completion of the organization were adjusted. The officers elected were: President, W. G. Ross, Montreal; vice-president, W. H. Moore, Toronto; secretary and treasurer, Allan Royce, vice-president of the Toronto suburban railway; executive committee, C. E. A. Carr, general manager London street railway; E. A. Evans, manager Québec street railway; D. McDonald, manager Montreal street railway. H. H. McLean of St. John, N. B., was chosen attorney. After the meeting the members visited the power stations and repair shops of the Montreal Street Railway Company.

## SPACE TELEGRAPHY.

G. Simmons of Kenosha, Wis., who owns a steel tower on the top of Pike's Peak, has granted permission to the American De Forest Wireless Telegraph Company to use the tower for an experiment station, and elaborate preparations are being made by the company for tests.

Tests are to be made by the De Forest Space-telegraph Company in Chicago in receiving wireless messages from an automobile running at full speed. An automobile has been equipped with the necessary apparatus and has already received messages while at rest. At the office of the company in Michigan Avenue an official said: "All that is necessary for the success of this experiment is that a wire be trailed upon the ground. Hereafter we hope it will be possible for business men, even while

automobiling, to be kept in constant touch with La Salle Street."

Work on a space-telegraph station in the Brooklyn navy yard will soon be begun, it is said, to enable Commander Robert E. Peary to keep in touch with civilization during his next attempt to reach the North Pole. It is said that Commander Peary will erect wireless stations after he leaves the Labrador coast, to keep in touch with the nearest station on the mainland as he proceeds northward. From there communication with New York will be attempted.

## MISCELLANEOUS.

Permission has been granted the Macdonald Turbine Company of Glasgow, Scotland, to test one of its turbines at the Port Dundas generating station.

In the year 1904 there were imported at the port of New York 902 automobiles of all descriptions; their total appraised valuation being $2,209,492. In 1903 the number was 325 and the value about $1,100,000.

Radium is said to have been discovered in great abundance in alkaline metallic earth on an estate called Carlsro, a few miles from Skofde, Sweden. The metallic earth in which it is found also contains uranium and polonium.

Sixty thousand dollars in gold was divided up among the 4,000 employes of the Boston Elevated Railway Company as a Christmas gift, each employe going home with $15. A similar distribution took place a year ago, which was at that time said to be an unprecedented action on the part of a street-railway company.

A cocker spaniel dog owned in North Tonawanda, N. Y., is said recently to have swallowed two colored electric-light bulbs that had been used to decorate a Christmas tree. Shortly afterward the little animal while playing in front of the house playfully snapped at the heels of a pedestrian, who turned and kicked the dog. The bulbs exploded, killing the spaniel.

## TRADE NEWS.

Kimball & Burnette have engaged in the electrical supply business at Parsons, Kan.

The Electrical Construction Company of Wellington, Kan., has decided to move its office to Winfield, Kan.

The Herman Andrae Electrical Company of Milwaukee, with a capital of $10,000, was incorporated January 5th to take over the construction work of the John Andrae & Sons Company; however, will continue in the electrical business. The incorporators are Herman Andrae, Herman Schmidt and Jacob Tebert.

The Boardman Electrical Construction Company of Memphis, Tenn., has been organized with J. J. Boardman, president, and J. H. Hart, vice-president. The company also handles electrical supplies.

It is announced that the Illinois Steel Company of Joliet, Ill., is about to begin an extension of its works at a cost of $500,000 to accommodate the business of the Continuous Rail Joint Company of America. The latter company is a New Jersey corporation, with headquarters at Newark, N. J. It has extensive works at Troy, N. Y., but has found that its western business requires a plant nearer the center of trade.

An increase is taking place in the exportation of electrical machinery from the United Kingdom. The shipments during November last were the largest so far recorded, amounting to £64,514, as contrasted with £51,268 in the preceding month, and £23,889 in November, 1903. For the first 11 months of the year the aggregate exports attained a value of £470,288, which compares with only £394,170 in the corresponding 11 months of 1903.

Paul Letheule, recently chief of the French electrical department at the St. Louis Exposition, and at present at Rebekah Hospital in St. Louis, believes that American electrical manufacturers will do well to avail themselves of the opportunities for extension of trade afforded by the Liege Exposition of 1905 and the Milan Exposition of 1906. He points out that the St. Louis Exposition attracted comparatively few visitors from Europe, and so far as foreign trade is concerned the American exhibitors did not reap the reward of their efforts. Liege and Milan are in close proximity to the capitals of the Old World, and the expositions will undoubtedly be well attended. In certain cases it will no doubt pay American concerns to send exhibits in charge of a special representative familiar with European trade. In other cases this expense will not be warranted, but an arrangement may be made with a resident exhibitors' agent. Mr. Letheule offers his services to American exhibitors in connection with these expositions, and indeed in relation to the whole subject of foreign agencies, sale of patents and the like.

## BUSINESS.

A round-trip rate of $56.50 has been made by the Northern Pacific Railway Company from Chicago to Portland, Ore., on account of the Lewis and

[illegible]

poles and ties. This will enable the Fowler company to better advantage than heretofore

[illegible]

care of this year's pole business, which, it is expected, will be larger than that of many years. The company has been operating three yards in Dickinson County, Mich., since last September, and has thus far produced a large number of poles of exceptional quality. The Lindsley company expects to be in better position to handle pole orders than at any time in its history. The company is also producing a fine assortment of Idaho poles at its Idaho headquarters.

An investigation of the entire field of cedar-pole offerings was recently made by southern interests and resulted in recommending the stock coming from the northern firm of W. C. Sterling & Son, Monroe, Mich., which has 11 sorting yards in that state, having been in the cedar business for the last 20 years. This company's cedar poles are of superior quality for telephone, telegraph and electric-light use, and show an unusual knowledge of the requirements of such articles on the part of those intrusted with their selection. Nothing approaching them in excellence, it is said, is to be found within the borders of the southern states.

The H. W. Johns-Manville Company of New York has just placed on the market two additions to its complete line of asbestos packings, known as Kearsarge spiral high-pressure piston and valve rod packing, and International hot-water pump packing. The Kearsarge spiral packing is the asbestos and rubber-wound cloth coil packing, so well known to the trade, put up in spiral form to meet the growing demand for that type of packing. The International is a specially prepared and treated packing for use on pumps handling water at high temperatures and on piston and valve rods of engines against wet steam. The manufacturer has prepared attractive literature descriptive of these two packings which it will be glad to send to anyone interested.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued (United States Patent Office) January 3, 1905.*

778,834. Means for Ventilating Electrical Machines. Albert Aichele, Baden, Switzerland, assignor to Brown, Boveri & Co., Baden, Switzerland. Application filed December 7, 1903.

The stator of the dynamo has passages between its windings and an inclosing casing. Rotor is provided with one or more air outlets. Means establish a forced circulation of air from the center of the casing about the axis of rotation of the rotor to the periphery of the stator through the passages between its windings to the rotor and through passages between the windings of the stator to its periphery and to the air outlets in the casing.

778,877. Telephony. Albert Meinema, Chicago, Ill. Application filed May 2, 1904.

A switch device at a sub-station of the telephone line controls the telephone and signal circuits. A bodily movable actuating appliance actuates the switch device, and electromagnetic mechanism at the sub-station operates the switch-actuating appliance. The switch when actuated maintains the circuit closed.

778,888. Hair-drying Apparatus. Otto Peter and Herbert von Kempski Ràcoszyn, Osnabrück, Germany. Application filed July 29, 1904.

Electric incandescent lamps are placed in two concentric cylinders with orifices at the ends. The cylinders are so connected that air is drawn into the outer cylinder by a fan, heated by the lamps, and expelled from the inner cylinder for the purpose of drying out the hair.

778,893. Galvanic Battery. Charles J. Reed, Philadelphia, Pa., assignor to the Security Investment Company. Application filed July 12, 1901.

A galvanic battery comprises a solution of one or more ferrous salts, an iron electrode located in the solution, a solution of one or more ferric salts, a partition having a high degree of porosity between the solutions and an electronegative electrode located in the solution of ferric salt.

778,894. Process of Making Spongy Lead for Secondary-battery Electrodes. Charles J. Reed, Philadelphia, Pa., assignor to the Security Investment Company. Application filed May 7, 1903.

Spongy or finely divided lead for secondary battery electrodes is formed by mixing one or more compounds of lead with finely divided metallic zinc, then subjecting the mixture to a liquid which will convert the lead compound into metallic lead and the zinc into a soluble zinc salt and lastly washing out the zinc salt.

778,897. Motor Control for Hoisting Buckets. Lewis J. Robb and William M. Rosewater, Pittsburg, Pa., assignors to Heyl & Patterson, Pittsburg, Pa. Application filed December 19, 1903.

Two motors have independent starting and stopping means, a single operating means and connection between the latter and the starting means so arranged that by a single movement of the operating means in one plane both of the motors may be put and maintained in operation, one being started in advance of the other.

778,911. Automatic Suspension and Contact Appliance for Electric Arc Lamps. John Stevenson, Jr., Portobello, Scotland. Application filed December 22, 1903.

A suspension and contact appliance for electric arc lamps requiring to be raised is described.

778,913. Rheostat for Electric Arc Lamps. Bernard A. Stowe, Cleveland, Ohio, assignor to the Jandus Electric Company, Cleveland, Ohio. Application filed October 28, 1903.

A resistance device comprises a sectional annular support of insulating material having a groove and a coil of resistance wire removably mounted in the groove, the coil having depressions to reduce the contacting portions of the coil with the support.

778,914. Electric Arc Lamp. Bernard A. Stowe, Cleveland, Ohio, assignor to the Jandus Electric Company, Cleveland, Ohio. Application filed April 30, 1904.

A main shell or casing of the lamp is associated with a lamp frame, a ring removably attached to the frame and holding the shell or casing in place, a supplemental shell adapted to receive and hold a globe, and means for removably attaching the supplement shell to the ring.

778,915. Electric Arc Lamp. Bernard A. Stowe, Cleveland, Ohio, assignor to the Jandus Electric Company, Cleveland, Ohio. Application filed May 19, 1904.

In a lamp casing are a hood, a floor, and a rigid connecting device between the hood and floor. A vertically movable shell carries devices co-operating with the lamp floor for forcing the upper end of the shell against the hood.

778,916. Illuminated Advertising Apparatus. Alexander Stumm, Offenburg, Germany, assignor to Simmler & Venator, Offenburg, Germany. Application filed July 1, 1904.

Electric lamps behind a partly translucent and partly opaque surface illuminate figures upon the surface.

778,933. Trolley Catcher and Retriever. Charles F. Wilson, New York, N. Y. Application filed August 19, 1903.

A hinged latch for engaging a disk attached to the trolley-cord drum is provided with a spring for actuating the latch, the spring being mounted so as to be moved from one side to the other of the hinge pin of the latch.

778,971. Electric Burglar Alarm. Franklin S. Holmes, New York, N. Y. Application filed May 17, 1904.

Combined with a central station and the guarded structure are a single electric protective circuit connecting them, and two sources of electric potential common to the central station for energizing the circuit at will by either of them. A variable resistance is located in the circuit at the central office in series with a variable resistance located in the circuit at the guarded structure, and means at the central station simultaneously change both resistances.

778,984. Electric Lamp Bracket. Edwin H. Lux, Logansport, Ind. Application filed June 10, 1904.

A suspension bracket for electric lamps is described.

778,987. Trolley. William W. Mercer, Norfolk, Va., assignor of one-half to Benjamin J. Cady, Washington, D. C. Application filed May 28, 1904.

The trolley head has a socket with a spindle journaled in the socket. The spindle has a transversely disposed shoulder arranged on one side associated with a wheel journaled in a bracket. A spring is secured to the head and located longitudinally of the spindle, the spring having an inturned free portion that rests against the shoulder and normally holds the bracket in a fixed position though permitting the partial rotation thereof.

779,003. Automatic Magnetic Circuit-breaker. William M. Scott, Philadelphia, Pa., assignor to the Cutter Electrical and Manufacturing Company. Application filed June 28, 1901.

The device embodies a tripping mechanism, switch-restraining means, a number of coils connected in parallel with each other and in series in a circuit, one of the coils operating to control the restraining means, and a potential coil connected in shunt with the circuit and co-operating with another of the coils to control the restraining means. (See cut on next page.)

779,004. Multiple-transfer Switchboard. Charles B. Smith, New York, N. Y. Application filed May 8, 1900.

In a switchboard with several sections are metallic-circuit trunk lines, each terminating at a section in a plug, a receiver normally bridged across the trunk lines and switching devices at each section associated with the trunk lines of the other sections adapted to establish telephonic communication with the receiver.

779,054. Electric Generating Unit. Sterling Shaw, Jacksonville, Ill. Application filed August 29, 1899.

An electromagnetic friction coupling means connects the energizing coil in shunt with a low resistance in an electric-current-carrying conductor so as to pass through the coil an electric current sufficient and of proper polarity to demagnetize the coil long

779,066. Insulated Railway Rail Joint. Bancroft G. Braine, New York, N. Y., assignor to the Continuous Rail Joint Company of America. Application filed March 29, 1904.

An improved insulated rail joint comprises the rails, connecting plates and bolts, insulation interposed between the rails and connecting plates and protecting plates interposed between the rails and insulation.

779,068. Headlight. Frank Buchanan, Dayton, Ohio. Application filed May 31, 1904.

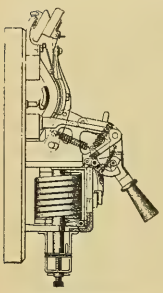
A case contains a reflector and either arc or incandescent lamps.

779,072. Safety Gas Cock. Benjamin F. Clarke, San Francisco, Cal. Application filed March 14, 1904.

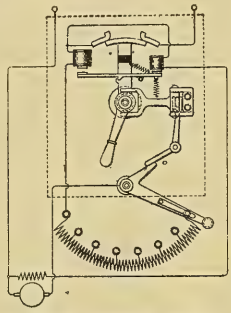
An arrangement is provided by which an electric alarm circuit is closed when the supply key of a gas jet is turned so as to allow of the escape of unignited gas.

779,075. Block System. Antonio Fiorini, Pontremoli, Italy. Application filed April 13, 1904.

In a block system are combined an electrical conductor connecting two stations, a source of electricity in one station, another source of electricity in the second station and a switch located in the first station the throwing of which puts the first source of electricity into circuit and sends the current to the second station. A second switch near the second station is thrown by the current to break the first circuit and to throw the second source of electricity into communication with the conductor and



NO. 779,003.—CIRCUIT-BREAKER.



NO. 779,182.—COMBINED CIRCUIT-BREAKER AND STARTING RHEOSTAT.

thereby send a current back to the first station. An electrical signal at the first station is actuated by the second current, and means whereby the electrical conductor may be interrupted for any cause are also provided.

779,090. Thermoelectric Element. Albert L. Marsh, Lake Bluff, Ill., assignor to William A. Spinks & Co., Chicago, Ill. Application filed June 4, 1904.

In a thermoelectric couple are a metallic element formed of an alloy electronegative to an alloy of copper and nickel and having a melting point in excess of the melting point of pure copper.

779,098. Electric Plug. Nelson H. Raymond, Brooklyn, N. Y., assignor to Stanley & Patterson, New York, N. Y. Application filed April 13, 1904.

An electric plug comprises a binding plate, a terminal, a connecting member, a longitudinal clamping post and insulating material between the plate and the terminal clamped into place by the post and surrounding the clamping post and connecting member.

779,150. Third-rail System. Giosué D'Esposito, Pittsburg, Pa., assignor of one-half to Stuart Patterson, Pittsburg, Pa. Application filed March 12, 1904.

In a third rail for motor cars, brackets having flanges embrace the cross-ties. A girdler is secured to the bracket and a filling block secured to the girder, the girder and filling block having apertures for a bolt. A second filling block and girder through which the bolt extends, a rail clamped between the filling blocks and suitable means for insulating the parts are the remaining features.

779,182. Combined Circuit-breaker and Starting Rheostat. Robert H. Read, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 28, 1903.

An automatic circuit-breaker and rheostat are provided with means for disconnecting the operating handle from the movable contact of the circuit-breaker and means controlled by the rheostat arm for establishing a connection between the handle and movable contact only in the off position of the arm. (See cut.)

779,190. Static Influence Electrical Machine. Elihu Thomson, Swampscott, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed April 12, 1903.

An electrostatic influence machine is made with substantially no space for containing ozonized air around its active parts.

779,199. Motor Controller. Charles E. Barry, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 24, 1903. Renewed May 21, 1904.

A resistance-controlling device and a series-parallel-controlling device with means for causing the series-parallel device to be maintained in one of its operative positions, and means for causing it to be moved into another of its operative positions as the operating handle of the resistance-controlling device is moved forward from its "off" position are the patentable features.

779,204. Electric-railway System. George L. Campbell, Nyack, N. Y., assignor to the American Construction Company. Application filed October 11, 1902.

An insulating block for electric railways is formed with a pocket, an armature vertically movable in the pocket, anti-friction device co-operating with the armature and a non-magnetic frame above the pocket in the insulating block. Contact blocks are carried by the frame and armature, and a laminated magnetic cover is placed in the frame and above the armature.

779,206. Control System. Frank E. Case, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 24, 1903.

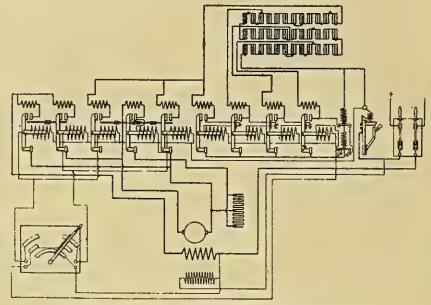
The system embodies a motor controller of the separate electromagnetically actuated contact type, a master controller, conductors connected with the master controller and adapted to be connected to the actuating coils of the contacts of the motor controller, and an auxiliary switch or switches independent of the master controller and operatively connected with motor-controller contacts for connecting the actuating coils of certain other contacts to the conductors.

779,207. Sparking Igniter for Internal-combustion Engines. Henry Devlin, Philadelphia, Pa. Application filed November 4, 1903.

Details are described.

779,222. Dustproof Automatic Circuit Closer and Opener. Ulysses G. King, Harlan, Iowa, assignor of one-half to William H. King, Des Moines, Iowa. Application filed April 9, 1904.

A casing having contacts thereon included in a circuit with a source of electricity and an alarm has connected



NO. 779,207.—CURRENT-CONTROLLING APPARATUS.

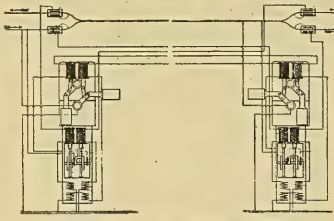
to it a hollow revoluble device. Slides are mounted in the device and extend therefrom, being adapted to bear upon one of the contacts. Weighted bell-crank levers within the revoluble device are connected to and adapted to operate the plungers.

779,231. Induction Coil. John G. Meyers, East Providence, R. I., assignor to the Varley Duplex Magnet Company, Providence, R. I. Application filed August 4, 1904.

An induction coil embodying a primary winding divided into sections connected in series includes an electrical controlling device connected in the primary circuit between the sections.

779,247. Apparatus for Testing Electrical Resistances. John B. West and Frederick M. Du Bois, Syracuse, N. Y.; said Du Bois assignor to said West. Application filed January 2, 1904.

Two induction coils have their primary windings electrically connected in series, one of the primary windings



NO. 779,390.—RAILWAY SIGNAL SYSTEM.

being adjustable to vary the current strength in its secondary winding. Means indicate the degree of the adjustment and a current-strength indicator is electrically connected in parallel with the secondary winding of one of the coils.

779,249. Time Circuit-controlling Apparatus. Johan M. Andersen, Boston, Mass., assignor of one-half to Albert Anderson, Boston, Mass. Application filed December 14, 1903.

Motor mechanism operates a circuit controller. Associated with the clock mechanism is a rotatable device controlled by the clock mechanism and governing the operation of the motor mechanism. Gearing actuated by the motor mechanism rotates the device in conjunction with the clock mechanism.

779,267. Current-controlling System. Arthur C. Eastwood, Cleveland, Ohio. Application filed August 9, 1904.

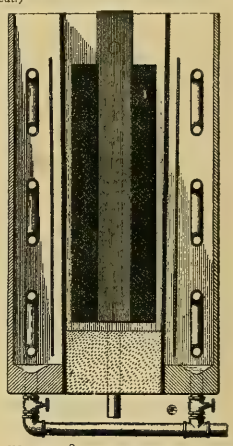
Current-limiting means for a motor include automatic switches having a winding or windings connected so that their operation depends on the current flow through the limiting means, with mechanism for cutting the means into circuit with the motor when the current flow reaches a predetermined maximum and subsequently cutting the means out of circuit when the current has fallen below the maximum. (See cut.)

779,376. Automatic Magnetic Circuit-breaker. William M. Scott, Philadelphia, Pa., assignor to the Cutter Electrical and Manufacturing Company. Application filed May 27, 1899. Renewed December 11, 1901.

In an automatic electric switch separable co-operative contacts possess means for restraining them in normal position, an overload coil for controlling the restraining means, and means for controlling the restraining means upon low voltage or reversed energy flow. The latter means comprise a current winding and a potential winding co-operating upon the same magnetic circuit.

779,383. Electrolytic Apparatus. Clinton P. Townsend, Washington, D. C. Original application filed April 12, 1902. Divided and this application filed May 10, 1904.

An electrolytic cell comprising a vessel having two compartments is provided with a pervious cathode between the compartments, an anode and a body of electrolyte in one compartment, and a body of a liquid which is substantially immiscible with and inert toward a cathode product of the electrolysis, in the other compartment. (See cut.)



NO. 779,183.—ELECTROLYTIC CELL.

779,384. Electrolytic Process. Clinton P. Townsend, Washington, D. C. Original application filed April 12, 1902. Divided and this application filed May 11, 1904.

A process of electrolyzing solutions consists in passing an electric current through the solution to a cathode, recovering a cathode product of electrolysis by means of a liquid which is substantially immiscible with and inert toward the product, and circulating the liquid in contact with the cathode.

779,390. Signaling for Railways. William S. Berry, Pittsburg, Pa. Application filed May 25, 1903.

In a signaling system for electric railways are combined a circuit branching from the trolley circuit, a signal, electrically operated mechanism controlling the signal, a make-and-break mechanism controlling the branch circuit and means for changing the amount of current in the branch circuit controlled by the signaling magnet. (See cut.)

779,401. Trolley-pole Controller. Arthur W. Harrison and Eugene H. Fosdick, Los Angeles, Cal. Application filed June 2, 1904.

A trolley-pole controller comprising a base having an air chamber contains also a solenoid magnet secured to the base, a plunger for the magnet projecting into and forming a piston in the air chamber, a cap rotative upon the magnet, a trolley pole pivotally secured to the cap and a pitman pivotally secured to the trolley pole and operatively connected to the magnet plunger.

REISSUE.

12,301. Process of Electrolytically Refining Lead. Anson G. Betts, Lansingburg, N. Y. Application filed April 22, 1903. Original application dated November 11, 1902.

A process of electrodepositing lead consists in subjecting to electrolysis an electrolyte containing a lead salt of a fluorine acid, and an agent capable of restraining the crystallization of the electrodeposited lead.

DESIGN.

37,283. Casing for Telephone Toll Apparatus. George A. Long, Hartford, Conn., assignor to the Gray Telephone Pay Station Company, Hartford, Conn. Application filed February 6, 1904. Term of patent, seven years.

The ornamental design of a telephone-casing is shown.

## EXPIRING PATENTS.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on January 10, 1905:

376,060. Telephonic Transmitter. S. E. Beedy, Farmington, Me.

376,071, 376,072. Electrical Circuit-breaker. Wm. R. Cole, Detroit, Mich.

376,120. Dynamo Electric Machine or Motor. E. Thomson, Lynn, Mass.

376,116. Lighting Cars by Electricity. A. D. Stevens, Minneapolis, Minn.

376,121. Electric Clock. C. A. Tucker, Islip, N. Y.

376,133. Fire-alarm Circuit. J. P. Barrett, Chicago, Ill.

376,171. Annunciator. J. P. Tirrell, Somerville, Mass.

376,281. Pole Indicator for Electric Conductors. A. Berghausen, Elberfeld, Germany.

376,307. Dynamo Electric Machine. F. Ichl, Paris, France.

376,323. Electric Lamp. L. H. Leber, York, Pa.

376,326. Armature for Dynamo-electric Machines. H. Lemp, Hartford, Conn.

376,149. Receiving, Transmitting and Distributing Instrument for Electromagnetic Thermoscopes. H. J. Haight, New York, N. Y.

# WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXVI. CHICAGO, JANUARY 21, 1905

## Scheveningen Space-telegraph Station of the Dutch Telegraph Department.

By Alfred Gradenwitz.

The Wireless Telegraph Company of Berlin recently installed a number of space-telegraph stations for the Dutch Telegraph Department which present some new features in the art. Fig. 1 is a picture showing the apparatus of the Scheveningen station.

In the first place the transmitter is designed both for single excitation (in case great distances are to be traversed with a given amount of primary energy) and for jar excitation, which plan allows of a sharper tuning and a larger variation in the wave lengths.

The capacity of the Leyden jars is about equivalent to that of the antenna, so that the resonance of the inductor only differs slightly in either of the two arrangements. A similar arrangement has been impossible heretofore, on account of the small capacities concerned. This result was made possible only by the use of subdivided spark gaps and by the large discharging tensions thus available. The application of smaller capacities also proved necessary to obtain a more accurate tuning.

The receiver contains both recording and hearing devices, which are switched in series, so as to allow of a telegram being received with both at the same time. The recording receiver is loosely coupled with the antenna and allows of the wave length of the telegram being measured, one man taking care of the receiving and another of the measuring work.

Considering first the low-tension transmitter, the source of current consists of a storage battery that is charged by a direct-current dynamo, driven by a petroleum motor. During telegraph work the motor is uncoupled and the direct-current dynamo switched on to an alternator. As the direct-current machine now receives current from the battery it runs as motor, driving the alternating-current dynamo, which supplies its current direct to the induction coil.

The arrangement of the low-tension circuit is shown in Fig. 2. The terminals of the battery are designated by ($A_1$) and ($A_2$). One cable (+) leads to a blind contact (b) of the starting resistance, and at the same time to the contact ($C_1$) of the maximum-current relay, while the contact ($C_2$) of the same relay is connected to the handle of the starting resistance. The last contact plug of the latter communicates with one motor brush, while from the other brush a cable leads direct to the negative pole of the battery. One of the poles of the inductor magnet is connected to the middle contact of the starting resistance, and the other to the negative battery terminal.

The coil of the maximum-current relay is joined on one hand to the handle of the starting resistance and on the other, through an incandescent lamp (L), a commutator and a switch placed on the receiving apparatus, to the negative terminal. The commutator should be placed on the contact ($C_2$) during telegraph work, and on contact ($C_1$) during the charging of the batteries, when the receiving apparatus is switched off. The direct current machine is started in the following way: The [illegible] switch is thrown in and the handle of the starting resistance is adjusted to the third contact (3) of the resistance. In this position current flows through the coil of the maximum-current relay, so that, the armature being attracted, connection is established between ($C_1$) and ($C_2$). By turning the handle round, the motor is adjusted to the proper number of revolutions. The object of this switching is to allow of the motor being started slowly, and to produce in switching off only a small spark at the receiver switch, as the latter controls merely the current traversing the coil of the maximum-current relay.

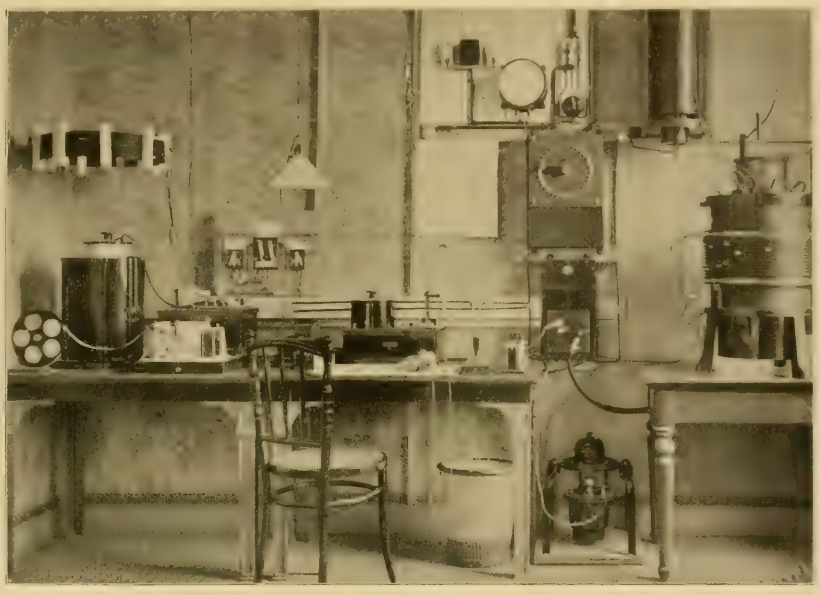


FIG. 1. INTERIOR OF SCHEVENINGEN SPACE-TELEGRAPH STATION OF THE DUTCH TELEGRAPH DEPARTMENT.

For protecting the source of energy and the insulation of the direct-current motor, incandescent lamps are inserted between ($A_1$) and ($A_2$) and the ground, so as to cause any possible supertension to be counterbalanced, between the low-tension conductors and the earth.

The alternating-current dynamo is driven through a rigid coupling, the excitation of the inductor magnet being effected direct from the terminals of the source of energy. The alternating current which is generated in the armature flows through a resistance, a choking coil with three sections, the primary of the induction coil, the blocking of the high-tension switch and the Morse key, back to the armature.

Low-tension energy is transformed to high-tension energy by means of a special transformer (induction coil). These induction coils are constructed for special capacity loads and special tensions, and are so calculated as to produce electrical resonance with a given secondary capacity load and a given frequency of interruption in the primary, so that no transformer can be exchanged unless proper arrangements be made. The choking coil inserted to control the sparking is subdivided into three sections.

For the purpose of giving the Morse signals a key closes the main current on being pressed down, and opens it on being lifted. In order to eliminate sparking, the platinum contact is applied to a small lever borne by the working lever and carrying an armature that stands opposite to an electromagnet. By a downward pressure on the main lever the current is made to flow through the windings of [illegible] of the induction coil high-tension cables lead to the two terminals of the spark gap (Sp), that is separated into [illegible]. The [illegible] the antenna (A) at one pole, and, at the other pole, the earth cable (E), are simultaneously closed, so that the excitation of the antenna is effected direct from the spark gap. The wave length desired at the antenna, when connecting the antenna, spark gap and [illegible] duction in the antenna or else di[illegible] by switching in a capacity in the earth cable.

The spark gap consists of an in[illegible] [illegible], the electrodes of the individual sparking are mounted on hard-rubber supports. These electrodes are hollow, containing each a small Leyden jar which is switched in parallel to each spark gap, and which is intended to equalize the tension. In the upper part of the casing there are eight hard-rubber handles, fitted each with a spring bolt at its lower end. When pressing these handles downward spring bolts are introduced between the spark gaps, short-circuiting them, so as to allow of diminishing the amount of energy without the wave length being altered. The maximum energy is attained when switching in all the spark gaps, each of which is five millimeters in length.

Most important of the points relating to the individual spark gaps is that they should all have equal lengths.

The closed-oscillation-circuit transmitter is represented in Fig. 4. The induction coil is switched in exactly in the same way as with the simple transmitter.

The capacity of the Leyden jars (LC), the eightfold spark gap (Sp) and part of the self-induction form together the closed oscillating circuit to which is connected the antenna (A) on one hand and the terminal (E) on the other. With a given capacity of the Leyden jars, the self-induction is controlled so as to give the required wave length of the antenna by switching in a self-induction. The closed oscillation circuit and the antenna are next coupled together in a proper way. By short-circuiting the individual spark gaps the radiated energy can again be decreased without any change in the wave length. Care should, however, be taken that all the sparking distances be accurately equal.

An eightfold spark gap, the Leyden-jar battery and the self-inductive coils comprise the excitation circuit. The spark gap has been described above. The Leyden-jar battery includes four sets of Leyden jars which are series-connected and each of which contains 16 jars, switched in parallel. The jars are arranged so as to be readily exchanged.

The syntonizing or self-induction coil consists of

a glass cylinder having a wooden foot and cover. The bare copper-wire windings are placed outside on the cylinder. By means of two fixed terminal contacts any desired connection at the coils may be effected.

The high-tension commutator consists of a hard-rubber plate with a hard-rubber lever. At the center of rotation of the lever is the blocking of the alternate current, which is switched in if the position of the lever is perpendicular to the hard-rubber plate, and switched out if the lever lies close to the plate. At the free end of the lever is a plug connection that is joined to the antenna. In receiving, the lever is applied to the foundation plate in a forked contact, which is in connection with the receiving apparatus.

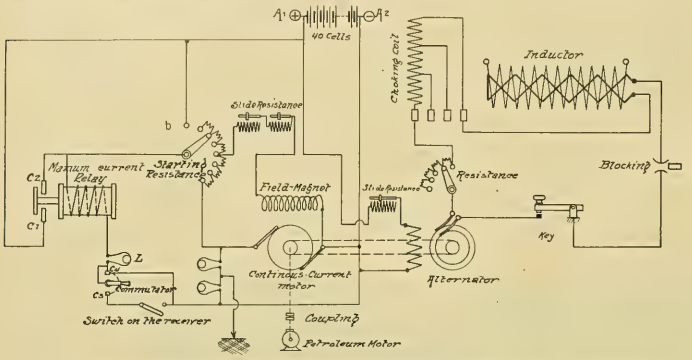



FIG. 2. LOW-TENSION TRANSMISSION CIRCUIT OF SPACE-TELEGRAPH APPARATUS USED AT SCHEVENINGEN.

## Edison Medal Competition.

The Edison medal committee of the American Institute of Electrical Engineers has published in complete form the conditions governing the competition for and award of the Edison medal. This medal was established by the Edison Medal Association, and the gift was formally made and the responsibility of conferring the medal assumed by the Institute at its annual dinner in New York on February 11th last.

The by-laws and general working machinery governing the competition and award have been perfected, and the committee is in every way prepared to make the award for 1905. The medal shall be awarded to a single qualified student only of some institution of learning who individually shall have regularly submitted to the Edison medal committee, through the secretary of the Institute and chairman of the committee, the best thesis or record of research on theoretical or applied electricity or magnetism, of which the committee shall be the judge, and who shall have complied with the specifications for competing theses and records of research as set forth in the by-laws.

The committee requests the authorities of all such institutions of learning as may seem, to such authorities, qualified to compete for the medal under the by-laws, to send, through their proper channels, their names to the Edison medal committee of the American Institute of Electrical Engineers, 95 Liberty Street, New York city, on or before April 1, 1905, if desirous of competing this year. The committee will promptly attend to communications from institutions of learning deeming themselves qualified and desiring to compete, and will notify them early of their qualification to compete, or disqualification, as the case may be.

John W. Howell of New York is chairman of the Edison medal committee.

## Washington-Baltimore Electric-railway System.

The Bishop-Sherwin syndicate of Cleveland has concluded negotiations by which it purchased the Washington, Baltimore and Annapolis Traction Company, the Annapolis, Washington and Baltimore and the Washington, Berwyn and Laurel railway companies. The plan is to put all three roads into one big modern traction company. When completed the system will furnish the only traction connection between Washington and Annapolis. There will be 120 miles of track in the system. The line from Washington to Baltimore will be constructed wholly on right-of-way owned by the company and will be double-tracked. The other lines will be single-track for the present.

## Electrical Section of Western Society of Engineers.

The Electrical Section of the Western Society of Engineers held its monthly meeting at the society's rooms in Chicago on January 13th. At this meeting the annual election of officers took place, which was the first in the history of the section. F. M. Holbrook, one of the members of the executive committee, called the meeting to order. The nominees for the various offices as named at the December meeting were: Chairman, W. B. Hale of the Western Electric Company; vice-chairman, S. G. McMeen, consulting telephone engineer; executive committee, W. G. Carlton of the Chicago Edison Company, George A. Damon of the Arnold Electric Power Station Company, and Prof. P. B. Woodworth of Lewis Institute. The secretary was instructed to cast the unanimous vote of the Electrical Section for the gentlemen named. Of the members of the executive committee, Mr. Carlton is to serve one year, Mr. Damon two years and Mr. Woodworth three years. The regular term of office of members of the executive committee is two years, but in order that in the future one new member may be elected each year the members were elected this time for the terms mentioned.

The membership committee of the Western Society of Engineers has been appointed. It consists of Messrs. G. M. Wisner, Walter H. Baldwin, C. H. Cartlidge and J. R. Cravath, the last named being the member from the Electrical Section.

After the election Mr. Hale took the chair and introduced the speaker of the evening, Mr. C. A. S. Howlett of the Western Electric Company, who read an instructive paper upon "The Commercial Aspect of Engineering," which subject was afterward well discussed. The paper is given further attention elsewhere in this issue.

The next meeting of the Electrical Section will be held February 10th, at which Prof. C. F. Burgess of the University of Wisconsin will read a paper upon the "Present Status of the Electric Furnace."

## Intramural Railway at St. Louis Exposition.

The intramural railroad which was in use at the St. Louis Fair earned $566.477 above operating expenses. Manager Thomas Murphy reports that the cash fares collected amounted to $627,473.80. The operating expenses, including salaries of officers and clerks, was $52,624.95, and the total expense, including cost of maintenance, was $60,995.88, leaving a net balance turned into the Exposition treasury of $566,477.92. The average number of passengers carried daily is given as 35,452.

## Some New Rectifying Effects in Conducting Gases.[1]

By P. G. Nutting.

The passage of electricity from a metal to a gas, or from a gas to a metal, occurs in a manner not yet well understood. The present investigation was undertaken to determine what conditions of the metal or gas favor the transfer of electricity from one to the other, and, if possible, to throw some light on the mechanism of surface conduction. While the results here presented are crude, they bear directly on the theory of metal-gas conduction, and the method, though very simple, is believed to be new. The work suggested itself during some spectroscopic work with Plücker tubes.

If we use a direct current in studying the electrode drop in potential, we are confronted by the great difficulty in keeping the condition of the surface, temperature, pressure, etc., constant, and in reproducing these conditions in successive tests. But if we use an alternating current of a maximum voltage just a little above the maximum total drop in potential between electrodes, conditions cannot appreciably change between successive alternations, and the excess of current in one direction may be taken as a rough measure of the relative surface conductivity at the two electrodes. It is hardly conceivable that there can be any rectifying effect due to the gas itself away from the electrodes, for this would require not only molecular or atomic dissymmetry, but a fixed orientation of these particles. Hence we must regard rectification as due to conditions existing at the metal-gas surface and in the immediately adjacent metal and gas. The general form assumed by a single-phase alternating-current wave when a conducting gas is included in the circuit is discussed later on in relation to the dissymmetry of the wave caused by partial rectification.

The greater part of the work here described was done with the current from a transformer of 100:2,000 volts and 600 watts capacity. Occasionally some of the work was repeated on smaller 100:1,000 volt transformers of 100 or 300 watts capacity. To control the current in the secondary, a variable non-inductive resistance of about 100 ohms was placed in the primary of the transformer. The current in the secondary varied from 10 to 40 milliamperes, according to the density of the conducting gas. Most of the work was done with ordinary Plücker tubes, slightly altered according to the conditions desired. They were of the short, stout form now preferred and had either rod or disk aluminum electrodes. The tubes were connected with rubber pressure tubing to a Geryk pump and hydrogen generator by a three-way cock, so that they could be quickly exhausted and filled or washed with hydrogen. A direct-current milliameter in series with the tube gave the amount of current rectified, while an alternating-current voltmeter used in series as an ammeter gave the total current. In this way rectification as small as half of one per cent. could be easily measured and a tenth as much detected. It is difficult to prepare a tube that will not show as much as one per cent rectification. The effects here recorded are as large as five to 40 per cent. and decidedly reversible.

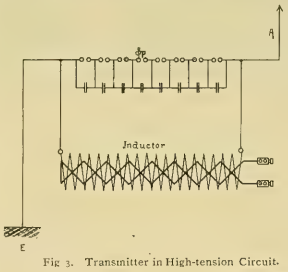



Fig. 3. Transmitter in High-tension Circuit.

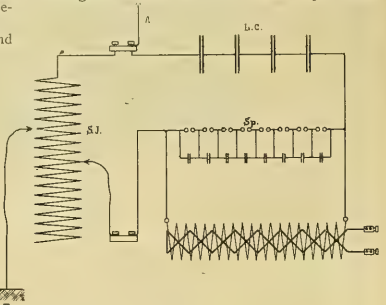



Fig. 4. Closed-oscillation-circuit Transmitter.

SPACE-TELEGRAPH APPARATUS AT SCHEVENINGEN.

The principal rectifying effects obtained are indicated diagrammatically in Fig. 1. The number at the left corresponds with the number of the descriptive paragraph in the context. The percentages at the right indicate the maximum percentage of the current rectified, while the intermediate arrow indicates its direction. Except the first, the effects showed but little variation in percentage of rectification with the density of the conducting gas, as the pressure of this was varied from six to 0.1 millimeter.

1. The difference in pressure of the gas about the two electrodes was accomplished by constricting the tube to a fine capillary between the electrodes and rapidly exhausting. If the exhaustion is sufficiently rapid, complete rectification occurs, i. e., half of the current wave fails to pass at all. Judging by the width of the cathode dark space, the corresponding pressures in the two bulbs are about four millimeters

1. From the Bulletin of the Bureau of Standards.

and 0.3 millimeter. Sudden admission of gas into an exhausted tube reverses the rectification.

We can hardly attribute the effect to any difference within the electrode itself to the ease of escape of electrons from metal to gas. But if we consider the current carried by the negative electrons alone, then the current will be able to start much more easily from the electrode surrounded by the more rarefied gas, for here the electrons will have a greater free path and will be more easily able to attain ionizing velocity. Hence the (negative) current will travel most easily from low to high pressure as observed. A cruder and less tenable explanation is possible if we consider the current carried by both positive and negative electrons. The strong current of gas through the capillary from high to low pressure would tend to sweep the larger positive electrons with it rather than the much smaller negative electrons. Hence the (positive) current would flow from high to low pressure as observed.

2. The relative size of the electrodes is an important factor in producing rectification. The excess of current flows from the small to the large electrode. When the large electrode was three times the area of the smaller, a rectification of 12 per cent. was observed; when it was 10 times the area, 35 per cent. was observed. The tests were made with aluminum electrodes in Plücker tubes. When the pressure is so great and the current so small that the glow covers only a portion of the larger electrode the effect is null or reversed. After the current has been passing for some time the heating effect next described (3) may mask the effect of relative size. There appears to be little, if any, difference in size of the cathode dark space at the large and small electrodes.

The current density being less at the larger electrode, any competition between the electrons carrying the current will be less at this electrode. At the larger electrode negative electrons starting out would be less interfered with by the pressure of positive electrons. The effect can hardly be traced to the difference in capacity of the large and small electrodes, for connecting one electrode to a large capacity or even to earth produces but a slight rectifying effect.

3. A difference in temperature of the electrodes gives a partly rectified current from the hot to the cold electrode. When one bulb of a Plücker tube was heated to about 250 degrees and the other bulb kept cold by a wet cloth, and protected by an asbestos screen, a rectification as large as 25 per cent. was observed on starting the current. This decreased rapidly as the current heated the cold electrode. Using tubes with disk electrodes, the cathode dark space was at least 50 per cent. larger at the hot electrode than at the cold. At the same time the canal ray glow within the dark space was scarcely perceptible, while at the cold electrode it nearly filled the cathode dark space.

A continuous current heats the cathode much more energetically than the anode. Hence when an alternating current passes between a hot and a cold electrode we should expect the rectified portion to pass in such a direction as to heat the cold electrode more than the hot, and so produce equilibrium. This is what actually occurs. But the electron theory would lead us to expect a current from cold to hot. At the hot electrode negative electrons escape from greater exposed surface could not be determined.

6. With one electrode mercury and the other iron, of the same size, but a slight rectifying effect from mercury to iron was observed on starting the current. After the current had been running some time mercury vapor over the mercury electrode tended, by (4), to increase the recification, while the much hotter iron electrode, by (3), tended to decrease it. It would appear that the action of the Cooper Hewitt rectifier on a three-phase current is largely due to the much greater surface exposed by the mercury electrode and the greater density of mercury vapor in its immediate neighborhood. If cathode drop of potential played an important role, we should have obtained greater rectification with the tube just described and a single-phase current. When aluminum was used against iron in atmospheres of air and hydrogen, a rectification of 20 per cent. was again observed. When hydrogen was used, the rectification was just perceptibly less than in air.

7. Placing a metallic band about one electrode and connecting this band with the other electrode, a strong, often complete, rectification is produced, the current passing toward the electrode having an external band. It has frequently been noticed that placing the hand near a discharge tube steadies the discharge. An earthed metallic band about the tube near one electrode was much more effective in strengthening the discharge. Finally, this band was connected with the opposite electrode, and complete rectification obtained. A similar device has been used to facilitate starting in mercury-vapor lamps, a metallic covering being placed about the cathode and connected to the anode.

Throwing an intense beam of sunlight on the front face of one of the (disk) electrodes by means of a lens produced no perceptible rectification. The effect of exposing one electrode or the adjacent gas to the action of X-rays was not tested, but from (4) and (6) we should expect the side exposed to become anode.

Tests 8 and 9 were made with tubes provided with three mercury electrodes. One of these was connected to one 2,000-volt terminal, and the other two, through different resistances, to the other. Current was found to enter through the low resistance and leave by the high. Such an effect by (3) would

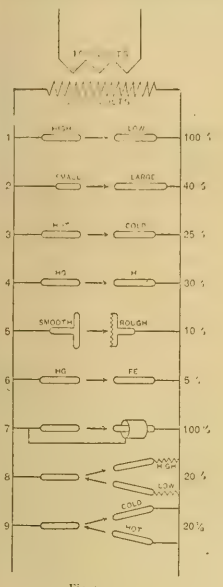



Fig. 1.

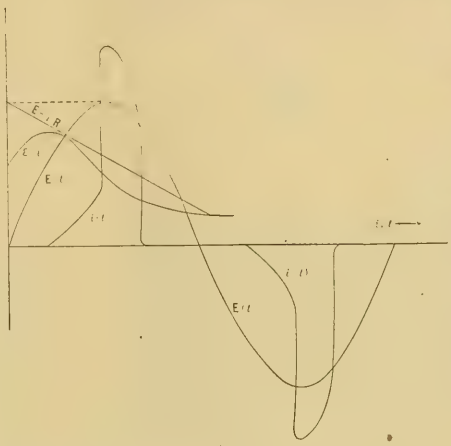



Fig. 2.

RECTIFYING EFFECTS IN CONDUCTING GASES.

the other with air or hydrogen there is a decided rectifying effect [illegible] the hydrogen. In [illegible] frequently observed complete rectification under similar conditions.

In some previous work on the [illegible] gases (this bulletin) it was shown that in a mixture, other things being equal, gases or vapors of great atomic weight appear to give always greater spectral energy than those of small [illegible] that they carry current more readily or are more readily ionized, we have a simple explanation for the above rectifying effect. The current is more easily started in the bulb containing heavier vapor, so that half the alternating-current wave is reduced in area, according to the diagram discussed later.

5. The condition of the surface of the electrodes appears to determine a slight but decided rectifying effect. Aluminum disk electrodes were used, one polished and the other cut in ridges, like a file, with a sharp knife. An excess of current passed from the smooth to the rough electrode. Whether this effect was anything more than that due to a [illegible] flattened or rounded, say, than the upper, and the effect will be shown as partial rectification.

A tube having one internal and one external electrode showed no trace of rectification. This might [illegible] curve rises steeply and continuously and the current curve i (t) is a low, broad sine curve, which would show little, if any, dissymmetry

## Chicago Street-railway Amalgamation.

A unification of the traction interests in Chicago seems now to be [illegible] By the [illegible] control of the Chicago City and Union Traction Companies passes into the hands of a syndicate composed principally of Chicago men. Marshall Field, John J. Mitchell, P. A. Valentine and John A. Spoor are the principals from Chicago, and to this list is added J. Pierpont Morgan of New York.

This syndicate has issued an offer to buy 90,001 shares of stock in the Chicago City company for $200 each. This is a majority of the 180,000 shares outstanding. The offer is conditional upon the required number of shares being deposited with the Illinois Trust and Savings Bank by February 15th. At this time it is said that the majority of shares will be forthcoming. Plans for acquiring the control of the Union Traction's North and West Side lines by the syndicate have been perfected. It is understood that the present consolidation does not mean a complete unification of management. This is to come about when it is known definitely, and agreed upon, what the city will demand of the unified interests for franchise extension.

It is given out that the syndicate expects to give to the city within 60 days a definite, good-faith franchise proposition, embodying a liberal compensation, an unconditional 20-year term with no provision for municipal purchase before its expiration, complete rehabilitation of the combined system on modern lines, and a "one city one fare" agreement. It is said that the new interests will not favor, for the present at least, any plan for a subway for the car lines in the heart of the city. Their argument on this point is that the recent developments in the Chicago freight-tunnel project give sufficient assurance of relief from congestion on the streets to permit of the developing of a comprehensive surface system for the street-railway lines.

At this week's meeting of the City Council the ordinance recommended by the local transportation committee for universal transfers was passed without comment, as was the one prohibiting the traffic in transfers. The former was drawn to apply to the South and West Side lines. The principal West Side lines were originally part of the Chicago City railway. If they had remained a part of that system transfers between the South and West Sides could have been demanded under the Supreme Court decision.

A new feature has been added to the traction tangle in the form of injunction proceeding instituted in the state Circuit Court by Edward Roby, who seeks to restrain the City Council from passing the proposed City Railway ordinance pending a decision on the constitutionality of the 99-year act. Mr. Roby's attack is upon the validity of the acts of February 14, 1859; February 21, 1861, and February 6, 1869. He declares all are unconstitutional and void. The last-named is the 99-year act, under which, it is claimed, the street-railway rights of Chicago passed to the companies until 1968.

## Protection and Control of Large High-tension Alternating-current Distribution Systems.[1]

By George N. Eastman.

A system may have overhead and underground lines supplying step-down transformers operating induction motor-generators, synchronous motor-generators or rotary converters, or it may have induction motor-generator sets or synchronous motor-generator sets directly connected to the primary distribution system. The combination of nearly all these conditions is obtained in a few large high-tension transmission systems now in operation in some of our large cities. It is evident that the contingencies which will arise on such a system will be more varied than the contingencies arising on a system supplying only one class of transmission lines and only one type of translating apparatus. The system of the Chicago Edison Company and the Commonwealth Electric Company is representative of the former class, and as examples and conditions presented throughout this paper will refer particularly to this system, a brief description of the principal features relative to the examples and conditions cited will be given.

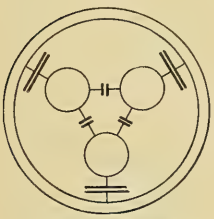


Fig. 1. Distribution of Capacity in Underground Cable.

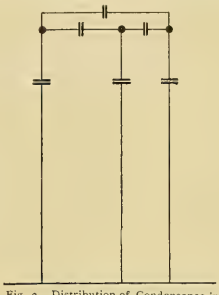


Fig. 2. Distribution of Condensance in Overhead Lines.

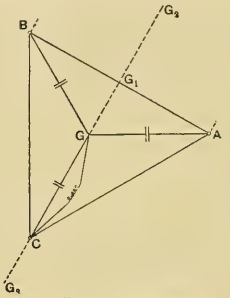



Fig. 3. Effect of Inductive Ground.

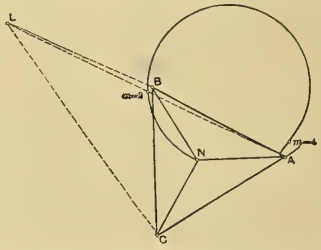



Fig. 4. Effect of Ground on Primary of Star-connected Set of Transformers.

PROTECTION AND CONTROL OF ALTERNATING-CURRENT DISTRIBUTION SYSTEMS.

The high-tension system of the Chicago Edison Company and the Commonwealth Electric Company consists of a three-wire, three-phase, 25-cycle, 9,000-volt primary distributing system fed with but one exception by three-phase star-wound generators. The system is operated from two generating plants, the Fisk Street station having at present a normal capacity of 15,000 kilowatts, and the Harrison Street station having a normal capacity of 10,000 kilowatts. The neutral of the 9,000-volt generators is brought out and connected to a common ground bus in each station.

The primary distributing lines consist of 43 lines of three-conductor, paper-insulated, lead-covered cable and one overhead line interconnecting-generator stations and sub-stations. With few exceptions the cables are made up of No. 0000 conductors with insulation of six-thirty-seconds-inch paper concentric with the conductor and four-thirty-seconds-inch paper wrapped over all, jute or hemp filler being used, and the whole treated with a resin oil. The length of underground cables connected to the system is 63 miles. The length of overhead lines, 9.4 miles.

The translating apparatus in the sub-stations consists of 9,000-volt, three-phase synchronous motors direct-connected to 60-cycle generators; step-down static transformers operating rotary converters and step-down static transformer driving an induction motor for operating exciter generators.

On any alternating-current system the relative potentials which exist between any part of the system and ground will depend upon the distribution of the electrostatic capacity throughout the system. The insulation resistance is necessarily so high that its effect in determining the potentials which will exist between the system and ground will not be noticeable.

The condensance of the system performs the function of elastic ligaments, connecting the system to ground. The elastic limit of the ligaments is the potential at which the dielectric is broken down and a direct short-circuit established. The effect of a ground on the system depends upon the nature of the ground and the value of its reactance in relation to the condenser reactance. An appreciation of the above statement can be best obtained by the presentation of a few examples which might occur in actual practice.

The total capacity of the overhead and underground transmission circuits of the Chicago system is 2.79 microfarads between two conductors and 10.64 microfarads between each conductor and ground. The capacity reactance (condensance) between two conductors at 25 cycles equals 2,285 ohms and the condensance between each conductor and ground is 598 ohms.

Fig. 1 represents the distribution of capacity in a three-conductor underground cable. The lines representing the condenser plates are drawn to scale, so that a relative comparison between two conductors and between each conductor and ground is graphically represented. It will be noted that the capacity between conductor and ground, which is the factor determining the relative potentials which will exist between ground and system, is several times greater than the capacity between conductors.

The distribution of condensance in overhead lines is shown in Fig. 2. In this diagram it is assumed that the line conductors are properly transposed so that the capacity between conductors, considering the entire system, is balanced. It will again be noted that in the overhead system the capacity between each conductor and ground is greater than the capacity between conductors.

It is interesting to make a comparison between the capacity of a system with underground cables and the equivalence with overhead lines. If all the lines of the Chicago system were overhead, assuming a distance between conductors of 16 and 25 inches, respectively, and a height of 35 feet above ground, the total capacity of the system between two conductors would be 0.57 microfarads and between each conductor and ground 0.65 microfarads. The condensance at 25 cycles between two conductors would be 11,300 ohms and the condensance between conductors and ground 9,620 ohms. The ratio of capacity in the overhead system to that in the underground system would be one to 16.4 between conductors and ground and one to 4.9 between two conductors.

The effect of a ground on any conductor is to shunt the condensance of the system between that phase and ground, and it is evident that the relative potential which will exist between the system and ground will depend upon the nature and value of the grounding impedance and the relation it bears to the shunted condenser reactance.

An idea of the effect which will be produced by an inductive ground can best be obtained by an inspection of Fig. 3. In diagram Fig. 3 it is assumed that the condensance of (C) phase is shunted by inductive reactance having no resistance component. It will be readily conceived that if the inductance is equal to the condensance that the impedance of the circuit between (C) and (G) will be infinite, and the relative potential to ground will be determined by the capacity between the phases (A) and (B). If these two condensers are of equivalent value the ground will be located at the point ($G_1$) midway between (A) and (B), and the potential from (A) and (B) to ground will be one-half of the delta potential of the system; the potential from (C) to ground will be 86.6 per cent. of the delta potential of the system. As the inductance is decreased it will be evident that the potential between the system and ground will be increased; since the condensers between (A) and (B) are in series with an inductive reactance. The potential will increase as the inductance is decreased, until the latter is one-third of the reactance of each condenser. For this value of grounding reactance the potential between system and ground will be infinite. With a further decrease in the inductive reactance, line (G $G_2$) will swing through infinity and the potential will decrease along the line (G $G_3$) until, when the grounding reactance is zero, (C) will be at ground potential.

If an inductive ground could be obtained having no ohmic component, a ground of 199 ohms on the underground system of Chicago would produce an infinite voltage, and if the system were overhead a ground of 3,206 ohms would produce the same effect. Thus, it will be seen that the factor which determined the relative potential to ground depends both on the grounding impedance and the condensance of the system.

Fig. 4 is a diagram showing conditions which would be obtained when the ground is on the primary of one transformer of a star-connected set of transformers. The transformer on which the ground is obtained is connected between (A) and the neutral. The curve shown is plotted for a solid ground on the primary for different points along the winding. Condition ($M_2$) would be obtained when the ground occurred in the center of the transformer. Condition ($M_1$) would be obtained when the ground is on the primary, one-quarter the distance between (A) and the neutral. (A L) represents the pressure which would be impressed upon the transformer when the ground occurred at the center of the primary winding and (C L) and (B L) represent the potentials which would be impressed on the other two transformers.

The remedy adopted for the Chicago system for eliminating the possibility of obtaining high potentials between the system and ground was the solid grounding of the neutral of all the star-wound generators in the generating stations. It is universally admitted that grounding the neutral will eliminate the chances of obtaining excessive electrostatic disturbances on the system. Fear is expressed by some engineers that with a grounded system, a ground on the system which directly becomes a short-circuit between neutral and one conductor of the generators will result in surging throughout the system, thereby producing results which would be as disastrous as the trouble which it was aimed to eliminate. In some instances a resistance has been installed between the neutral and ground to limit the flow of current to ground. It is hoped that in this manner the short-circuit could be so dampened that surging would not result. In a large high-tension system it would be impracticable to install a resistance for the purpose of dampening short-circuit oscillations on account of the enormous current which the resistance would have to take care of.

It would seem that a better system would be the operation of only one generator at a time with the neutral grounded, thus limiting the current which would flow on the occurrence of a ground to the short-circuiting current capacity of that machine.

It should be borne in mind that with the occurrence of a short-circuit which is limited to one conductor and ground that the energy which is furnished the short-circuit will be supplied by the generators in the generating station and that the synchronous apparatus in the sub-stations, unless their neutrals be grounded also, will furnish no energy until the short-circuit has been translated to other conductors. Thus, if a ground can be detected and removed from the system before it has had time to develop into a short-circuit between conductors, the effect on the system will be greatly decreased. In the operation of the Chicago system, in nearly all cases the short-circuits in the underground cables have occurred between conductor and ground, and when the overload relays were not retarded in their action by time-limit devices, the circuits on which the trouble has occurred have been opened before the short-circuit was transmitted to other conductors.

The above fact has led to the investigation of a means for obtaining a ground detector which could be used for the purpose of indicating a ground or operating a relay controlling the circuit-breaker of the circuit on which the ground occurs. For this purpose the Chicago Edison Company is experimenting with a device, a diagram of which is shown in Fig. 5. This device consists of a laminated iron ring having three independent windings of an equal number of turns, uniformly distributed over the core, and a fourth winding of any desired number of turns which is connected to a meter or relay for providing the desired indications. Each of the three similar windings is connected to the secondary of a line-current transformer. So long as there is

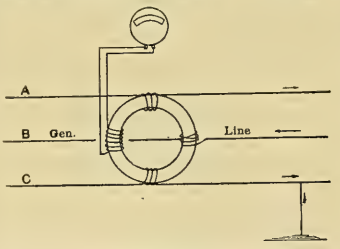



FIG. 5. GROUND DETECTOR CONNECTIONS IN ALTERNATING-CURRENT DISTRIBUTION.

1. A paper, slightly abridged, presented to Section E of the International Electrical Congress at St. Louis, September 12, 1904. Mr. Eastman is one of the engineers of the Chicago Edison Company and was a delegate to the Congress from the National Electric Light Association.

no escape of line current from the line to ground the current through the three winding will neutralize each other and no flux will result in the iron core. As soon as the ground is obtained part of the current fed through the transformer will return to the generator through the ground and an indication will be obtained by means of the fourth winding. It is hoped that by means of this with the combination of instantaneous and time-limit relays, the line on which the ground occurs will be automatically located and its circuit-breaker opened instantly. In this manner the ground may be cut off before the trouble has been transmitted to other conductors and the trouble limited to one line and only that part of the system which is affected by its operation.

The introduction of an overhead line operating in multiple with a large system of cable introduces a very hazardous element and makes it necessary to safeguard the system against atmospheric charges. Every possible precaution should be taken with a view of preventing the transmission of a high potential on the overhead line to the underground system. There is but one overhead line connected to the Chicago system, and although it has been in service only a few months several cases of trouble have occurred on it and the protective apparatus installed has successfully prevented the transmission of trouble to the underground system. This overhead line is connected to the bus bars at the Fisk Street station through a 900-foot length of underground cable. At the junction of the underground cable and the overhead line a lightning-arrester house was built, in which were installed choke coils, lightning arresters and a circuit-breaker on the line. The choke coils installed had an inductive equivalent of 200 feet of overhead line. Two banks of lightning arresters were installed, one being connected to the center of the choke coils and the other on the overhead side of the coils. Besides the line circuit-breaker in the lightning-arrester house, a circuit-breaker was installed in the switch house. Each precaution was taken to adjust the overhead relays so that in case of trouble on the line the switch in the lightning-arrester house would be the first to open.

One of the most important parts effecting the control of a high-tension system is the overload relay which controls the automatic opening of the line circuit-breakers. These relays should be capable of selecting the line on which trouble occurs and opening the line instantly. For this purpose, a combination of a time limit and instantaneous element is necessary, the time-limit feature being set to protect the cable or apparatus against dangerous overloads and the instantaneous device being adjusted to operate only in case of short-circuits or grounds. The time-limit devices which have been used without the combination of these two elements have resulted in the operation of circuit-breakers of lines on which no trouble has occurred, in some cases shutting down the entire system. In laying out the system the application of the overload relay should be borne in mind and wherever possible the lay-out should be so arranged that each line receives its energy either over a number of lines or else directly from the bus bars of the generating station, in this manner causing the short-circuiting or grounding current in the line on which trouble occurs to exceed in amount the current of any other line on the system.

The application of no other device has played such an important part in making the operation of a large high-tension system possible as has that of the oil switch. Experiments have shown that with the presence of electrostatic capacity the open arc in air has very destructive effects. Instances have been obtained where, upon opening the circuit in air, arc lengths of from 20 feet to 30 feet have been obtained. Confining the arc in oil, the phenomenon which is obtained with the open arc apparently ceases to exist. This fact should be borne in mind and precaution taken throughout the system as far as possible to limit to a confined space the short-circuiting arcs which are apt to occur. Every precaution should be taken with auxiliary circuits and devices upon which the operation of the circuit-breaker depends. The opening of a switch or the falling back of a switch into a closed position may result in as much damage to the system as the most severe short-circuit. The switch should be capable of successful operation through a very wide range in voltage in order that the control will not become inoperative when trouble on the circuits causes a drop in pressure of the secondary system.

The apparatus in the sub-station feeding from the primary distribution system should be protected with overload relays operating circuit-breakers, both on the primary and secondary system. With a sudden reversal of current in either a series or a shunt-wound rotary converter the field is apt to be weakened to an extent such that a dangerous speed would be obtained. To prevent this a speed-limit device controlling the direct-current circuit-breaker should be installed. To guard against the speeding up of a rotary converter on which the speed-limit device has failed to operate and translating its excessive speed to other synchronous machines in multiple with it, the speed-limit device should also control the operation of the alternating-current circuit-breakers.

To reduce the liability of obtaining excessive speeds on converters the sub-station translating apparatus should be arranged wherever possible so that rotary converters do not operate in parallel with synchronous motor generator sets on the same line. The opening of the line switch in such a case would result in the dropping out of step of the motor, thereby causing the speeding up of the rotary converter, due to the demagnetizing effect of the heavy lagging current set up in the rotary armature.

In any system care should be taken to prevent the manual operation from interfering with the automatic. The combination of hand and automatic operated device should be avoided as far as possible, thus minimizing the tendency of the operators to rely upon automatic devices. For example, when certain cases of trouble arise the automatic devices may be deprived of their means of automatic control and hence fail to perform their functions of protection. In such a case an attempt to operate these devices manually would also result in failure and a loss in time, which may cause the wrecking of the apparatus involved, whereas if the operator had performed the regular routine of manual operation the damage would probably have been prevented.

Every precaution should be taken in the installation of automatic controlling devices to make their operation independent of the normal-service conditions of the system, thus insuring their successful operation under any conditions which may arise.

In conclusion, too much stress cannot be laid on the careful testing of all pieces of apparatus to be installed on the system. All lines and apparatus should be periodically inspected and tested and no expense should be spared in obtaining correct explanations of the causes of all trouble which arises on the system.

## Electrical Power Development at Niagara Falls.

Electrical engineers will watch with increasing interest the operation of the new installation of the Canadian Niagara Power Company, which was started on Monday, January 2d, as related in the Western Electrician of January 7th. The adoption of a unit of 10,000 horsepower is expected to result in the reduction in cost of development per horsepower. The Canadian development was less expensive than the development on the New York side because of the shortness of tunnel; and with the lower cost of generator per horsepower and with the lower cost of turbine per horsepower the Canadian development should be able to show some gratifying economies.

SCENE IN STATION OF CANADIAN NIAGARA POWER COMPANY ON OCCASION OF STARTING FIRST TWO 10,000-HORSE-POWER UNITS.

At the start the commissioners of Victoria Park placed an assessment on companies to which they granted franchises, so that, as the Western Electrician has told, they are now in touch with a source that promises considerable revenue. That the legislators of New York state are also alert to the possibilities of the state receiving a revenue from the Niagara and other power developments is clear from the fact that Assemblyman Wade of Jamestown, chairman of the committee on taxation and retrenchment, has introduced a bill that provides that every person, partnership, company, joint-stock association or corporation taking water from Niagara

[redacted]

person or concern to the comptroller between November 1st and 25th. Any person or concern refusing to make such report shall forfeit to the state treasurer an amount equal to 50 per cent. of the proposed tax. Unpaid taxes under this act may be collected by a comptroller's warrant, directing a sheriff to levy upon and sell the real and personal property of the person or concern.

If taxes are unpaid for one year and the omission is intentional the attorney-general on application of the comptroller shall bring an action for the forfeiture of the concern's charter. It is specifically stated in the act that the tax imposed for the use of the water shall not be construed or deemed as in lieu of any other tax payable by any such person or concern.

The bill in conclusion states: "But this act shall not affect the rights of any party under any existing contract between such party and the state for taking waters from any of the canals of the state."

It is estimated that the passage of this bill would increase the revenue of the state from $700,000 to $1,000,000.

For the purpose of comparing the proposed New York charge with that now made on the Canadian side it may be stated that the power companies at Canadian Niagara pay an annual rental and also pay at the rate of $1 per annum for each electrical horsepower generated and used and sold or disposed of over 10,000 electrical horsepower up to 20,000 electrical horsepower, and the further payment of the sum of 75 cents for each electrical horsepower generated and used and sold or disposed of over 20,000 electrical horsepower up to 30,000 electrical horsepower and the further payment of the sum of 50 cents for each electrical horsepower generated and used and sold or disposed of over 30,000 electrical horsepower; that is to say by way of example that on generation and use and sale or disposal of 30,000 electrical horsepower the gross rental would be $32,500 per annum, which is payable half yearly.

There are now 30,000 kilometers of land-telegraph lines and 3,290 kilometers of submarine cables controlled by the Spanish postoffice and telegraph authorities. There are 1,588 telegraph offices in the country, which in 1903 dealt with 3,456,000 messages.

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## DATES AHEAD.

Independent Telephone Association of Wisconsin (annual convention), Hotel Pfister, Milwaukee, January 25th and 26th.

American Institute of Electrical Engineers (annual dinner), ballroom of the Waldorf-Astoria, New York city, February 8th.

Ohio Independent Telephone Association (annual meeting), Columbus, March 30th.

National Electric Light Association (annual convention), Denver, June 6th, 7th and 8th, and Colorado Springs, June 9th, 10th and 11th.

Ohio Electric Light Association, Hotel Victory, Put-in-Bay, August 16th to 18th.

PUBLIC OWNERSHIP of street railways will undoubtedly play a large part in the coming spring campaign in Chicago preceding the election at which a mayor and other city officers are to be chosen. The interminable "traction question" is still unsettled, and a large section of the community is undoubtedly in favor of the immediate "municipalization" of the lines, without realizing very clearly how this result is to be brought about in the present state of the city's finances. Another portion of the public, more conservative, is in favor of a settlement with the companies, giving them a franchise not to exceed 20 years, with liberal compensation to the city and stringent provisions as to rebuilding the plants, which are, in truth, in a pitiable condition of neglect. The "settlement" people say that municipal ownership may be all right, but that it is certainly impracticable now. In addition, there is a small band of faithful souls opposed to municipal ownership on principle, and the socialists, who would "municipalize" everything as a step directly in line with their theories. The situation is further complicated by receiverships and litigation in which one of the two companies is involved; by the famous "99-year Act" under which the companies lay claim to rights in the streets for 60 years to come, and by the fact that the franchises expiring are of different dates and relate to different streets and parts of streets, and were often granted to companies "underlying" those which now control the grants. Then, too, the fact that there are two companies rather than one, with interests that are not always identical, adds another element of embarrassment. At present it seems likely that an amalgamation will be effected, and it is possible that a combination will be hammered into shape in which the public will have more confidence than in at least one of the existing companies.

In this situation Mr. John M. Harlan is an avowed candidate for the Republican nomination for mayor, and he has received assurances of support from nearly all the ward organizations, so his nomination seems practically a foregone conclusion. He is accused by the municipal-ownership people of being in favor of settlement with the companies, but, although he has been connected with the "traction fight" in one way or another for several years, he has not as yet made a public pronouncement of his present attitude on the question.

Mayor Carter H. Harrison is not a candidate for renomination, so the Democrats will find it necessary to unite on another man. Judge Edward F. Dunne, a jurist of high character, has been mentioned for the office by some of the municipal-ownership advocates, and he promises, if nominated, to make a straight fight on the public-ownership issue, as he strongly favors municipal ownership and operation of the Chicago street railways.

It will thus be seen to how great an extent the question of public versus private ownership promises to figure in the forthcoming Chicago mayoralty campaign. If this debate were conducted free of selfish intrigue, on the high plane of public good alone, it would be of great interest and importance. But, in view of the record of American municipal politics, we can hardly hope that this will be the case.

PRACTICAL commercial education shows an interesting modern development in the annual lecture courses given for the salesmen of large manufacturing and supply companies. A number of companies in the electrical field now make it a yearly practice to assemble their salesmen or sales managers, either from the whole country or a considerable section of it, at some convenient center, often the home office. To this gathering addresses are delivered by experts in the manufacture and operation of the machines and appliances which the salesmen have to offer to their customers. A general discussion follows, and it may be supposed that the apparatus of competitors is considered with attention, and its defects noted, if any can be found, while all the points of the particular appliance under discussion are carefully brought out. The affair usually winds up with a dinner, and has pleasant features of social reunion which are not to be disregarded. Thus the salesmen are thoroughly informed of the year's development in the particular branch of the art in which they are interested, and they start on another year's work with reanimated zeal and reinforced intelligence. These gatherings are undoubtedly highly profitable to all engaged in them, for the salesmen, coming often from considerable distances, give their quota of information about the conditions and demands of the industry in all parts of the country. They show in a striking manner the educational tendency of the age, and as whatever tends to the diffusion of practical knowledge is to be commended, they should be encouraged to expand in number and usefulness.

MUCH interesting statistical information is contained in the Census Bulletin in relation to telephones and telegraphs, which was dated last month and of which advance sheets have been issued. The figures given, however, are as of December 31, 1902, and are therefore two years old at the time of publication. It is to be regretted that the good work of the Bureau of the Census in collecting, digesting and tabulating these statistics cannot be further enhanced by more prompt presentation. It would seem that a year or less ought to suffice for the collection and compilation of the data, although it will be readily admitted that the task is one of large proportions and that the Census Bureau must carry it on concurrently with much other work. It might be well, perhaps, to sacrifice exhaustive detail for greater promptness. Then, too, it may be expected that succeeding bulletins will be more easily and quickly prepared, taking advantage of existing experience, methods and channels of information. But we think every effort should be made to get out the advance bulletins as quickly as possible. Our own experience in giving annual estimates of the value of electrical and auxiliary manufactures in our New Years numbers inclines us to have a high opinion of the value of promptness in the presentation of statistical information. The present bulletin relates to statistics of operation rather than of manufacture, and is confined to one section of the electrical art; but if the figures given were those of December 31, 1903, or, better still, June 30, 1904, the value of the compilation would have been increased.

Nevertheless, while the Census report would have been even more acceptable if the figures given were of later date, it is, as it stands, of great interest and no little importance, particularly to the telephone industry, which owes its thanks to the government and to Mr. T. C. Martin, the special agent who aided in the preparation of the report. It is shown that the total number of telephones in use in the United States on December 31, 1902, was 2,371,044, of which it appears that 1,317,178 were Bell instruments, while 1,053,866 were connected to Independent systems. But in the latter number the Bell people contend that there is "probably included" Bell instruments leased by 84,021 subscribers and operated by sub-license arrangement with Bell licensee companies. The total miles of wire is placed at 4,900,451 and the number of public exchanges at 10,361. Of a total of 2,315,297 telephones in commercial and mutual systems, 886,152 were on party lines. The total revenue of the telephone-operating companies in 1902 was $86,522,211, of which $14,981,649 was paid in dividends.

It is interesting to observe that on November 30, 1902, the parent Bell company reported that it had 3,099,346 telephone instruments "outstanding." Considering each transmitter and receiver as one telephone, this would mean 1,549,673 telephones, compared with the 1,317,178 Bell telephones actually in service, according to the Census Bureau, on December 31, 1902. This would seem to show that quite a number of "outstanding" Bell telephones are not in use.

Telegraph statistics are not so interesting, nor perhaps really so important, as those of the telephone, and this explains why a comparatively small part of the bulletin is devoted to the older invention, which is, notwithstanding, of vigorous vitality.

The report contains many other facts of interest, and the reader is referred to the abstracts of the two parts of it published in this issue. The figures of financial returns from telephone-exchange operation are particularly valuable, while the whole forms a valuable addition to the literature of "that most magical of modern electrical industries—the telephone service."

## Indiana Electric Railway Association.

The organization of the Indiana Electric Railway Association was effected at its first annual meeting, held in the auditorium of the Traction and Terminal Building, Indianapolis, on January 12th. The meeting was called to order by A. L. Drum, general manager of the Indiana Union Traction Company, who, in a felicitous speech, congratulated the Indiana interurban people on the bright prospects of an interesting and profitable association. On recommendation of the committee on nominations and arrangements, these officers were elected:

President—Charles L. Henry, president and general manager of the Indianapolis and Cincinnati Traction Company.

Vice-president—J. W. Chipman, general manager of the Indianapolis and Eastern Traction Company.

Secretary—Paul H. White, general manager of the Indianapolis and Martinsville Rapid Transit Company.

Treasurer—W. F. Milholland, treasurer of the Indianapolis Traction and Terminal Company.

Executive committee—A. L. Drum, general manager of the Indiana Union Traction Company; C. C. Reynolds, general manager of the Indianapolis and Northwestern Traction Company, and Gardner F. Wells, general manager of the Terre Haute Traction and Light Company.

Finance committee—Charles Murdock, president of the Fort Wayne and Wabash Valley Traction Company, and William G. Irwin, general manager of the Indianapolis, Columbus and Southern Traction Company.

Mr. Henry thanked the members of the association for the honor conferred on him, and pledged his endeavors to make the Indiana Electric Railway Association the best in the country.

Constitution and by-laws were next adopted, to the effect that the object of the association shall be to promote knowledge of all matters relative to the construction and management of electric railways and their equipment which may be brought before the association for consideration and discussion; to encourage social relations among the members, and to promote the interchange of traffic. It was decided that any person engaged in the construction, operation or maintenance of an electric railway, or persons of distinction in the electric-railway world, and any others whom the association may wish, shall be eligible for active membership. The regular meetings of the association will be held on the second Thursday of each month, and these meetings will be held in the various cities of the state, so that the members of the association may visit the various power houses and other electrical plants of interest. The annual meetings of the association will be held on the second Thursday of January of each year.

An interesting paper on "The Cost of Electric-railway Power Production and Transmission in the State of Indiana" was read by A. S. Richey, electrical engineer of the Indiana Union Traction Company. This paper was generally discussed by the members present, and it was shown to what extent modern appliances have reduced the cost of production and transmission of power since the pioneer road was constructed.

Immediately after the lunch hour there was a trip on a special car furnished by the Indianapolis Traction and Terminal Company, to its power house and barns west of the river. Upon the return of the excursionists a paper was read on "Track and Roadbed Construction and Maintenance, with Particular Reference to the Life and Chemical Preservation of Ties, Poles and Cross-arms," etc., by T. B. McMath, chief engineer of the Indianapolis Traction and Terminal Company. Many questions were asked during the discussion of this paper, which was regarded with so much favor a resolution was adopted providing for its publication. The next paper, on "The Construction and Maintenance of Cars and Equipment," was read by L. M. Clark, master mechanic of the Indianapolis and Northwestern Traction Company. This paper also brought out an interesting discussion.

The meeting was attended by 52 members, and the interest manifested was such as to greatly encourage the promoters of the association. Interchangeable mileage tickets and the baggage and freight questions were lightly touched on and will be taken up at the next meeting. It is a matter of local pride that the Indiana interurban roads have developed so many young engineers and mechanics along electrical lines. Papers prepared and read by them are sought after as being eminent in authority. Future papers will be prepared in duplicate and sent to the members for examination before each meeting. In this way members hope to be prepared to ask questions and discuss the papers when read in the meetings. S. S.

## Northwestern Electrical Association.

Although the [illegible] day [illegible] Electrical Association [illegible] those in attendance [illegible] ing day of the convention.

A jolly party went up from Chicago [illegible] parlor car which was chartered [illegible] the H. T. Paiste Company, which courtesy was much appreciated.

The following-named gentlemen were upon the train, which arrived in Milwaukee shortly before noon: Harold Almert, superintendent Cicero Light, Heat and Power Company, Oak Park, Ill.; [illegible] Brooks, Pass & Seymour, Solvay, N. Y.; Harry Byrne, Allis-Chalmers Company, Chicago; George Cutter, George Cutter Company, Chicago; P. E. Davenport, Porter & Berg, Chicago; Locke Etheridge, Stanley Electric Manufacturing Company, Chicago; Leon Ely, Porter & Berg, Chicago; George A. Gray, Thomas G. Grier Company, Chicago; G. Brewer Griffin, Westinghouse Electric and Manufacturing Company, Pittsburg, Pa.; J. H. Harding, treasurer and superintendent Laporte Electric Company, Laporte, Ind.; George H. Lukes, North Shore Electric Company, Evanston, Ill.; Julian S. Jackson, Pass & Seymour, Chicago; Charles Messer, president Dearborn Electric Company, Chicago; A. A. Morton, Stanley Electric Manufacturing Company, Pittsfield, Mass.; H. B. McMeal, Telephony, Chicago; Samuel Mankowitz, president Monarch Electric and Wire Company, Chicago; L. W. Marshall, Electrical Review, Chicago; Llewelyn Owen, Peoria, Ill.; Frank L. Perry, Western Electrician, Chicago; Charles W. Price, Electrical Review, New York; J. G. Pomeroy, Adams-Bagnall Electric Company, Chicago; Frederic S. Richmond, Oak Park, Ill.; Francis Raymond, General Incandescent Arc Light Company, Chicago; E. K. Seymour, Wagner Electric Manufacturing Company, Chicago; James Wolff, New York Insulated Wire Company, Chicago; George P. Westover, superintendent Cummer Electric Light Company, Cadillac, Mich.; George S. Whyte, president Macomber and Whyte Rope Company, Chicago; W. P. Upham, Electric Appliance Company, Chicago; J. M. S. Waring, Electric Storage Battery Company, Chicago; H. W. Young, Western Electrician, Chicago.

A short session was held in the club room of the Hotel Pfister Wednesday forenoon, at which President T. F. Grover of Fond du Lac, Wis., delivered his address and Secretary Thomas R. Mercein read his report, after which the meeting was adjourned.

President Grover called the meeting to order promptly at 2 p. m., and a short business session was held before taking up the papers of the afternoon. This consisted of the appointment of committees, reading of applications for membership, reports of committees and miscellaneous business.

The business session over, Mr. W. B. Jackson of Madison, Wis., read a paper upon "Successful Joint Utilization of Several Small Waterpowers," in which he gave the results of some interesting work which has been carried out by the Janesville (Wis.) Electric Company.

O. M. Rau of Milwaukee followed next with a paper upon "Alternating-current and Direct-current Distribution," which drew forth considerable discussion.

The secretary then read the paper of Prof. George D. Shepardson of the University of Minnesota upon "The Rating of Arc Lamps."

The last paper of the afternoon was by Mr. C. H. Williams of Madison, Wis., upon "Distribution and Dollars," which was received with much appreciation, and on account of its importance and the lateness of the hour, its discussion was deferred until the first thing Thursday morning.

Just before closing, Mr. Poage of the Sheldon School of Scientific Salesmanship gave a short address upon the principles upon which the courses of the school are based, which was interesting and well received. This closed the session.

A number of exhibits were installed by Wednesday noon and a number of others were in various stages of completion. These took up most of the second floor of the hotel and made an excellent showing.

A full report of the convention will be given in the Western Electrician next week.

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The United Railroads of San Francisco has commenced work on changing the present steam-dummy line from Central Avenue to the Cliff House into an electric railway.

## The Commercial Aspect of Engineering.

[illegible] Ill., replied that in his estimation the commercial [illegible] contracts he placed salesmanship ability higher than [illegible] human character which will do more to mold the [illegible]

The college-bred engineer may be ever so well grounded in the theories of the profession, and his mind may be trained to grapple with the engineering [illegible] utterly unfit to grapple with the problem of securing a contract, for the knowledge he has obtained does not fit him to be proficient in the persuasion of men. In order to develop the commercial instincts and better to fit college men to be able to make a success in the selling end of the business, which must necessarily go hand in hand with the engineering work, the speaker suggested that technical and professional schools should incorporate in the courses of the senior year a series of lectures upon salesmanship, and that the students be given practical work in the way of "talking" up various classes of apparatus before the classes as if making a demonstration to a prospective customer.

Professor Brooks was called upon during the discussion, and he said that they were doing work along this line at the University of Illinois. He has prepared for his students from time to time specifications of various pieces of construction work and has had them prepare estimates and submit bids for the work. All manner of practical work of this kind is given to them, even to sending for the catalogues of various companies and studying up the selling points of various makes of apparatus, the students then acting as salesmen and endeavoring to secure orders from their classmates. The plan thus far has been productive of much good.

Others who entered into the discussion of the paper were Harold Almert, W. S. Hine, W. G. Carlton, C. E. De Crow and W. J. Warder, Jr.

## New York Central Extends Its Traction Holdings.

A daily newspaper says: "The report is out that the Andrews-Stanley syndicate has extended its traction holdings in the East by the purchase of the Schenectady street-railway system. This movement was merely the formal closing of a deal which has been in anticipation for a long time. It has been known that the New York Central did not intend to stop with the electrical adaptation of a small part of the West Shore railroad, but that it was going to follow the lead of the New Haven in completing a system of traction lines that would completely parallel the main line. It has determined that if there is any virtue in the system and any gain which might accrue to the New Haven or any other road, it is going to get in on the game.

"The plans for the new station for the New York Central at New York indicates something of these intentions. This station shows arrangements for handling all of the business that will be done by electric-line service as far up as Albany. It has been supposed that the electric connections with the New York Central station, via the subway, would be only the suburban business, on which quick service is desired. The plans, however, indicate something else to be the intentions. The road wants quick service and all that, but it wants more. It wants the low-rate business which is going into the hands of other companies. The Schenectady road has a line from that city to Albany, another to Troy, and a third to Ballston, which is to be extended to Saratoga. The company has a capitalization of $600,000 and a bond issue of $2,000,000 bearing 4½ per cent. The price which was paid for the control is not stated."

## Census Report of Telephone Systems at the Close of 1902.

The Bureau of the Census, Department of Commerce and Labor, of which Mr. S. N. D. North is director, has issued (under date of December 15, 1904) bulletin No. 17 on "Telephones and Telegraphs," bringing together statistical information upon the equipment, service and operation of this class of electrical apparatus up to the close of the year 1902. The bulletin is to be followed later by a report in which the statistics will be presented in detail, together with historical and descriptive text prepared by Mr. T. Cummerford Martin of New York city. That part of the bulletin relating to the telephone is of especial interest and the following extracts relate entirely to that branch of the art.

The statistics, as shown separately in the report, are divided into three classes, as follows:

1. Commercial systems, including all systems operated by individuals, firms or corporations primarily for revenue.

2. Mutual systems, including all systems operated through a mutual arrangement between the persons deriving benefit from the service, primarily for the benefit of the owners, revenue being incidental to the operation of the line.

3. Independent farmer or rural lines having no regular exchange or centrals. These lines are often operated under conditions similar to those controlling mutual systems.

Table 1 is a summary of the statistics for commercial and mutual systems (exclusive of Independent farmer or rural lines).

Table 1.

| | Total. | Commercial. | Mutual. |
|---|---|---|---|
| Number of systems | 4,151 | 3,157 | 994 |
| Miles of wire | 4,850,486 | 4,779,571 | 70,915 |
| Number of subscribers | 2,178,366 | 2,089,846 | 88,520 |
| Stations or telephones of all kinds | 2,315,297 | 2,225,981 | 89,316 |
| Number of public exchanges | 10,361 | 9,419 | 942 |
| Number of private branch exchanges | 7,883 | 7,883 | ........ |
| Number of automatic pay stations | 32,477 | 32,459 | 18 |
| Number of all other pay stations | 48,393 | 48,009 | 384 |
| Number of party lines | 258,166 | 248,908 | 9,258 |
| Number of stations on party lines | 886,152 | 808,571 | 77,581 |
| Switchboards, total number | 10,896 | 9,954 | 942 |
| Manual: | | | |
| Common battery | 837 | 830 | - |
| Magneto | 10,005 | 9,071 | 934 |
| Automatic | 54 | 53 | 1 |
| Messages or talks during year, total number | 5,070,554,553 | 4,971,413,070 | 99,141,483 |
| Local exchange | 4,949,849,709 | 4,851,416,539 | 98,433,170 |
| Long-distance and toll | 120,704,844 | 119,996,531 | 708,313 |
| Salaried officials, clerks, etc.: | | | |
| Number | 14,124 | 13,958 | 166 |
| Salaries | $9,885,886 | $9,871,596 | $14,290 |
| Wage-earners: | | | |
| Average number | 64,628 | 63,630 | 998 |
| Wages | $26,369,735 | $26,206,065 | $163,670 |
| Capital stock and bonds outstanding, par value | $348,031,058 | $347,366,793 | $664,265 |
| Common stock | $269,180,076 | $268,518,811 | $661,265 |
| Preferred stock | $4,869,621 | $4,869,621 | ........ |
| Bonds | $73,981,361 | $73,978,361 | $3,000 |
| Total revenue | $86,825,536 | $86,522,211 | *$303,325 |
| Operating expenses and fixed charges, except interest on bonds | $61,652,823 | $61,371,002 | $281,821 |
| Interest on bonds | $3,511,948 | $3,511,768 | $180 |
| Dividends paid | $14,982,719 | $14,981,649 | $1,070 |
| Net surplus | $6,678,046 | $6,657,792 | $20,254 |

*Includes assessments.

The number of Independent rural lines and systems on December 31, 1902, is given as 4,985; miles of wire, 49,965; number of telephones, 55,747.

### Comparison Between Years 1880 and 1902.

In 1880 the population of the United States was 50,155,783, and the number of telephones of all kinds reported in that year was 54,319, giving an average of 923 persons to every telephone. In 1902 the population had increased to 78,576,436 and the telephones to 2,315,297, the average being 34 persons per telephone.

Between 1880 and 1902 the total number of public exchanges increased from 348 to 10,361, and the number of employes from 3,338 to 78,752. The total revenue in 1880 was $3,098,081, or an average of $57.03 per telephone, as compared with $86,825,536, or $37.50 per telephone in 1902. The amount of capital stock authorized in 1880 was $17,386,700, while that for 1902 was $384,534,066, or a little more than 22 times as great.

Few, if any, industries have had such a development during the last 25 years. The extension of the long-distance service, the introduction of the commercial systems into rural districts, the establishment of Independent rural lines, the development in some instances of such lines into mutual systems with an exchange and more extensive service, and the rapidly increasing use of the telephone in private dwellings, all point to a growth of the industry that can hardly be realized.

### Revenue and Operating Expenses.

The total revenue of all telephone systems in 1902, from operation and from all other sources, amounted to $86,825,536, or a yearly average of $37.50 per telephone, and of 1.7 cents per message or talk. Of this amount, $81,599,769, or 94 per cent., was derived from the actual operation of the systems, and $5,225,767, or six per cent., from dividends and interest on investments, lease of lines, etc. The total operating expenses amounted to $56,867,062, or an average of $24.56 per year per telephone. The net income averaged $9.36 per telephone.

Of the $56,867,062 reported for operating expenses, the sums paid as salaries and wages form the principal item, amounting to $36,255,621, or 63.8 per cent. of the total. Next in rank is the $13,332,343 shown for maintenance and legal expenses, which includes all expenses for repairs and renewals and legal services.

Statistics show that while only 194, or 4.7 per cent., of all telephone systems reported 1,000 telephones or over, yet these 194 systems operated 72.5 per cent. of the telephones shown for all systems. The gross receipts from operation for these systems aggregated $71,374,134, or 87.5 per cent. of the total for the United States. Their income from other sources was $5,193,807, or 99.4 per cent. of the amount of such revenue. Their operating expenses were $50,806,748, and their fixed charges $7,562,950—89.3 per cent. and 91.1 per cent. of the respective totals. The dividends paid by these systems amounted to $14,357,918, or 95.8 per cent. of the dividends paid by all systems. The surplus for the year reported by these large systems as a whole was $3,840,325, or 57.5 per cent. of the net surplus of all telephone systems. But 11 of these 194 systems operated at a loss during the year covered by the report, the total deficit amounting to $217,527, hence the actual surplus for the 183 earning companies was $4,057,852. In the case of all but two of the 11 companies operating at a loss the deficit was due to the high fixed charges, while with the other two it was caused by the payment of a higher rate of dividend than the yearly net income warranted.

Table 2 shows by states and territories the average number of messages and talks, gross and net income and expenses per telephone.

Table 2.

| State or Territory. | Average Number of Messages or Talks Per Telephone Per Year. | Average Per Telephone Per Year. Gross Income. | Operating Expenses. | Fixed Charges. | Net Income. |
|---|---|---|---|---|---|
| United States | 2,190 | $37.50 | $24.56 | $ 3.58 | $ 9.36 |
| Alabama | 3,279 | 37.57 | 22.37 | 6.37 | 8.83 |
| Arizona | 1,557 | 35.13 | 21.44 | 1.95 | 11.74 |
| Arkansas | 2,174 | 33.45 | 21.80 | 1.87 | 9.78 |
| California | 1,673 | 38.39 | 30.02 | 2.17 | 6.20 |
| Colorado | 2,456 | 46.36 | 31.23 | 1.41 | 13.72 |
| Connecticut | 1,597 | 59.05 | 39.45 | 3.70 | 15.90 |
| Delaware | 2,088 | 44.22 | 36.66 | 11.39 | *3.83 |
| Florida | 2,301 | 25.82 | 16.65 | 5.38 | 3.79 |
| Georgia | 3,774 | 33.86 | 21.26 | 7.29 | 5.31 |
| Idaho | 1,671 | 46.16 | 34.79 | 3.02 | 8.35 |
| Illinois | 2,562 | 34.61 | 23.73 | 2.49 | 8.39 |
| Indian Territory | 1,564 | 30.79 | 17.55 | 1.17 | 12.07 |
| Indiana | 2,224 | 21.26 | 13.54 | 2.79 | 4.93 |
| Iowa | 1,609 | 16.35 | 10.53 | 1.15 | 4.67 |
| Kansas | 1,433 | 21.42 | 12.76 | 1.12 | 7.54 |
| Kentucky | 3,093 | 29.77 | 19.72 | 3.87 | 6.18 |
| Louisiana | 3,888 | 45.88 | 23.70 | 3.74 | 18.44 |
| Maine | 1,561 | 42.52 | 29.12 | 2.79 | 10.61 |
| †Maryland | 1,933 | 47.28 | 34.47 | 7.31 | 5.50 |
| Massachusetts | 1,897 | 63.49 | 43.58 | 6.26 | 13.65 |
| Michigan | 2,530 | 26.01 | 18.31 | 5.20 | 2.50 |
| Minnesota | 1,823 | 30.30 | 18.30 | 2.96 | 9.04 |
| Mississippi | 4,009 | 32.95 | 20.10 | 2.28 | 10.57 |
| Missouri | 2,595 | 31.81 | 19.14 | 3.50 | 9.17 |
| Montana | 2,004 | 56.26 | 39.43 | 2.34 | 14.49 |
| Nebraska | 2,025 | 30.63 | 22.10 | 1.07 | 7.46 |
| Nevada | 1,210 | 30.05 | 15.85 | 1.67 | 12.53 |
| New Hampshire | 1,707 | 39.87 | 30.67 | 2.33 | 6.87 |
| New Jersey | 1,147 | 55.91 | 39.55 | 5.50 | 10.86 |
| New Mexico | 1,732 | 21.94 | 12.98 | 0.52 | 8.44 |
| New York | 1,464 | 66.47 | 39.79 | 4.66 | 22.02 |
| North Carolina | 2,245 | 21.32 | 14.93 | 2.08 | 4.31 |
| North Dakota | 2,086 | 34.81 | 20.20 | 2.06 | 12.55 |
| Ohio | 2,508 | 27.80 | 17.06 | 4.56 | 6.18 |
| Oklahoma | 2,246 | 25.83 | 16.37 | 1.13 | 8.33 |
| Oregon | 1,690 | 31.13 | 21.34 | 0.85 | 8.94 |
| Pennsylvania | 2,646 | 43.33 | 28.91 | 4.94 | 9.48 |
| South Carolina | 2,283 | 27.23 | 17.86 | 4.41 | 4.96 |
| South Dakota | 1,739 | 27.86 | 15.84 | 1.11 | 10.91 |
| Tennessee | 3,557 | 34.73 | 24.47 | 2.94 | 7.32 |
| Texas | 2,594 | 38.60 | 24.60 | 3.41 | 10.59 |
| Utah | 2,050 | 51.26 | 37.59 | 2.33 | 11.34 |
| Vermont | 1,575 | 26.62 | 19.33 | 1.52 | 5.77 |
| Virginia | 2,714 | 25.25 | 16.73 | 4.07 | 4.45 |
| Washington | 2,055 | 31.48 | 24.77 | 1.81 | 4.90 |
| West Virginia | 1,859 | 22.69 | 15.21 | 2.52 | 4.96 |
| Wisconsin | 1,662 | 26.16 | 16.17 | 2.12 | 7.87 |
| ‡All other states | 1,844 | 69.31 | 43.46 | 1.98 | 23.87 |

*Deficit.
†Includes District of Columbia.
‡Includes Rhode Island and Wyoming.

### Assets and Liabilities.

The value of the construction and equipment of all telephone systems was $349,287,462, or 77.3 per cent. of the total assets; the value of the telephones in use was $17,274,232, or 3.8 per cent.; of the real estate owned, $22,716,538, or five per cent.; of the stocks and bonds of other corporations held by the telephone systems, $9,938,342, or 2.2 per cent. The other assets, consisting of machinery, tools and supplies, bills and accounts receivable, cash on hand and on deposit, and sundries, amounted to $52,955,972, or 11.7 per cent. of the total.

Of the total liabilities, $274,049,697, or 60.7 per cent., represented capital stock outstanding, and $73,981,361, or 16.4 per cent., outstanding bonds; the total for reserves and surplus combined was $52,364,858, or 11.6 per cent.; the amount reported for bills and accounts payable, $44,302,999, or 9.8 per cent.; the cash investment, $6,161,299, or 1.3 per cent.; and unpaid dividends, $188,067, or less than one-tenth of one per cent. Sundry liabilities, representing in many cases the value of telephones, etc., owned by individual subscribers, and also additional cash investment for incorporated companies showing stock or bonds, amounted to $1,124,265, or two-tenths of one per cent. of the total.

### New Construction.

In some systems an exact separation was not made of the expenditures for repairs, renewals and extensions, but the $51,903,021 may be accepted as a close approximation of the amount expended for new construction and equipment. Of this amount, $7,566,365, or 14.6 per cent., was expended by the systems of New York state, and $6,114,696, or 11.7 per cent., by those of Pennsylvania. In Illinois $4,472,060 was expended. Ohio, Missouri, New Jersey and Massachusetts each reported over $2,000,000 added in new construction, and Iowa, Indiana, California, Minnesota, Michigan, Kentucky and Texas each reported over $1,000,000.

### Salaries and Wages of Employes.

Of the total number of employes, 14,124, or 17.9 per cent., were salaried officials, general superintendents and clerks, and 64,628, or 82.1 per cent., were wage-earners. The salaries and wages paid during the entire year amounted to $36,255,621, of which the salaries formed $9,885,886, or 27.3 per cent., and the wages $26,369,735, or 72.7 per cent.

In many instances one employe—reported sometimes as an exchange manager, sometimes as a lineman—is engaged at a specified annual compensation to care for an entire exchange, keep the line in repair, and perform all duties incident to its operation; no operators are reported, as his family attend to the switchboard. This practice is followed in many mutual systems, and is in use also in some small commercial companies. In the smaller systems the same employe performs the duties of a foreman, inspector, lineman, wireman, battery man and trouble man—in fact, attends to the entire plant.

### Physical Equipment.

Table 3 shows at a glance a summary of the physical equipment of all systems.

Table 3.

| | |
|---|---|
| Number of systems | 4,151 |
| Switchboards, total number | 10,896 |
| Manual: | |
| Common battery | 837 |
| Magneto | 10,005 |
| Automatic | 54 |
| Total capacity of switchboards | 2,447,403 |
| Engines, horsepower | 2,750.5 |
| Dynamos, horsepower | 5,459.1 |
| Electric motors, horsepower | 4,209.8 |
| Auxiliary cross-connection boards, etc | 9,255 |
| Magneto generators, ringers, etc., in exchanges | 14,931 |
| Batteries: | |
| Primary, number of cells | 110,648 |
| Storage, number of cells | 19,001 |
| Stations or telephones, total number | 2,315,297 |
| Total miles of wire | 4,850,486 |
| Underground construction: | |
| Miles of duct | 16,474.9 |
| Miles of cable | 7,290.6 |
| Miles of wire | 1,690,502 |
| Overhead construction: | |
| Miles of single wire | 2,369,914 |
| Miles of cable | 8,104.5 |
| Circuit miles of wire in cable | 780,530 |
| Submarine: | |
| Miles of cable | 262.6 |
| Circuit miles of wire in cable | 9,540 |

### Telephones, Messages and Population in Various States.

There were approximately 2,190 messages or talks per telephone, and 34 persons per telephone, in 1902. On an average, therefore, each person used the telephone 65 times during the year. It should be noted, however, that in accepting averages based on the number of messages the fact that this number is an estimate must be given consideration.

In the states where there is a high population per telephone the same instrument is used more frequently, but the number of messages per capita is necessarily low. For instance, in South Carolina there are on the average 132 people to every telephone, 2,283 messages to each instrument, and only 17 messages per capita.

The number of telephones depends upon the density of the population and upon the character and extent of the business and industries of the locality served. The highest number of persons per telephone was 134, shown for Alabama, and the lowest, 14, for California. Mississippi, North Carolina and South Carolina had, with Alabama, more than 100 persons per telephone, while Indiana, Iowa, Ohio and Washington had, with California, less than 20 persons per telephone.

The average number of messages per person for the United States was 65. This average varied from 17 for South Carolina to 131 for Ohio. The only states or territories besides South Carolina showing an average of less than 20 messages per capita are Indian Territory and North Carolina. In addition to Ohio, the states of California, Colorado, Illinois, Indiana and Washington show an average of 100 or more messages.

While there has been a wide extension of the telephone service in the rural districts, the industry naturally shows the greatest development in the states having the greatest population and is carried to the highest point in the large cities. Of the 1,051 incorporated places in the United States having a population of 4,000 or over, 1,002 are provided with telephone facilities. In 137 of these places there is located only a telephone exchange controlled by a company operating independently of the American Telephone and Telegraph Company, in 414 there is located only an exchange controlled by that company, and in 451 there are exchanges controlled by both classes of companies.

The North Atlantic and North Central divisions

together reported 62.2 per cent. of the population, 75.1 per cent. of the telephones, and 72.1 per cent. of the messages or talks. The number of messages per capita was greatest in the North Central and Western states, and least in the South Atlantic states.

COMMERCIAL SYSTEMS.

Taking up the three classes of telephones, as laid out in the beginning of the report, separately the commercial telephones come first in rank. Some interesting data as to the localities where this class of service predominates is to be found in the bulletin.

The North Central states had the largest number of commercial systems, 1,856, or 58.8 per cent. of the total number, and they controlled 1,957,250 miles of wire, or 41 per cent. of all wire reported by commercial systems. The highest average number of messages per telephone, 3,031, is shown for the South Central states, and the lowest, 1,840, for the western. The North Atlantic states showed an average of 1,872; the South Atlantic, 2,508, and the North Central 2,329. Indiana reported 261 commercial systems, the largest number found in any one state; Illinois ranked second, with 243; Iowa third, with 241; Ohio fourth, with 236, and Missouri fifth, with 227.

In miles of wire New York state ranked first, with 621,315 miles; Ohio second, with 511,118 miles; Pennsylvania third, with 500,219; Illinois fourth, with 407,357; Massachusetts fifth, with 257,461, and Indiana sixth, with 200,379.

In number of telephones New York state ranked first, with 243,166; Ohio second, with 216,731; Illinois third, with 194,356; Pennsylvania fourth, with 185,089; Indiana fifth, with 122,799, and California sixth, with 106,181. No other state or territory reported as many as 100,000 telephones.

Of the 2,089,846 subscribers to commercial telephone companies, New York state reported 219,745, and Ohio 207,215; all other states reported less than 200,000 subscribers.

*Income.*—The total revenue derived by commercial telephone systems from all sources was $86,522,211, or an average of $38.87 per telephone. Of this amount $81,296,444, or 94 per cent., was realized from the actual operation of the commercial telephone systems. The net income amounted to $21,639,441, or an average of $9.72 per telephone, being somewhat higher than for all systems, $9.36.

*Operating Expenses.*—The total operating expenses amounted to $56,591,746, or $25.42 per telephone. All other deductions from gross receipts comprising fixed charges and dividends, amounted to $23,272,673, or $10.46 per telephone. Hence the total net surplus, after deducting charges of all kinds, was $6,657,792, or $2.99 per telephone, as compared with $2.88 for all systems.

Table 4 is an analysis of the operating expenses of commercial systems for 1902.

TABLE 4.

| | |
|---|---|
| Total | $56,591,746 |
| General operation and maintenance, including legal expenses | 40,332,620 |
| Salaries of general and other officers | 5,236,323 |
| Salaries of clerks, etc. | 4,635,273 |
| Wages | 26,206,065 |
| Maintainance, and legal expenses | 13,254,959 |
| Rentals and royalties on instruments and apparatus | 2,852,361 |
| Rentals of offices and other real estate | 2,402,676 |
| Rentals of conduits and underground privileges | 681,727 |
| Telephone traffic paid or due other companies | 436,666 |
| Miscellaneous | 815,696 |

The telephone systems in large cities are operated under conditions entirely different from those surrounding the systems in small places and rural districts. While there were 2,627 commercial systems, or 83.2 per cent. of the total number, which had their principal exchange or central in rural places, they controlled only 8.8 per cent. of the wire and 18.1 per cent. of the telephones. Their gross receipts formed only 7.6 per cent., and their expenses, including dividends paid, only 5.6 per cent. of the respective totals for all commercial systems. In other words, the systems located in the urban districts do nearly all of the commercial business. The relative activity of the urban and the rural systems is indicated by the fact that the average number of messages per telephone per year was 2,386 and 1,541, respectively. The net surplus shown for the rural systems is, however, in striking contrast with the other items, being $2,066,004, or 31 per cent. of the total for all systems.

The average gross receipts per telephone for urban systems amounted to $43.84, or nearly three times as much as the average for rural systems, which was $16.31 per annum. This wide difference between these two classes of commercial systems is due to the considerably higher rate for service charged by urban systems, because of the greater facilities furnished to the subscriber, the wider field for intercommunication, and the greater expense incident to the conduct of an urban system.

For urban systems the yearly average expense per telephone, including dividends, was $41.32, or nearly four times as great as the average for rural systems, which was only $11.17. Salaries and wages form 44.6 per cent. of the total expenses for the urban systems, as compared with 55 per cent. of the expenses for the rural systems. But there are many items peculiar to the urban systems—such as underground construction, licenses, franchise charges, special taxes, difficulties in wiring, and the large force required for the supervision of the numerous employes, etc.—which add greatly to their expenses. In some instances an entire rural system is cared for and operated [illegible]

[illegible]

MUTUAL SYSTEMS.

The mutual telephone system is the intervening stage of development between the independent farmer or rural line and the commercial system. This group includes all systems that have an exchange or central, but are operated primarily for the convenience of the owners, and not for revenue. Any deficit in the expenses of operation [illegible] by assessments on the owners, and the surplus, if any, is usually expended in improving the system. Extensions are made by connecting with independent farmer lines or at the expense of the party desiring the service. The systems included in this group had all their exchanges in cities of less than 4,000 inhabitants, and are therefore rural in character.

The growth of the mutual systems has been one of the interesting features of the development of telephony. To assist in tracing this growth, each system was requested to report the year of its establishment.

Accepting the numbers reported for each year as indicating the growth of mutual systems, it appears that between 1881 and 1895, inclusive, there were 37 such systems established, and from 1896 to 1899, inclusive, 212 systems. In 1900 there was a large increase in the mutual ownership, 181 systems being established. But the great increase began with the present century, 269 mutual systems being established in 1901 and 295 in 1902. In 1902 Iowa—probably one of the first states in which a mutual system was established—had 170 systems, or 17.1 per cent. of the total number of these systems; 159, or 93.5 per cent., were established between 1900 and 1902, inclusive. There were no mutual systems reported as in operation during the year covered by the report in Arkansas, Delaware, the District of Columbia, Indian Territory, Massachusetts, New Hampshire, New Jersey, New Mexico, Rhode Island, Utah or Washington.

*Income.*—The actual revenue derived by mutual systems from operation was $165,789, and the operating expenses amounted to $275,316, causing an operating deficit of $109,527.

The gross receipts from operation averaged $1.86 per mutual telephone, while the operating expenses averaged $3.08 showing an operating deficit of $1.22 per telephone. In addition to the operating deficit, the fixed charges were $6,685, making a total operating deficit of $116,212, which was covered by assessment. The assessments amounted to $137,536, or 45.3 per cent. of the total revenue, leaving a net surplus of $20,254, after deducting $1,070 paid in dividends by the seven companies declaring dividends.

*Operating Expenses.*—Of the operating expenses for mutual systems, salaries and wages together amounted to $177,960, or 64.7 per cent.; maintenance including legal expenses, $77,384, or 28.1 per cent.; rentals of offices and other real estate, $6,138, or 2.2 per cent.; telephone traffic paid or due other companies, $5,594, or two per cent.; rentals and royalties on instruments and apparatus, $4,652, or 1.7 per cent., and miscellaneous items, $3,588, or 1.3 per cent.

RURAL TELEPHONE SERVICE.

The telephone lines considered as independent farmer or rural lines have, as a rule, no independent exchange; are operated usually on a grounded, though sometimes on a metallic circuit, wire fences being utilized in some cases. Many of them connect with the exchanges of commercial systems, and thus, while preserving their independence for local communication, they at the same time secure the benefit of exchange facilities. These lines have had a wonderful development during the last six years, especially in the North Central states—Illinois, Indiana, Iowa, and Missouri containing 3,758 lines of this character, or 75.4 per cent. of the total number of such lines reported. Their comparative insignificance, however, made it difficult to locate them and the absence of a controlling representative rendered it almost impossible to secure definite information concerning their operation. Hence, the number enumerated cannot be accepted as the entire number in operation during the year.

The total number of lines operated primarily in rural districts was 21,577. Of this number 15,598, or 72.3 per cent., were lines owned and operated by commercial systems; 994, or 4.6 per cent., were the mutual systems, all of which are rural, and the remaining 4,985, or 23.1 per cent., were independent farmer or rural lines.

The total length of wire was 259,306 miles, or an average length of about 12 miles per line. The corresponding averages for commercial rural and for independent rural lines were 8.9 miles and 10 miles, respectively.

The total number of telephones was 266,968, giving an average of about 12 telephones to each line and a little less than one mile of wire to each telephone. The number of telephones per line numbered about eight for commercial rural lines, and about 11 for independent rural. The length of wire per telephone [illegible]

[illegible]

| | [illegible] | [illegible] | [illegible] |
|---|---|---|---|
| Number of systems | [illegible] | [illegible] | [illegible] |
| M[illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] |
| [illegible] | [illegible] | [illegible] | [illegible] |
| Manual | | | |
| Common battery | [illegible] | [illegible] | [illegible] |
| Magneto | [illegible] | [illegible] | [illegible] |
| Automatic | [illegible] | | |
| Messages or talks during the year, total number | [illegible] | 3,074,530,060 | [illegible] |
| Local exchange | [illegible] | [illegible] | [illegible] |
| Long-distance and toll | [illegible] | [illegible] | [illegible] |
| Salaried officials, clerks, etc. | | | |
| Number | [illegible] | [illegible] | [illegible] |
| Salaries | [illegible] | [illegible] | [illegible] |
| Wage-earners | | | |
| Average number | [illegible] | [illegible] | [illegible] |
| Wages | [illegible] | [illegible] | [illegible] |

The systems controlled by the American Telephone and Telegraph Company operated 69.8 per cent. of the wire mileage and 56.9 per cent. of the telephones reported by all systems; their wire mileage was more than twice as great as that of the Independent systems.

The Independent systems operated 7,076 switchboards of all kinds, as compared with 3,820 operated by the Bell systems; of the 54 automatic switchboards reported, 53 were operated by the Independent systems.

During the year covered by this report there were 5,070,554,553 messages or talks. Of this number, 3,074,530,060, or 60.6 per cent., and an average of 2,334 messages per telephone, were reported by the American Telephone and Telegraph Company's systems, as compared with 1,996,024,493, or 39.4 per cent., and an average of 2,000 per telephone, by the Independent systems.

The American Telephone and Telegraph Company's systems reported a far greater number of pay stations than did the Independent systems, but the latter operated nearly twice as many public exchanges as the former. The average amount of line controlled per exchange was considerably greater for the American Telephone and Telegraph Company's systems, being 902.7 miles, as compared with 221.3 miles for the Independent systems.

Of the total number of public exchanges or central offices, the Independent systems operated 6,608, or 63.8 per cent., and the American Telephone and Telegraph Company's systems 3,753, or 36.2 per cent.

The Independent systems operated exchanges in all the states and territories with the exception of the District of Columbia and Utah, and the American Telephone and Telegraph Company's systems operated exchanges in all save Indian Territory. There were 20 states and territories in which the exchanges controlled by the American Telephone and Telegraph Company's systems predominated, numbering 1,992, or 76.2 per cent. of the 2,615 exchanges operated in these states and territories.

## TELEPHONE MEN.

J. S. McComb of Humansville, Mo., has applied for a franchise to operate a telephone system in Rich Hill, Mo.

Tony Schaffer, manager of the Independent telephone exchange at Waxahachie, Texas, has been transferred to Ennis. Eldridge McCanless of Ennis takes the Waxahachie exchange.

H. J. Pettengill, vice-president of the Northwestern Telephone Exchange Company, Minneapolis, Minn., will assume the duties of president of the company on February 1st. C. E. Yost, the retiring president, is to be transferred to Omaha, where he will have charge of the Bell interests in that district. Mr. Pettengill, who now resides in Boston, will remove to Minneapolis.

## COMMUNICATION.

### The Word "Hello" in the Telephone Vocabulary.

To the Editor of the Western Electrician:

Concerning the word "hello" and its use in the telephone vocabulary, permit me to say that it must be evident that the use and misuse of this term are doing a great deal every day to destroy the time-saving qualities of telephone service. The man in a hurry makes a telephone call and in a very short time hears a voice and says "Hello," and the other says "Hello," or perhaps "Hello yourself," and the first man may say, "Well, I said hello." This may go back and forth a number of times before it occurs to either one to say who he is, whereupon each proceeds to make himself known after a loss of time and probably some patience. Now, if the person called in answering the telephone had immediately responded by giving his name or the name of his firm, for example, "This is Jones & Co.," the way would have been cleared at once for the transaction of the necessary business. The word "hello" would have been an interloper and as entirely out of place as it would have been in a face-to-face conversation. I believe that telephone users will save a lot of time and annoyance if they will give it up.

Now, as to the value of "Hello" or the expression "Are you there?" to be used when the telephone connection is broken.

All who are familiar with the necessarily intricate systems of signaling involved in modern telephony understand that from accidental causes wrong signals may be given to operators whereby occasionally lines are disconnected before the conversation has been finished. It is gratifying to note that statistics indicate that while this trouble never has reached a greater average than one call in 1,000, it is now decreasing. One of the most aggravating features is the fact that, when it does occur, in a large majority of cases both telephone users attempt simultaneously to re-establish the connection. You and I have been talking by telephone. We are cut off. I immediately try to get you and you immediately try to get me. The fact that I am thus making a call makes my line "busy." The fact that you are doing the same thing makes your line "busy." I am therefore unable to get you and you cannot get me because we are both "busy." If in such cases telephone users will proceed as we proceed in face-to-face conversations this will be avoided. If in a face-to-face conversation I am addressing or calling you, and something interferes to cut me off, after the interference has ceased I go ahead and address you again. This may occur many times every day. In the case of a conversation by telephone, if I have called for you and we have been cut off, you will know that I will call for you again to re-establish the connection and finish the conversation. If you will, therefore, hang up your telephone and leave your line disengaged it will make it possible for me to reach you. When this is done and you are again called if you respond with your own name, I have instant assurance that the connection is re-established, and here again the use of the word "hello" is superfluous.

A. S. Hibbard.

Chicago, January 16, 1905.

[Mr. Hibbard speaks as an expert, of course, and his views are entitled to much respect. But it will be difficult, we fancy, to eradicate the familiar and homely "Hello" from the telephone service. Is it not the lubricant on the ways of the telephone conversation? Will not its abolition, telephonically, result in more cumbersome phrases? We shall be glad to have the views of other telephone managers and users on this subject, which is not only of general interest, but of considerable importance as well.—Ed.]

### Everett-Moore Syndicate Released from Trusteeship.

The release of the Everett-Moore syndicate from the hands of trustees, which was formally agreed upon a few days ago, places the telephone business in Ohio upon a different basis from what it has been for the last three years. The debt of the Federal Telephone Company is now less than $3,000,000 and the entire liabilities of the syndicate have been reduced from $17,000,000 to $4,000,000. To Col. F. S. Dickson is due in a large measure the success of the plans to emancipate the syndicate, but other members, including Messrs. Everett, Moore, Mahler, Wason, Hanna and Hoge, have carried forward a great part of the business and took the lead in the various transactions that have made it possible to reduce the debts in this manner. The properties of the Federal Telephone Company will now be looked after by the syndicate, and all that can be done in the way of development will be done.

The South McAlester-Eufaula (Texas) Telephone Company has been reorganized with William Busby, president; C. E. Foley, vice-president; L. H. Roberts, secretary, and D. M. Hailey, treasurer. The company owns several hundred miles of telephone lines in Indian Territory, and will expend $50,000 in improvements, installing the central-energy system.

### The Telephone in Kansas.

The Portland Mutual Telephone Company of Portland has made arrangements with the farmer's mutual company for connections at South Haven.

The citizens of Coldwater are organizing a company to build farmers' lines to connect the country surrounding.

The Medicine Lodge Telephone Company expects to build several rural lines in Barber County. It has a toll line to Coldwater and Lake City.

The St. Johns Telephone Company has moved its office since the late fire and is connecting up about nine rural lines.

The Mulvane Mutual Telephone Company has been organized by the business men of Mulvane to build an exchange in the city and connect with the farmer's rural lines that are being built in the surrounding country.

The Southwestern Telephone Company, with headquarters at Anthony, is rebuilding its exchange at Harper, having completed the work on the home exchange. It has an exchange at Enid, O. T., of 2,000 subscribers.

George W. Brown, general sales agent of the Chicago Telephone Supply Company, Elkhart, Ind., has been working in the territory of Oxford and Burton this week, meeting with good success.

H. B. Hewitt, western representative of the Stromberg-Carlson Telephone Manufacturing Company, with headquarters at Chillicothe, Mo., spent Sunday in Winfield looking after his interest in this section.

A fire in the Colorado Building at Arkansas City destroyed six 100-pair cables for the Missouri and Kansas Telephone Company and seven for the Independent company. An estimated damage of about $100,000 was done by the fire.

In addition to its new 5,000-section board at Wichita the Missouri and Kansas Telephone Company is installing a 200-section central-energy-type board at Mulvane. Power will likely be furnished at Wichita and transferred to Mulvane, a distance of about 15 miles.

Manager Pettyjohn of the Dodge City Telephone Company of Dodge City is overhauling the entire system and expects to replace nearly all wires with cables. He expects to extend the toll line to Ford City and Bucklin.

Final contracts have been signed for a trunk line of the Union Telephone and Telegraph Company to extend from Abilene south through Marion, Newton, Hutchinson, Wichita and thence to Oklahoma. This company has at present a direct line into Kansas City and its proposed line will give all Independent companies of Southern Kansas and Oklahoma direct connections with the East. K.

### Telephone News from the Northwest.

The City Council of Fargo, N. D., has refused the Tri-state Telephone Company permission to establish an exchange or a toll station in that city. The company can build a line through the city only after costly condemnation proceedings. The city will resist, having filed a demurer.

The Citizens' Telephone Company of Montevideo, Minn., has declared a semi-annual dividend of three per cent.

The Northwestern Telephone Exchange Company is expecting to extend its lines west from Jamestown, N. D., to Bismarck this season.

The Rhinelander Mutual Telephone Company of Rhinelander, Wis., announces a new schedule of rates, adding 25 cents a month to all business and residence telephones.

It is expected that the projected telephone line will be built in the spring to connect Pierre, S. D., with Rapid City.

The Red River Valley Telephone Company has bought the exchange at Mayville, N. D., making eight stations owned by this company.

A rural telephone line is proposed from Little Falls, Minn., through Belle Prairie and Green Prairie.

The City Council of Faribault, Minn., has granted a franchise for a local exchange to the Rice County Rural Telephone Company.

A local telephone company has been organized at Minnesota Lake, Minn., by E. A. Brecht and others, and a franchise has been granted.

John A. Peterson, proprietor of the local exchange at Wimbledon, N. D., will build a line to Spiritwood Lake, and also to connect with the long-distance system of the Northwestern Telephone Exchange Company.

The directors of the Marquette County Telephone Company at Ishpeming, Mich., have declared a dividend of 10 per cent.

A company is being formed at Buffalo Gap, S. D., to construct rural lines to the various ranches.

New Amsterdam, Wis., a small town near La Crosse, Wis., is to have a local exchange installed, to connect with the La Crosse Telephone Company.

The South Dakota Legislature will consider a bill which requires telephone companies operating in the same territory to make joint rates and connecting arrangements.

The Tri-city Telephone and Telegraph Company has been granted a franchise through Buffalo, Minn.

B. C. Way and others have incorporated the Flat Independent Telephone Company of Britt, Iowa, with a capital stock of $12,000.

The Iowa Telephone Company is planning to entirely remodel its system at Oskaloosa, Iowa, at a cost of $15,000.

The Sheldon (Iowa) Telephone Company has been granted a franchise. R.

### Indiana Telephone Items.

The Otter Creek Telephone Company, which proposes to construct, maintain and operate a telephone system in Vigo County, with the principal exchange and office in Edwards, was incorporated recently. The capital stock is $12,000. W. T. Carty, G. L. Stevenson and S. D. Humphrey are the incorporators.

The Home Mutual Telephone Company of Stoney Point has increased its capital stock from $10,000 to $30,000. William B. Anglin, president, announces that the company will make extensions and install modern appliances.

John L. Horney, owner of the Home Telephone exchange at Clinton, has asked permission of the City Council to put in an underground system. The business of the exchange has grown so rapidly that sufficient wire room cannot be found in the city. Mr. Horney says he will organize a stock company and greatly increase the business in that territory.

A radical competition is expected to be waged in Crawfordsville with the opening of the new exchange of the Central Union company. It is estimated that the Central Union will have spent $100,000 by the time the new system is completed. Solicitors are offering citizens free telephones for two months and other inducements. Before the Central Union company commenced its improvements the Home company had 1,500 telephones in operation and the sympathy of the citizens generally. The Home company has executed a coup on the opposition by assuming control of the Co-operative company's system, which has some 500 telephones in the county, thus giving a complete county service without toll charges and at greatly reduced monthly rates. There is considerable speculation as to where and how the Central Union will obtain its patronage.

The New Long-distance Telephone Company of Indianapolis has completed its line to Bloomington. The company will now build a line from Bloomington to Bedford and thence to French Lick Springs.

The Wabash City Council at its last meeting rejected the franchise submitted by the Central Union Telephone Company. The Home company ordinance limits the rates to $2 and $1.50, respectively, but there was no rate limit in the ordinance rejected. The council called up the ordinance granting the Central Union company a franchise on the same terms as that granted to the Home company, and a resolution passed directing the Bell people to accept its terms or vacate the streets. Encouraged by the action of the council, the Home company increased its capital stock from $20,000 to $50,000, and will put in a $10,000 switchboard at once.

The Indiana Appellate Court has rendered a decision holding a telephone company liable for a personal injury when it extended its wires across private property in such a manner as to come in contact with electric-light wires. The fact that the contact was due to a storm did not relieve the company from liability for its negligent omission, since such companies must reasonably expect storms and their action should be guarded against. S.

### Ohio Telephone Notes.

The Cleveland Telephone Company (Bell) has begun a new system of rates which is a cut from former figures, but it is not believed that the Cuyahoga company will attempt to meet the competition. Some time back the Cleveland Telephone Company made a rate of 50 cents a month for residence extension-set service, and this last move is said to contemplate a still lower rate. The Cuyahoga Telephone Company has for some time gone on in its own way securing business and has given little attention to other than this. The management realizes that it is necessary to make a certain profit on the business, and it seeks to make the service worth what is charged.

Within the last year the United States Telephone Company has added about 150 miles of new lines to its system. Connections have been made with the Indiana lines and with Wheeling, W. Va.

A telephone system has been established at Austinburg and connections made with Ashtabula. Connections may also now be established through a number of other lines with several other towns.

At the annual meeting of the stockholders of the Peninsular Telephone Company of Florida, held at Wapakoneta, a few days ago, it was decided to enlarge the exchange at Tampa and several other towns and to build more toll lines. Senator W. G. Brorein was elected president. The lines will likely be extended to Jacksonville within the next year.

An increase of capital stock from $3,000 to $5,000 has been made by the Newcastle Telephone Company, Newcastle.

The Marietta Telephone Company of Marietta has notified the secretary of state of an increase of capital stock from $50,000 to $100,000.

A private exchange, connected with the Bell system, has been installed in the offices of the Ohio Central Railway Company at Columbus. This will be connected with the outside service by eight trunk lines, and is probably a part of the private long-

distance system that is to be used on this and the Hocking Valley road.

The Cleveland Stock Exchange has installed a long distance booth on the floor of the exchange, so that connections with any other city may be had without delay.

Arrangements have been made by the Belmont Telephone Company of Bridgeport to make important extensions to its line in the near future. The Ohio Valley Telephone Company of Bellaire will become a part of this system on April 1st.

H. M. Shellhamer, A. F. Turner and other have incorporated the Bremen Telephone Company of Bremen, with a capital stock of $5,000.

The Rushville Telephone Company of Rushville has been incorporated with a capital stock of $5,000 by B. A. Thomas, C. E. Linville and others.

O. P. Scott, W. O. Downing and others are the incorporators of the Huntsville Telephone Company of Huntsville, with a capital stock of $5,000.

The New Lyme Telephone Company of New Lyme has increased its capital stock from $600 to $3,000.

C.

## Michigan Telephone Matters.

The farmers of Johnstown Township, near Battle Creek, have organized and built a township telephone system of their own, which will have a central exchange and connect with other lines via the Independent state telephone line at Battle Creek. It is understood that other townships are ready to try this plan as soon as it once proves a success.

It is understood that the Michigan State Telephone Company will cut rates at Marshall in competition with the Independent telephone companies now located there.

The Livingston Mutual Telephone Company has just held its annual meeting at Howell and the following-named officers were elected: President, H. W. Norton of Marion; vice-president, E. A. Kuhn of Gregory; secretary, H. E. Reed of Marion; treasurer, A. J. Van Patten. The company has 240 stockholders at present.

The directors of the Michigan State Telephone Company met in Detroit last week and declared a quarterly dividend of 1½ per cent. on the preferred stock. The company has, it says, expended over $600,000 in the maintenance of plants in the various parts of the state in addition to the operating expenses. It declares that it has also paid out for new construction and betterments $1,000,000 to meet the growing demands upon its system. N. W. Harris, the banker-broker of Chicago, who is chairman of the board of directors, asserts that the company is in a prosperous condition and that the growth of the telephone business throughout the state has been remarkable.

The new Home Telephone Company of Cassopolis has been incorporated with a capital of $25,000.

W.

## Southeastern Telephone Developments.

It is given out that the Bell Telephone Company at Jacksonville, Fla., has been granted the right to absorb the defunct Jacksonville Telephone Company, and that $30,000 will be expended by the Bell company in improvements in the city. The enlarged capacity will be 5,000 telephones.

The town of Opelika, Ala., has refused a franchise to a second applicant for telephone privileges, stating that the use of one system was regarded as more satisfactory. The Bell company owns the local exchange.

The Common Council of Lynchburg, Va., having granted a 35-year franchise to the Southern Bell Telephone Company in that city, the matter is now with the Board of Aldermen for a decision. A restriction of rates is stipulated according to the number of telephones in use.

The local telephone company at Chester, S. C., has circulated a petition, which has been largely signed, against the entrance of another company. The concern seeking admission is the Bell company.

The Southern Bell Telephone Company is extending its lines from Bessemer, Ala., to Virginia mines.

The Piedmont Telephone Company at Lincolnton, N. C., has effected a compromise in the proposed increase of rates by agreeing to allow rates to remain as at present until a metallic circuit is put in.

L.

## Telephones for Train Dispatching.

Many of the steam railroads are successfullly using telephones in the transmission of train orders and messages relating to railroad business. At a recent conference of the dispatching forces of the Baltimore and Ohio railroad a set of rules and forms was arranged to reduce the method of handling trains by telephone to a standardized system. Charles Seldon, superintendent of telegraph, was chairman of the conference, and it is the expectation that every non-telegraph station that has a passing siding will be fitted up with a telephone connection to the nearest telegraph office. This will enable the transmission of train orders from the telegraph office to the train crews at such sidings direct, or to an employe stationed there for that purpose. For some time the Baltimore and Ohio has been extending the use of the telephone [illegible] headquarter[illegible] means of the [illegible] circuit have been [illegible] tion of the system.

## South Dakota Telephone Association.

The South Dakota Telephone Association met in Sioux Falls on January 11th, 12th and 13th. The meeting was to have opened in the afternoon, but the delayed trains detained a number of delegates and the association did not [illegible] readily after the hour of [illegible] tendance from all parts of the state. Routine business matters occupied the first meeting.

In the evening of January 11th there was an address by I. J. Kusel of Chicago upon "Automatic Apparatus and Its Relation to the Manual, and Vice Versa." H. J. Menhennick of Sioux City, Iowa, spoke upon "Cable Construction and Electrical Engineering as Applied to the Telephone." These two papers aroused much interest. Other addresses were: "Telephone Construction," by J. T. L. Zietlow of Aberdeen, S. D., of the Dakota Central Telephone Company; "Farmer Lines," by J. A. Steninger of Parker; "Forecast of the Future Life of Telephone Construction as Applied to Local Exchanges," J. J. Nate of Minneapolis; "Cedar Poles," H. S. Gilkey of Minneapolis. Two unassigned subjects—"Central Energy" and "Care of Switchboards"— had been named for discussion. These were handled by Mr. Clark of Chicago.

The morning of the 12th and most of the afternoon were devoted to an inspection of the apparatus which was on exhibition at the convention by various manufacturers. The final business session resulted in the selection of Sioux Falls as the place of holding the next annual convention, to meet on the second Wednesday in January, 1906. The election of officers resulted as follows: President, C. B. Kennedy of Canton; vice-president, J. A. Steninger of Parker; secretary-treasurer, H. B. Hartwell of Irene (re-elected).

The convention closed with a banquet at the Cataract Hotel, at which there was an attendance of about 40 telephone men. Addresses were made by President Kennedy, I. J. Kusel of Chicago, H. J. Menhennick of Sioux City, J. J. Nate of Minneapolis and R. R. Crothers of Hetland, S. D.

## EXTENSIONS AND IMPROVEMENTS.

The city of Tuscumbia, Ala., is said to have granted a 25-year franchise to John C. Monteith of Chicago, giving the power to erect and operate a telephone system in the city.

It is reported that the telephone company now being organized in the United States by Dr. Bourns will be ready to begin operations in Manila, P. I., not later than May 1st of this year. It is the intention to put in a conduit system.

The Southern Bell Telephone and Telegraph Company, with general offices at Atlanta, has secured a 30-year franchise to operate a telephone system at Lynchburg, Va. It is said the company will erect an exchange at a cost of $100,000.

The county commissioners of Thurston County, Wash., have granted a permit to the People's Cooperative Telephone Company of Centralia, Wash., for the use of county roads for a period of 40 years, between Chehalis and Olympia, and between Chehalis and Oakville, to construct and maintain telephone lines.

The Suburban Telephone Company of Clayton, Mo., has completed making its connections with the Kinloch system in St. Louis, thus bringing the residents of Clayton in direct communication with all telephones belonging to the Kinloch company. The service in the county will be free, with a toll of 10 cents for connection with St. Louis. The Suburban company has in use exclusively automatic telephones, similar to the system in Chicago.

Superintendent J. W. Lindsay of the Patersón, Passaic and Suburban Telephone Company of Paterson, N. J., announces that about March 1st the new telephone exchange and offices of the company will be opened in the Smith Building. A modern switchboard and telephone plant of 5,000-subscribers capacity is now under construction and being installed. The instruments at the subscribers' stations will be changed as rapidly as possible, which is also true of the wire and cable systems.

## MANUFACTURERS AND DEALERS.

Among recent Illinois incorporations is the Guarantee Telephone and Equipment Company of Chicago, capitalized at $2,500. The company purposes to manufacture telephones and electrical supplies. L. Anderson, Albert Duce and D. E. Turner are the incorporators.

"Telephones and Telephone Apparatus" is the title of a tasteful bulletin just issued by the Utica Fire-alarm Telegraph Company of Utica, N. Y. A complete line of all manner of telephone apparatus and supplies is listed and the various types are clearly described and the bulletin is well illustrated.

## GENERAL TELEPHONE NEWS.

[illegible]

ating lines in the state, to keep their offices open all day and all night in cities of 9,000 or more inhabitants.

The joint meeting of committees representing the National and the Interstate Independent telephone associations, which was to have been held at the Claypool Hotel in Indianapolis on January 14th, was postponed one week [illegible] to adopt plans for merging the two associations.

A meeting of the executive board of the Ohio Independent Telephone Association was held in Columbus a few days ago, and arrangements were made to hold the annual meeting on March 30th. An interesting programme will be arranged for the occasion and it is expected that some excellent addresses will be made. President James B. Hoge of the National association is spending quite a little time in the advancement of the association work, both in Ohio and over the country.

Senator Clark of Kansas City has a bill before the Missouri Senate giving cities in the state of 100,000 population and over the right to fix charges to be made for the use of telephones. The bill affects St. Louis, Kansas City and St. Joseph. In the same bill the right to regulate the price of water and electric lights is given in the same cities. The principal clause is directed at the telephone companies, it having been charged that the rates on telephones were exorbitant in view of the cheapness with which they are now constructed and operated, and in view of the valuable franchises they hold, from which the cities derive little revenue.

## Gasoline-engine Unit for Lighting Service.

The use of gasoline engines for operating independent electric-lighting plants is becoming more general, and in some cases they have proved to be strong competitors of the best type of steam engines. The improvement in regulation in both engine and dynamo has made it possible for the best type of gasoline engine to meet the exacting specifications required for satisfactory electric-lighting service. A

GASOLINE-ENGINE UNIT FOR LIGHTING SERVICE.

combination of engine and dynamo, direct connected, as shown by the accompanying picture, was installed a short time ago in one of the forts of the United States government and successfully met all the requirements specified by the government engineers. The engine is of the four-cycle type and manufactured by the Charter Gas Engine Company of Sterling, Ill.

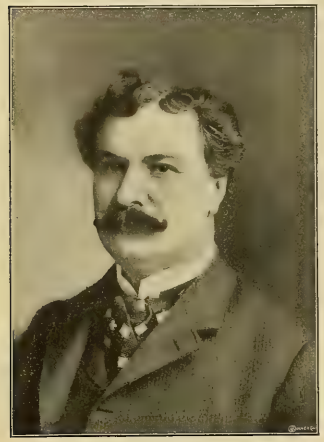
The campaign recently inaugurated by Mr. Henry L. Doherty, committee on membership for the National Electric Light Association, is accomplishing the prompt and satisfactory results that usually follow Mr. Doherty's undertakings. Among those recently added to the membership list are Sidney Hosmer, William H. Atkins, W. P. Hancock, G. M. W. Goettling and La Rue Vredenburgh of the Edison Electric Illuminating Company of Boston, Prof. George D. Shepardson of Minneapolis, Frank W. Frueauff of the Denver Gas and Electric Company, and Frank H. Taylor, G. B. Griffin, B. G. Lamme, C. F. Scott, K. C. Randall (all of Pittsburg), T. P. Gaylord (Chicago) and W. S. Rugg (New York) of the Westinghouse Electric and Manufacturing Company.

## Fort Wayne Electric Agents' Convention.

The Fort Wayne (Ind.) Electric Works is one of the oldest concerns in the country now engaged in the manufacture of electric-lighting and power apparatus. It is probably best known to the electrical interests of the United States, if not the world, as the manufacturer of the "Wood" systems of electric lighting and power, which may be found in use in a large number of plants. "Wood" electric-lighting generators and arc lamps were among the pioneers in the industry and have always maintained the distinction of receiving a ready reception from the users of that class of apparatus.

The original company from which the present concern has been developed was formed in Fort Wayne in 1881 to manufacture electric-lighting apparatus and was called the Fort Wayne Electric Light Company. Its history has been marked by successive changes in name from the original name to Fort Wayne Electric Company in 1889, Fort Wayne Electric Corporation in 1894, and to the present name in 1899.

The part this company has taken in the development of the electrical manufacturing industry of this country has been in no small way due to the thorough and skilled designing ability of Mr. J. J. Wood, who is today recognized as one of the foremost inventors in the arc-lighting field of this country, in which he was a pioneer in 1879. Modern demands on electrical engineers, both in the lighting and the power applications of electricity, have been met and often anticipated by his tireless genius and strong personality showing in the products of the Fort Wayne Electric Works.



J. J. WOOD.

The extent of territory covered by the sales organization reaches from Boston to San Francisco and from St. Paul to Atlanta. The modern methods of a progressive business enterprise are well illustrated by the periodical conventions at Fort Wayne of the district managers of the various sales territories with the home-office organization of this company.

Beginning Tuesday morning, January 10th, and closing Friday following, the daily business sessions of the sales forces were relieved by evening social functions of an enjoyable nature. Representatives from Boston, New York, Philadelphia, Syracuse, Pittsburg, Atlanta, Cincinnati, Grand Rapids, Chicago, St. Paul and St. Louis discussed matters of common interest on the ground of the central organization. The social features of the convention were distributed over the period covered by the sessions, several of the Fort Wayne hosts entertaining the visitors at their homes.

The closing feature of the convention was a banquet at the Anthony Wayne Club, at which over 50 of the sales force joined in disposing of a good dinner, presided over by Judge R. S. Taylor, who has been counsel for the company ever since its infancy. Guests from Fort Wayne included the local directors and others interested in local electrical organizations. Those from the district offices attending the banquet were J. Allen Smith, Boston; J. C. Lott, New York; T. L. Sturgeon, Philadelphia; C. A. Woolsey, Philadelphia; E. H. Porter, Philadelphia; A. E. Dresser, Syracuse, N. Y.; F. S. Nicholson, Syracuse, N. Y.; J. E. Hall, Pittsburg; T. J. Ryan, Cincinnati; G. B. Edgar, Cincinnati; James O. Spear, Atlanta, Ga.; W. S. Goll, Chicago; Frank McMaster, Chicago; C. E. Sedgwick, Chicago; W. C. Knight, St. Louis; A. H. Savage, St. Paul, Minn.; A. L. Searles, Grand Rapids, Mich.

During the evening the district managers, as an expression of their appreciation and esteem for the one who is responsible for the products they handle, presented to Mr. J. J. Wood a handsome loving cup through their spokesman, Mr. W. S. Goll, manager of the Chicago office. Mr. Wood has been with the Fort Wayne company since 1890, when he went to Fort Wayne from Brooklyn, where he was manufacturing his arc dynamos and lamps, when the Fort Wayne company purchased the Brooklyn plant and Mr. Wood transferred its machinery and men for making his arc-lighting apparatus to Fort Wayne. He immediately assumed charge of designing new electrical apparatus and redesigning the old apparatus and electrical devices already in production by the company. Numerous new designs were the result of his inventive genius, and electric-lighting supplies were made in a more perfected form than ever before. The company advanced rapidly in the electrical manufacturing field and "Wood" systems became widely used in electric lighting and power. That they are today in such extensive use is due primarily to the thorough and skilled designing ability of Mr. Wood. It was in recognition of this that the district managers of the company presented him the beautiful testimonial mentioned.

## Westinghouse Railway Motor.

In general design the Westinghouse No. 92 A motor closely resembles Nos. 93 and 101 B, and incorporates the many improvements which were first introduced in those motors. Fig. 1 gives a good idea of its general appearance. The motor is designed for city and suburban service. In city service a double equipment of these motors is suitable for operating single or double-truck cars not exceeding 30 feet over all and weighing without equipment or load from 14,000 to 15,000 pounds. In this service, with runs from one-eighth to one-quarter mile in length, a two-motor equipment, with gear ratio of 14 to 68, will produce schedule speeds of 10 to 13.5 miles per hour, assuming a pressure of 500 volts and a straight, level track. A four-motor equipment in the same service will operate a double-truck car not over 40 feet in length and weighing 30,000 pounds, attaining practically the same schedule and maximum speeds, as stated above.

The nominal rating of the motor is 35 horsepower for one hour, but this rating is only an approximate indication of its suitability for a given service. A decision in regard to the proper motor for any particular set of conditions requires a careful study and a knowledge of the characteristics of motors of each capacity. The curve (Fig. 2) shows the performance characteristics for one-gear ratio, and the performance curves furnish the proper data for judging of the operation of the motor in a given service. The motor has a continuous capacity of 30 amperes at 300 volts or 28 amperes at 400 volts. In service it will safely develop any output shown on the curves, provided the integrated heating effect does not exceed that produced by continuous operation at a load requiring either of the above currents at the corresponding voltage. At the close of a shop run of 24 hours at either of the loads stated above the temperature rise in the windings, as measured by a thermometer, will not exceed 75° C. In actual service under a car the better ventilation will usually reduce this rise to 55° C. Heavier loads may be carried for periods of varying length, as determined by the time-temperature curves, these curves being based on a rise of 20° C. in the interior of the motor coils. For example, if the motor had been running under a load of 28 amperes at 400 volts for a sufficient time for the temperature to rise to 75° C., it may then be operated for two hours at a load of 33½ amperes, or for one-quarter hour at a load of 59 amperes. The temperatures assumed are entirely safe and do not subject the insulation to injury or rapid deterioration.

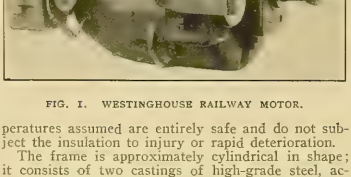


FIG. 1. WESTINGHOUSE RAILWAY MOTOR.

The frame is approximately cylindrical in shape; it consists of two castings of high-grade steel, accurately milled on the common surface to secure a good joint. Ready access to the commutator and brush-holders is provided by a large opening in the upper frame; this opening is closed by a dustproof lid held in place by a cam-locking device.

There are four poles projecting inwardly at angles of 45 degrees with the horizontal. Each is built up of carefully annealed soft-steel punchings, riveted together between end-plates of wrought iron and bolted to the frame. The retaining studs pass well into the punchings and terminate in a special rivet. This arrangement holds the pole firmly, yet leaves the pole face smooth and unbroken.

The field coils are wound with copper strap insulated with asbestos and mica and protected by several layers of tape. They are repeatedly dipped and dried and thoroughly impregnated, the process resulting in a solid coil, thoroughly weatherproof and practically indestructible. The coils are straight and, being machine wound, are interchangeable. Flat steel springs between coils and frame prevent looseness, due to shrinkage. The coils are protected by leatheroid and oiled-duck washers and are held in place by the spreading tips of the poles.

The armature is of the slotted drum type. It is built up of circular punchings of soft steel on a cast-iron spider and held between end-plates. The steel in every armature is carefully annealed by a process which gives it permanent magnetic qualities. The punchings rest on ridges on the spider, and the grooves between the ridges are open to the air at the pinion end. Air ducts between the stampings connect with these grooves, and thus air is continually drawn in through them and forced out against the pole-pieces and field coils, producing a uniform temperature throughout. The diameter of the armature is 13 inches.

Hard-drawn copper is used for the commutator, which is of the straight-bar type, without necks, and is built up with 123 bars, separated by segments of soft amber mica, and clamped on a bushing between V-shaped surfaces, from which they are insulated by specially molded mica. The wearing surface is nine inches in diameter and 3 9-16 inches long. The wearing depth is fully five-eighths inch. The complete commutator is forced on the armature spider under pressure and prevented from turning upon it by a steel key.

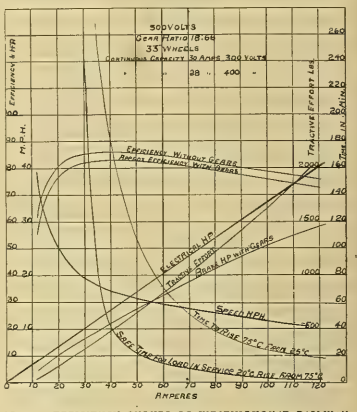



FIG. 2. EFFICIENCY CURVES OF WESTINGHOUSE RAILWAY MOTOR

Two cast-brass arms firmly fastened to the upper frame by bolts carry the brushes. They are well insulated by means of washers of treated fullerboard and radial adjustment is provided to compensate for wear of the commutator. The holders are of the sliding type. Each arm carries two spiral brush springs, each of which bears upon a separate brush.

The armature bearings are of liberal size. The bearing at the commutator end is 6½ inches long with three-inch bore, and that at the pinion end 7½ inches long with three-inch bore. Each bearing consists of a cast-iron bushing in one piece lined with babbitt. Each bearing is carried in a housing of cast iron, the seat of which is turned to a cylindrical shape and is clamped between similar surfaces on the two halves of the frame.

The motor is designed for cross-bar suspension. A rectangular suspension bar supported over the truck frame is bolted to special lugs on the front corners of the upper field frame. A pinion of forged steel with machine-cut teeth is keyed to the shaft and held on a taper seat by a nut and lock washer. The gear is made of cast steel, in two parts, which are bolted together and keyed to the axle. The face is five inches. Gear ratios of 15 to 69 to 26 to 58 may be used; 15 to 69, 18 to 66 and 22 to 62 are standard.

Approximate weights of the motor are as follows: Motor alone, without gears and gear case, 1,995 pounds; motor complete, with gears and gear case, 2,320 pounds; armature complete, with commutator and windings, 475 pounds.

The approximate weight of a two-motor equipment with two controllers and the usual details is 5,680 pounds. A corresponding equipment of four motors, controllers, etc., will weigh approximately 10,900 pounds.

## Proposed Indiana Legislation.

Bills introduced in the Indiana Legislature last week were as follows: One to repeal the law authorizing towns, cities and townships to vote subsidies to steam and interurban railroads; three separate bills to limit the speed and regulate the use of automobiles on the public highways; one to give cities power to require railroads and interurbans to sprinkle the street crossings, and a bill providing that no city will have the right to grant a franchise for heat, light, telephone, telegraph, water, gas, power, electric or steam railroads for more than 25 years, and every city will have the right at the end of this time to purchase such utilities at a price based on the actual value of the tangible property.

## Benjamin "Arc-Burst."

The fixture illustrated herewith represents a novel and useful application of the Benjamin [illegible] cluster. It is called the "Arc-burst Cluster" and is manufactured by the Benjamin Electric Manufacturing Company of Chicago and New York. By grouping a number of 25 candlepower Meridian lamps in a circle under a double porcelain shade with a 55 candlepower Meridian type lamp located centrally under a prismo reflector, a powerful and well distributed light results. The lamps are frosted and therefore the quality of light is excellent. The form of this cluster is such as to produce an ornamental and pleasing effect. This device is said to be replacing arc lamps, as the energy consumed is much less than that of an ordinary enclosed arc lamp.

BENJAMIN "ARC-BURST."

It is also cheaper in first cost and is considered more ornamental. Actual experience has demonstrated the excellence of this light for displaying goods of various kinds. This is especially true in art galleries. A further advantage is that while the cluster is ordinarily furnished in six or seven lights, it can be furnished with as few as four lights effectively, which further reduces the cost of operation and is especially adapted for places where less amount of light is required than that furnished by an ordinary arc light.

## General Electric Salesmen Meet in Chicago.

The annual meeting of the western salesmen of the General Electric Company, attended also by a number of technical men from the factory, was held at the Grand Pacific Hotel, Chicago, last week, beginning on Monday and ending Friday night. The meeting was an educational one, nearly all branches of the electrical industry being represented by speakers. At the meetings technical papers were read by men especially versed in the subjects assigned to them, and the discussion, being on the details of modern electrical machinery, and covering a wide range of commercial conditions, brought out an interchange of knowledge and experience of much value to those present.

Those who attended the meetings from out of town included W. G. Corey, F. G. Vaughn, P. D. Wagoner, H. W. Hillman and E. P. Edwards of Schenectady, N. Y.; S. D. Gilbert and H. C. Houck of Cincinnati, Ohio; L. M. Paige of Grand Haven, Mich.; J. H. Livsey and M. B. Beattie of Detroit, Mich.; J. B. Tingley of Oshkosh, Wis.; W. F. Smith and C. W. Halsey of Minneapolis, Minn.; G. D. Rosenthal, C. R. Croninger and William Hand of St. Louis; C. W. Hough of Joplin, Mo.; George A. Seabury of Omaha, Neb.; J. F. Schaefer of Kansas City, Mo.; C. H. Alexander of Helena, Mont.; O. E. Turner of Oklahoma City, and H. L. Monroe and A. H. Feineman of Dallas, Texas.

Among those who participated in the meeting from the Chicago office were Western Manager B. E. Sunny, J. W. Johnson, manager power and mining department; S. F. Dibble, small motor department; James Lyman, engineer; J. Scribner, manager lighting department, and F. N. Boyer, manager supply department.

The meeting was brought to a close on Friday evening with a dinner at the Grand Pacific, presided over by Mr. Sunny. After dinner a theater party was enjoyed.

## "Firefly" Lamp Flasher.

A unique, simple [illegible] for automatically flashing a number of ordinary electric lights has recently been invented by Dr. C. O. Schneider of 84 Adams Street, Chicago. It will flash from one to [illegible] lamps, six or less eight-candlepower lamps, one, two or three 16-candlepower lamps [illegible] lamp from 20 to 30 times a minute on either direct or alternating current. The lamps remain bright considerably longer than they are [illegible] can be partially regulated by means of an adjustment screw.

There is, as shown in the accompanying illustration, a coil of fine wire surrounding two pieces of metal having different coefficients of expansion.

"FIREFLY" LAMP FLASHER

These strips are riveted together and fastened to the base at one end. The other end is free and contains a platinum tipped screw directly above a platinum disk, which is mounted on a binding post below. These form the points of contact that are operated by the mechanism. One end of the fine wire is fastened to the fixed end of the metal strips, while the other is secured to the binding post below, thus forming the circuit while contacts are separated. The fine wire coil resists the current to such an extent that the lamps do not glow, although a slight amount of electricity is still passing. This resistance in the coil creates heat, which causes the metal strips to expand lengthwise, but being riveted together and the top piece expanding most the motion is of necessity downward, thereby causing the connection to be made between the screw in the free end with the binding post below. The effect of this is to short-circuit the coil, cutting out all resistance, and the current passes through the metal strips, lighting the lamps. There is now no more current passing through the coil, so it begins to cool, the metal contracts and the connection is soon broken, so the lamps go out. When the contact is broken the current immediately passes through the coil again and heat is produced, causing expansion and the connection is again completed.

There is nothing to get out of order and as the contacts are heavy platinum it should continue to alternately make and break the current indefinitely. It is easily connected; all that is necessary is to cut a wire leading to the lamp and fasten an end under each nut. After waiting a minute or two for the coil to warm up the lamps will commence to flash. Then without any more attention the device will continue to perform its function for months, saving current and at the same time attracting a great deal of attention. On account of the intermittent flashing the device, which is for sale by the inventor, has been called the Firefly flasher.

## Business Opportunities Abroad.

The city of Reichenberg, Bohemia, Austria, will erect large electric works.

A large electrical central station is to be built at Stanz, on Lake Lucerne, Switzerland.

The municipality of Oberurnen, Switzerland, contemplates the erection of electric works.

The city of Lugano, Switzerland, has just voted $372,000 for establishing an electric plant.

The municipality of Valladolid, Spain, will receive bids to erect an electric plant for lighting the city.

The construction of an electric plant for lighting the city of Salamanca, Spain, is to be awarded by contract.

The governmental construction bureau of Servia at Belgrade will contract for a large quantity of telephone materials and cement, plates, etc.

The government of Victoria, Australia, plans the construction of an electric tramway between St. Kilda and Brighton Beach, to cost $455,000.

An electric power station for the Danube Canal is to be built. Application for information should be made to the Danube Commission, No. 1 Kaiser Ferdinandplatz, Vienna, Austria.

"Haag Tamway Maatschappy," at The Hague, Netherlands, will receive bids for supplying 25 electric motor cars. The director of this company will furnish particulars to inquirers.

Concessions for the building of electric railways have been asked for by the city of Vigo, Spain, by the Sociedad Colonia Sanatorio de la Playa de la Malvarrosa, and by the Compañia Eléctrica Madrilena de Tracción, for city tramways in Madrid. Particulars may be obtained by addressing "Dirección General de Obras Públicas," Madrid, Spain. An electric tramway is to be established between Badajoz and Cuesta de Castilleja, and another is to be built between Azcoita and Zumaga.

## Telegraph Systems in the United States.

[illegible]

number of miles of wire in operation is more than [illegible] times, and the receipts from messages more than [illegible]

The wire mileage in operation in 1902, exclusive of 16,677 nautical miles of cable, was 1,027,137 miles greater than [illegible]

[illegible] 287, for which the receipts were $29,118,089. This includes 820,498 cable messages, for which receipts were [illegible] 1902, after deducting the number of cable messages and receipts therefrom, was 31 cents, as compared with 43 cents in 1880.

The number of telegraph offices in 1902 was 27,377, an increase of 14,867, or 118.8 per cent. over 1880. Of the total number in 1902, 20,809 were in railway stations.

Between 1880 and 1902 the number of salaried employes increased from 337 to 829, or 146 per cent.; the number of telegraph operators from 9,661 to 13,093, or 35.5 per cent., and the amount paid in salaries and wages from $4,886,128 to $15,039,673, or 207.8 per cent.

There were 684 railway companies that reported the operation of telegraph or telephone lines in connection with the transportation business. In connection with their reports to the Interstate Commerce Commission the railway companies furnished considerable information concerning their telegraph and telephone systems. This information was supplemented by data obtained by the bureau of the census through correspondence with the companies. The 684 railway companies operated 204,503 miles of single track and had 1,127,186 miles of single wire along their right-of-way. Of this wire mileage, which includes both telegraph and telephone lines, no segregation being possible, only 242,837 miles, or 21.5 per cent., was owned by the railway companies.

A large proportion of the telegraph and telephone wire along the right-of-way of railway companies and a considerable proportion of that operated by the railway companies is owned by commercial telegraph or telephone companies and included in their reports. Hence an unknown portion of the wire mileage reported for railway telegraphs and telephones is a duplication of that shown in the report on commercial-telegraph companies. Moreover, many of the commercial messages reported are included also among the messages reported by the commercial-telegraph companies; but few railway companies maintain telegraph lines for other than railway business, the commercial privileges, as a rule, being granted to commercial telegraph companies.

The railway companies reported 31,278 telegraph offices, but only 30,336 telegraph operators. It is probable that in a number of instances the railway companies reported as station masters, agents, etc., employes who also performed the duty of telegraph operator.

## Alas, Too True!

There seems to be some sort of a spell upon the municipal-ownership people that prevents them from so keeping their books as to show the exact financial results of their operation. This is not less to be lamented by those who hope to find in such ownership of public utilities a remedy for many existing evils than by the antagonists of the hopeful ones, who think the plan dangerous and chimerical. The common tendency of the innovators was well illustrated by a Chicago man, called as a witness last week by Controller Grout. This expert declared that with a municipal plant arc lights have cost Chicago about $55 per year, but when he was questioned by a representative of one of the local companies, he admitted that the $55 did not include any allowance for the taxes a private concern would have paid, none for depreciation, and none for return on the capital invested. Possibly with reasonable amounts added for all these things, the Chicago price would still not be brought up to the New York price, but it was very evident that the witness did not know what Chicago is really paying for her arc lights, and he hurt the municipal-ownership cause instead of helping it.—New York Times of January 16th.

# CORRESPONDENCE.

## New York.

New York, January 14.—Controller Grout's official inquiry into the cost of city lighting has been proceeding during the week, but the official representative of the New York Edison Company, who was examined, did not furnish any real information, declining to divulge the facts desired. Mr. Grout is still determined to obtain the details he wishes, and meanwhile has heard the testimony of electricians from Baltimore and Chicago. The Baltimore expert, Charles E. Phelps, testified that New York is paying about 40 per cent. more than his city, the figures given by Mr. Phelps being those which appeared in the Western Electrician of December 24th. On Friday Edward B. Ellicott, city electrician of Chicago, testified that the cost of Chicago's city lighting plant was $152,000 and supplied about 13,000 lights. The cost per lamp for the last three years, he said, has been respectively, $56.52, $52.54 and $53.54. At the request of Mr. Grout a sum of $25,000 has been allocated for the purpose of defraying the costs of his investigation. A committee of the Brooklyn League has passed a strongly worded resolution calling for municipal lighting and the acquirement of conduits.

W. B. Parson's plans for rapid-transit extensions appear to have threatened a large number of public and private interests. The rapid transit commissioners have been listening to arguments and protests all the week, especially as to a proposed subway extension through Bronx Park, and the commission has rejected this particular proposal. Brooklynites also are particularly angry over the plans affecting their borough and are demanding a subway under Fourth Avenue.

There was a rear-end collision between two subway trains on the uptown local line at Worth Street early on Wednesday morning. Three persons were hurt, but the trains proceeded on their way within 10 minutes. No alarm has been occasioned on account of this accident, but the fact has become public that the much-vaunted safety devices have so far been fitted only on the express tracks.

The explosion of a steam pipe in the Seventy-fifth Street power house last Saturday evening led to a stoppage of the dynamos and the complete tying up of all the elevated traffic in Manhattan for nearly 30 minutes. Passengers who had paid their fares and desired to leave the platforms were given an accommodation ticket available within 48 hours.

The stock of the Interborough Rapid Transit Company has risen nearly 100 points in less than a year, and recently it rose 23 points in a single week. Rumors are afloat that some large deal is pending that will materially improve the position of the company. Some kind of amalgamation will probably come in the future, but there are no clear signs that any vital negotiations are actually pending.

A new concern, to be known as the Hudson Companies, was incorporated at Albany on January 8th with a capital of $21,000,000 to take over and operate the two tunnels now being constructed under the Hudson River between Manhattan and Jersey City. These tunnels will not, it is thought, have any physical or financial connection with the Pennsylvania Railroad scheme, and it is also denied that the Interborough company has any interest in them. The tunnels will be completed toward the end of 1908.

New bills are being introduced at Albany by the dozen, mostly of the freak variety. Those affecting the electrical industry call for a new elevated station on Eighth Avenue and One-hundred-and-thirteenth Street; illuminating gas of a certain standard at 70 cents per 1,000 cubic feet in cities of 400,000 population, and the abolition of advertising signs in the subway and other public places. Assemblyman Wade is reviving a scheme to tax companies who take water for power purposes from the Niagara River.

The report of the New York Fire Department for 1903 has been issued after a full year's delay. Of the 6,787 fires in the city in 1903 only 83 were caused by defective electric fixtures, but 211 fires occurred on street and elevated cars from various electrical causes, it is said.

A new regulation of the building department requires that in future all elevators shall be provided with automatic speed governors. The precise regulation can be had from Isaac A. Hopper, superintendent of buildings, City Hall, Manhattan.

The West End Association, an organization of taxpayers in New York city, is demanding legislation calling for lower telephone rates. City ownership of conduits is also urged.

The Brooklyn Eagle on January 8th published an account of the extensive private telephone system of the Brooklyn Rapid Transit Company, which has no less than 175 miles of wires and is possibly the largest private exchange in the world. The company is also a large subscriber to the local telephone service.

A suit is pending in the New York city circuit court between the Marconi and De Forest wireless telegraph companies, the former alleging infringement of patents. On Monday a demonstration of space telegraphy was made before Judge Townsend, who is himself familiar with the technical side of the question.

A number of old and new electric automobiles and accessories are being exhibited at the fifth annual automobile show which opened this evening at Madison Square. D. W. W.

## Ohio.

Cleveland, January 14.—Attorney William M. Reynolds has brought two more injunction suits against the city and the Forest City Railway Company of Cleveland to prevent the latter from taking possession of the Woodland and Central Avenue lines, now in possession of the Cleveland Electric Railway Company.

The intention of the Fort Wayne, Van Wert and Lima Traction Company, it is rumored, is to move its general offices from Fort Wayne to Lima, space having been secured in the Stamets Block, where the Western Ohio offices are located. It is further said that these two roads will inaugurate a through service between Dayton and Delphos, thence over the Clover Leaf into Toledo.

Officers have been elected by the Toledo Urban and Interurban Railway Company, with George B. Kerper as president. A mortgage for $1,000,000 in favor of the Union Savings Bank and Trust Company has been filed to secure a bond issue of that amount. This company has leased the Toledo, Bowling Green and Southern, which is owned by Mr. Kerper and other Cincinnati capitalists.

Nine trains will be operated by the Hocking Valley Railroad Company between Logan and Marion through Columbus to meet the competition of the trolley lines—the Scioto Valley and the Columbus, Delaware and Marion. Family commutation tickets will be issued and the management has asked farmers along the line who have property to sell to list it with the company, that it may be bulletined for the benefit of city people who want country homes.

The management of the Toledo Railways and Light Company has denied that the new City Council at Toledo will be asked to grant it a franchise at once. Something may be done later on, but at the present time the company seems to be satisfied to continue with the franchises it already holds.

New York and Toledo men interested in the Toledo, Columbus and Cincinnati line held a conference with W. H. Luctenberg in Columbus a few days ago. Mr. Luctenberg is to build the road and is interested in it himself. Of the $10,000,000 bonds, it is said that half of them have been sold in New York, and the remainder will soon be disposed of. F. C. Schinness of Toledo is the president of the road.

The Citizens' Electric Company will be organized at Mt. Vernon to build and operate an electric-light plant.

J. G. Schmidlapp and Myron H. Wilson, receivers for the Appleyard roads, made a tour of inspection over the line a few days ago.

The general belief now is that the Sandusky Southwestern will have to be sold at receiver's sale, although Manager F. O. Oleson is in the East endeavoring to form a syndicate to take it over.

The Buckeye Street Railway Company of Canton has changed its name to the Traffic and Transportation Company. It is said to be composed of Cleveland men, who are planning to build a line from Akron to Canton over the old Everett-Moore route.

Theo. Fluhart, S. H. Carr and George W. Wood of Dayton have been appointed by the stockholders of that city as a committee to examine into the affairs of Arthur E. Appleyard to ascertain what disposition has been made of the earnings of the Dayton, Springfield and Urbana and other roads in which they are interested. The claim that the profits of the Dayton, Springfield and Urbana have been used to support other roads will receive special attention.

The Electric Storage Battery Company of Chicago has brought suit to enforce the statutory liability against the Central Market Street Railway Company of Columbus, claiming that it has a bill for $23,000 for batteries furnished the company. The claim is also made that the company is insolvent and a receiver is asked.

The Dillonvale Heat, Light and Power Company of Dillonvale has been incorporated with a capital stock of $50,000 by William D. Dager, Frank Alexander and others.

The line of the Lake Erie, Bowling Green and Napoleon from Pemberville to Woodville will be placed in operation within a short time.

The Baker Motor Vehicle Company of Cleveland has increased its capital stock from $200,000 to $400,000. The company manufactures electric vehicles.

County commissioners are considering the advisability of building a lighting and heating plant for the county buildings at Bowling Green.

O. M. C.

## Southeastern States.

Charlotte, N. C., January 14.—One of the largest contracts ever reported in North Carolina for electrical development is that at the falls of the Yadkin River, near Salisbury, N. C., where D. A. Gillespie and associates of New York have been awarded the contract for the erection of a dam to cost in all $1,700,000. The work will be done for the Whitney Reduction Company and will require about two years' time.

Ladshaw & Ladshaw of Spartanburg, S. C., have in hand the construction of a lighting plant at Sumter, S. C., for lighting the town, it also being proposed to furnish power for manufacturing purposes.

The Catawba Power Company, which is now operating a big plant on the Catawba River, has bought the electrical plant of the Highland Park Manufacturing Company at Charlotte, N. C., for a reserve plant. The plant which has just been bought is one of the largest cotton-mill steam-electric plants in this section and is furnished with the latest machinery.

Contracts have been prepared for the construction of the long-talked-of electric line from Asheville to Weaverville, N. C. It is stated that New York capital is interested in the scheme and will aid financially in the work as funds may be needed.

L.

## Indiana.

Indianapolis, January 14.—The Holland Interurban Sleeping Car Company has arranged to run Holland sleepers regularly between this city, Dayton, Columbus and Cleveland. The service will be inaugurated in a short time.

The Central Indiana Railroad Company has made the rather unusual concession to an electric railway by posting at all its stations a timecard and rate sheet, showing its connections and rates from all points on its line to Indianapolis and return by way of Lebanon over the Indianapolis and Northwestern Traction Company's line. The Clover Leaf railroad has taken similar action by announcing rates and through service from stations on its line to Indianapolis, Dayton and other Ohio cities and St. Louis over interurban lines via Frankfort. Through tickets for this service will soon be on sale.

The Columbus, Greensburg and Richmond Traction Company, which proposes to begin construction early next spring, has made arrangements to enter Richmond over the Richmond Street and Interurban line from Centerville six miles west.

The Fort Wayne and Wabash Valley Traction Company is arranging its power house in Huntington so that both engines may be worked together. In a few days there is to be furnished from this power house and the power house in Logansport power for the electric line between Fort Wayne and Logansport, power for the Wabash city lines and some of the power for the Fort Wayne city lines. The company is soon to receive six new 56-foot cars for use in through service between Fort Wayne and Indianapolis via Peru.

The City Council of Marion in special session granted a franchise to the Kokomo, Marion and Western Traction Company to enter the city over Fifth Street. The council granted the franchise over the veto of the mayor and over the petition of the property owners of Fifth Street.

The government has sent inspectors to examine the Indiana Electric Railway Company's line with a view of establishing a mail route thereon. If the company secures a contract for carrying the mail by trolley the Fort Wayne and Wabash Valley Traction Company will try to secure a similar contract.

Willard F. Warner, superintendent of the city electric-light company of Muncie, has incurred the displeasure of the municipal-ownership advocates by stating in his annual report that the city could save $5,000 a year by contracting with a private electric-lighting company for its street lights instead of owning and operating a municipal-lighting plant. He shows by figures that that sum is wasted annually by the city because it does not keep its equipment up to the standard maintained by private companies.

The Perfection Magneto Company of Anderson has been incorporated for the purpose of engaging in the manufacture of dynamos, magnetos, sparkers, electrical machinery and general electrical supplies of all kinds. The capital stock is $20,000. F. G. Borden and R. E. & M. K. Creighton are the incorporators. S. S.

## Michigan.

Detroit, January 14.—The village of Northville has granted a franchise to C. A. Ward of Ann Arbor for the furnishing of electric light and power. The new company will put in three dams in the Huron River and the power house will be built at Hamburg. It is expected the company will furnish the public lights by July at the rate of two cents per kilowatt-hour.

Wallace Franklin, Michigan manager for Westinghouse, Church, Kerr & Co., has returned from an eastern business trip.

The city of South Haven has granted a franchise to an electric railway company covering the principal streets of the city and work will be commenced at once upon the construction of several miles of track. Henry Bardeen of Otsego, C. W. Williams of South Haven and S. J. Dunkley of Kalamazoo are the promoters of the line, which ultimately expects to build to Kalamazoo.

The Detroit, Monroe and Toledo Short Line electric road has been unable to effect a satisfactory basis for carrying on its through-passenger business with the Detroit United Railway between Cleveland and Detroit. The Detroit United has placed a high rate for terminal service on freight cars and asks that the Short Line handle no freight from Ecorse, Wyandotte, Sibley or Trenton. The Short Line will, however, go ahead with the development of the property, and it has been decided to double-track the road the entire distance between Detroit and Monroe.

The farmers along the Grand Rapids, Grand

Haven and Muskegon electric line are beginning to light their homes and to use electric power in running machines on the farm.

The business men of St. Johns are agitating the extension of the Lansing and St. Johns electric railway from that point northward. Representatives from Alma, St. Louis, Ithaca and Maple Rapids recently attended a meeting of the St. Johns Business Men's Association and a committee was named to investigate the matter.

A new street railway employes' association has been formed in Detroit and the first meeting was held this week. Committees were appointed for the coming year, about half of the executive board being composed of new members.

It is now determined that the St. Joseph Valley Traction Company will be a connecting link for a great Indiana Michigan electric railroad system. H. E. Bucklen of Elkhart is reported to be back of a proposition to build an electric railway from La Grange, Ind., through Elkhart to South Bend. It is also planned to have the line run through Cassopolis and thence to Benton Harbor. Within the last eight years about six electric lines have been projected into Benton Harbor, but this one is regarded as a surety and will be a great help to the southwestern part of Michigan.

The Detroit Public Lighting Commission expects, it is said, to cut the cost per arc light down to about $3.06 per light per month, making the rate about $36.70 a year per light. The lowest approach to this figure was the cost about two years ago, when it was reduced as low as $39.15. This decrease in cost is accounted for by the increased number of new lights which have been put in, as it costs but little more to put on extra lights once the machinery is going. Coal is also cheaper this year, which materially affects the cost.

The Grand Rapids Railway Company has placed in commission three new cars which are the finest street cars ever brought to the city of Grand Rapids. The windows are four feet in width, not unlike a Pullman drawing-room coach. The bodies are partly of steel and represent the most modern pattern of surface-car construction.

The Grand Rapids Public Lighting Commission is experiencing some difficulty with the schoolboard in regard to the sub-stations which are located in the school buildings, on account of alleged insufficient insulation of the wires carrying 5,000 volts.

In an address to the Common Council by the newly elected mayor, George P. Codd, he recommends that the board of estimates allow an issue of $150,000 in bonds to enlarge the capacity of the present lighting plant from 2,900 arc lamps to about 5,000 lamps. He also takes the stand that no further concession be given the street-car company until it complies with the ordinances covering sanitation and the protection of lives.

The Pere Marquette railroad will equip all the cars of its system with electric lights to take the place of oil and acetylene lights now in use on the majority of cars. The equipment consists of a dynamo attached to the car axle. When the car is stopped the current is automatically switched to a storage battery which is charged from the axle dynamo.

There is considerable strife over the ownership of the electric alarm factory now located at Muskegon Heights. William F. Braum and C. H. Shaffer are the principals in the controversy. C. G. W.

### Northwestern States.

Minneapolis, January 14.—The electric-light plant at Osceola, Iowa, is to be enlarged at once and a 24-hour service will be started.

The Kenosha (Wis.) and Lake Geneva Railway Company has been incorporated with a capital of $25,000. It is proposed to build an electric line from Kenosha to the lakes.

The Interurban Railway Company has begun the survey of a new line from Des Moines to Perry, Iowa.

The Milwaukee (Wis.) Electric Railway and Light Company has secured a site at Mukwonago on which to build a power house to furnish power for the new line from Milwaukee to Elkhorn.

The Rhinelander (Wis.) Power Company has let the contract for erecting a new dam and power house at Hat Rapids to P. B. Faragher of Cleveland, Ohio. Both dam and power house will be of concrete, and 13,000 horsepower will be developed. The total cost will be $26,650, and the work is to be completed September 1, 1905.

The Omaha (Neb.), Decatur and Northern Interurban Railway Company has let the contract to C. B. Pierce and L. F. Wakefield of Sioux City, Iowa, for the construction of 17 miles of the new line between Decatur and Tekamah. It is thought that the road will be in operation by October 1st.

The Great Northern Power Company of Duluth, Minn., has amended its articles of incorporation, increasing its capital to $2,000,000. It is claimed that power will be delivered within 18 months. R.

### Rocky Mountain States.

Salt Lake City, January 13.—The California-Nevada Mining, Milling and Power Company has been incorporated at Salt Lake, Utah, by Hon. George S. Nixon, Pierce Evans, John S. Cook and others with a capital stock of $5,000,000. Power will be generated on [illegible] About 10,000 [illegible]

The citizens [illegible] the question of [illegible] [illegible] The plant is to be [illegible] Fork.

It is the intention of [illegible] of California to construct a power plant [illegible] Lake, 120 miles from [illegible] from Goldfield, Nev.

The Nevada Power Company, which [illegible] been organized by Denver (Colo.) and Quincy (Ill.) capitalists, announces that it will begin at once construction work on the electric plant on Bishop Creek, near Bishop, Inyo County, Cal., from which it proposes to derive power for Goldfield and Tonopah, Nev.

L. R. Ames and Frank Simpson have organized a company in Smith Valley, Nev., with sufficient capital subscribed to build a telephone line from Wellington to Gardnerville, Nev. It is probable that the erection of the line will commence in the near future. A.

### Pacific Slope.

San Francisco, January 13.—Secretary Metcalf of the Department of Commerce and Labor, in setting forth the need of a detention station at San Francisco for the examination of immigrants, has submitted a detailed estimate of the cost of such an institution, to be located on Angel Island, in San Francisco Bay. Included in the estimate is a power plant for lighting to cost $58,000.

If control of the water in the river at Prosser, Wash., can be secured, President E. F. Benson of the Prosser Falls Land and Power Company will erect a power plant to furnish electricity for lighting, manufacturing and all purposes.

President Goode of the Portland General Electric Company of Portland, Ore., states that his company has decided to build a 40,000-horsepower electric station at Oregon City, Ore.

It is understood that a force of men will leave at once for Martin Rapids, Ore., on the McKenzie River, to clear a right-of-way for a canal to be built by the Willamette Valley Electric Railroad Company, with which to supply power for a power plant to operate its proposed electric-railway system. G. C. Diers, chief engineer for the company, verifies the report that work will begin at once.

E. D. N. Lehe, representing the Bay Counties Power Company, has applied to the Board of Trustees of Winters, Cal., for a franchise to construct poles, wires, transformers, etc., along the streets of Winters.

Plans are now being drawn in San Francisco to replace Station A of the Eureka Lighting Company at Eureka, Cal., which was recently destroyed by fire.

J. W. Eddy, who is one of the promoters of the incline railway up Mt. Hollywood, and the Broadway Land Company of Los Angeles, Cal., are grading the roadbed of the Mt. Hollywood railway. It is probable that the roadbed will be completed through Griffith Park to the foot of the incline at an early date. The plans include an electric railway to extend from Sunset Boulevard to Los Feliz Avenue, and to connect with the Los Angeles-Pacific railroad.

The Jamestown and Yosemite Railway Company has been incorporated by T. S. Bullock, S. D. Freshman, S. H. Smith and others, with a capital stock of $100,000. The route of the proposed road is from Jamestown, Cal., through Mariposa County, and thence into the Yosemite Valley. It is to be a standard gauge. There is to be a main line of 40 miles and a branch line of 35 miles. A bill is to be introduced in Congress providing rights-of-way into the valley.

It is announced that the Spokane Traction Company of Spokane, Wash., is arranging to build a branch electric line to the interstate fair grounds in time for the fair next fall. The City Council has granted the company a franchise.

It is reported that the Fortuna Lighting Company of Fortuna, Cal., will extend its lines into Ferndale, Cal., in the near future.

The Siskiyou Electric Power Company has leased from Charles Kappler his entire electric-light and power plant at Etna, Cal., and the new company will hereafter manage the business in connection with its own.

The Pacific electric railway of Los Angeles, Cal., will begin the construction of its branch line to Covina, and thence to Pomona next April. Engineers are now in the field making the final survey. A.

## PERSONAL.

C. A. Barney, superintendent of the electrical department of the Western Tube Company of Kewanee, Ill., was in Chicago this week in the interest of his company.

Alfred R. Wolff has been appointed consulting engineer for the heating and ventilation of both the United Engineering Building and the Engineers' Club, to be erected in New York city under the Carnegie gift to engineering of $1,500,000. C. O. Mailloux was selected as the consulting electrical engineer for the United Engineering Building, and [illegible]

[illegible]

[illegible] intendent, to take the place of A. S. Hatch, re[illegible]

C. J. Purdy has severed his connection with the [illegible] landt Street, New York city.

Friends of Mr. E. Kuhlman, president of the Kuhlman Electric Company of Elkhart, Ind., are extending their condolences on the occasion of the death of his 10-year-old daughter on January 11th. The little girl had been ill for about three years with rheumatism, which finally attacked the heart and ended her suffering.

Henry C. Mortimer, Jr., of the General Electric Inspection Company has joined the New York office staff of the Crocker-Wheeler Company. He will assist F. B. DeGress, manager of that office, and will succeed A. J. Thompson, who has accepted a position with the New York branch of the Bullock Electric Manufacturing Company.

Another matrimonial rumor is connected with the name of Mr. Marconi. This time the lady in the case is an Italian and a princess. The Patria of Rome reports that the inventor is engaged to marry Princess Giacinta Ruspoli, aged 21 years, the youngest daughter of Prince Francesco Ruspoli, master of the holy hospice, a high hereditary Vatican position.

Prof. W. E. Goldsborough of Purdue University has been decorated by the king of Italy with the Order of the Knights of the Crown, one of the highest honors ever conferred by the crown upon a foreigner. The decoration is a white maltese cross, having the crown of Italy on one side and the royal arms on the reverse. This distinction arose out of Professor Goldsborough's work while at the head of the electric department at the St. Louis Fair.

William F. Potter, vice-president, has been elected to succeed the late W. H. Baldwin, Jr., as president of the Long Island railroad. Resolutions were passed at the meeting praising the work of Mr. Baldwin in building up the railroad and the residential parts of Long Island. Mr. Potter is 49 years of age. He is a member of the Atlantic Avenue Improvement Commission and the Brooklyn Grade Crossing Commission, and also a member of the Engineers' Club.

A. L. Drum of Anderson, Ind., for the last two years general manager of the Indiana Union Traction Company, has resigned and will retire from duty February 1st. Mr. Drum is said to have accepted a similar position with the Chicago and Milwaukee Electric Railroad Company. Mr. Drum came to the Union Traction people from Terre Haute, Ind., where he was reared. He soon rose to assistant manager and then to general manager. He is a young man of exceptional executive ability, and the Union Traction people reluctantly accepted his resignation.

## ELECTRIC LIGHTING.

James Beezley has sold out his electric-lighting business at Paonia, Col.

The town of Homer, La., has under consideration the establishment of an electric-light plant.

The city of Anthony, Kan., is preparing to install a system of electric lights. W. A. Miller of Anthony heads the committee having the matter in charge.

The commissioners at Manila, P. I., have passed an act granting to Ignacio Arnalot authority to channel Albay River for the purpose of generating light and power.

On January 24th the city of Ocala, Fla., will vote on a proposition to issue $45,000 of bonds, a portion of the proceeds of which will be used to improve the electric-light plant.

The Denver Gas and Electric Company, Denver, Colo., in a circular letter, says that it is going to keep on pounding until it has convinced storekeepers that there are a dozen reasons why they should outline their windows with electric light.

The Sumter Electric Light and Railway Company of Sumter, S. C., has been incorporated with $200,000 capital by J. L. Almett, H. F. Wilson of Sumter, W. C. Brister, Albert De Haven of Philadelphia, Pa., and E. M. Bael of Lewisburg, N. C., to con-

struct electric-light and power plants. Mr. Almett had previously applied for a franchise.

George Page has succeeded to all the stock of the Gallup Electric Light and Power Company of Gallup, N. M.

It is reported that the city of Knoxville, Tenn., is considering the municipal ownership of the electric-light plant, and has appointed a committee to investigate the advisability of the proposition.

At the annual meeting of the Merchants' Electric Light, Heating and Power Company of York, Pa., the following-named officers were elected: President, C. H. Bear; vice-president, George C. Campbell; treasurer, Henry Washbers; secretary, Thomas B. Loucks; manager, William L. Bear.

In a paper "On the Temperature of the Arc," presented in the Bulletin of the Bureau of Standards, C. W. Waidner and G. K. Burgess conclude that in the light of the best evidence that is at present available it would seem that the true temperature of the hottest part of the positive carbon is between 3,900 degrees and 4,000 degrees absolute.

## ELECTRIC RAILWAYS.

The Knoxville Traction Company is building a $20,000 addition to its power house in Knoxville, Tenn.

The Northwest Arkansas Electric Railway Company has been incorporated to build an electric railway in Siloam Springs, Ark., and also from Siloam Springs to various towns and villages in Benton County. The incorporators are L. D. Moore of St. Louis, D. J. Godbold, Fort Smith, and John P. Logan, A. W. Perrine and Thomas Williams of Siloam Springs.

Clifford D. Bebee of Detroit, Mich., has purchased the franchises of the Bluegrass Consolidated Traction Company of Lexington, Ky., for $2,457. They were sold at public auction by Master Commissioner Webb on the strength of a receivership brought by creditors on claims for $20,000. Senator George B. Davis of Detroit promoted the enterprise and lost, it is said, probably $50,000.

Extension work on the South Side elevated railway in Chicago is progressing slowly. The foundation between Twelfth Street and Forty-third Street, where the new third track will be built, has been completed, but it may be the end of February before superstructure work is commenced. President Leslie Carter says the proposed express service will be running next fall. There is nothing definite with regard to the Stockyards extension of the road.

The City Council of Cleveland, Ohio, has authorized the Cleveland Electric Railway Company to begin an experimental service for an indefinite length of time to determine the profitableness of a three-cent fare within a radius of two miles from the center of the city. No transfers will be given on the three-cent cars. The cars will go only the length of the three-cent zone. The street-car company has the right to abandon the experiment at its discretion.

Apparatus will be erected on land belonging to the state, between Tomteboda and Värtan, in order to carry out the experiments in electric traction, for which a grant of 500,000 crowns ($134,000) has been made by the Swedish government. At Tomteboda station the double-trolley system will be used and at Värtan the third-rail system will be employed. For these experiments a high-tension, single-phase, alternating current will be used, the tension and frequency of which will vary according to requirements.

The ordinance allowing the proposed extension of the Northwestern elevated railway to Ravenswood has been passed by the Chicago City Council by an almost unanimous vote. Mayor Harrison, who had vetoed the ordinance on a previous passage, stated that he was in favor of the grant and explained that his refusal to sign it was on account of the bribery charges made by Alderman Butler in connection with the passage of the ordinance. These charges, it was shown, were unfounded, and he recommended the extension.

The proposed electric railway up Mt. Blanc, the highest of the Alps, may be constructed by a company just formed in Paris. The railway, if built, will start at the Fayet, on the Paris-Lyon-Mediterranean line, at a 1,500-foot level, and will have nine stations. Mr. Duportal, the official engineer of the French government, has made plans for obtaining the necessary electrical energy from some of the numerous waterfalls to be found in the locality. The line will end at Aiguilles du Gouter, 14,430 feet above the level of the sea. The cost of the whole line, which will have a length of 20 kilometers, will be $2,000,000, which has all been subscribed. It is calculated that 90,000 tourists go every year to Chamounix to try the ascent and that instead of paying $60 for the service of guides they will be glad to make the ascent by railroad at the cost of only $10 each. The Jungfrau line, which is nearly completed, arrives at an altitude of 12,498 feet above the level of the sea, but has the disadvantage of running mostly through tunnels. The Mont Blanc railway, on the contrary, will have only one tunnel.

## POWER TRANSMISSION.

Eastern capitalists are about to form the Tallapoosa Waterpower and Electric Company for the purpose of erecting a $500,000 electric power plant to develop power for manufacturing purposes in Alabama. Ashfield & Chapman of Montgomery, Ala., are the engineers in charge.

Work on the sub-station that the Spring River Power Company is building near Joplin, Mo., is complete and arrangements will be made to turn on power early in February. This is one of four sub-stations, each of 750-kilowatt capacity, that are to be supplied from a power plant at Lowell, Kan., where a generator capacity of 3,000 kilowatts, direct connected to waterwheels, is installed. Power is to be supplied to the zinc mines near Joplin. The engineering, as well as the work of construction in connection with this development, was done by the Arnold Electric Power Station Company of Chicago.

The Hamilton Cataract Power, Light and Traction Company has recently started the two 5,000-kilowatt Westinghouse generators in its De Cew Falls power station in Ontario. Power is supplied from Welland Canal feeders, tapped in about 14 miles above the power station, and at the station the water has a head of 267 feet. The Westinghouse generators are of the two-bearing type, direct connected to Escher-Wyss waterwheels and run at a speed of 286 revolutions per minute. They generate three-phase current at a frequency of 66 cycles and a pressure of 2,400 volts. The power is transmitted to the city of Hamilton, Ontario, where it is used for lighting, street railway and manufacturing purposes. A reserve steam-driven station is located at Hamilton, which contains two 1,000-kilowatt Westinghouse generators. The company has two separate three-phase transmission lines to Hamilton, a distance of about 35 miles. The high-tension apparatus is designed for a pressure of 40,000 volts, but will be operated for a time at 20,000 volts. Mr. William Hawkins is general manager of the Hamilton company and is also engineer in charge of the installation.

## PUBLICATIONS.

The Mica Insulator Company of New York has withdrawn all its former prices and has now issued a new price list for 1905. All the company's various products are listed in the new book.

The Wagner Electric Manufacturing Company of St. Louis has issued in pamphlet form a paper presented at the October meeting of the Kansas Gas, Water and Electric Light Association by G. Percy Cole, entitled "Answers to Some Central-station Questions About Single-phase Motors."

A new and interesting publication of the United States government is the Bulletin of the Bureau of Standards. The first number, dated November 1, 1904, is an illustrated pamphlet of 124 pages, containing, among other things, articles by K. E. Guthe on the "Silver Voltameter," Frank A. Wolff on "International Electrical Units," P. G. Nutting on "Rectifying Effects in Conducting Gases," and C. W. Waidner and G. K. Burgess on the "Temperature of the Arc." In a prefatory note Director S. W. Stratton of the Bureau of Standards says that the bulletin will embody the result of the investigations, researches and other work of the bureau which may be of importance to the scientific, technical and manufacturing interests of the country. It will be issued at intervals as frequently as the number of papers ready for publication may require. Schedules of fees, regulations and other matter pertaining to the testing work of the bureau will be issued in the form of circulars of information.

## CALENDARS.

The Resinol Chemical Company of Baltimore has a beautiful art calendar for 1905. Six sheets of heavy enameled paper contain on one side six fine color designs of babies and children, while on the reverse sides are drawings depicting child life, with spaces for the notation of baby's "sayings and doings." The calendar is distributed by the company by an arrangement of which it will no doubt send particulars on application.

W. H. Schott, engineer, of Chicago, is distributing a fine wall calendar, accompanied by a sight draft duly drawn in favor of the recipient to the amount of 365 days of health, happiness and prosperity, charged to the account of W. H. Schott. The picture on the calendar represents two newsboys, small, but capitalists nevertheless, who are dividing up the proceeds of their work, or, in other words, declaring a dividend.

One of the handsome wall calendars of the season comes from the National Carbon Company of Cleveland, Ohio. The picture of the young lady which adorns the calendar bespeaks the good taste of the National company and upholds its reputation of advocating only the best. A moonlight schedule for the year 1905 is also a feature and the schedule for each month is placed on the corresponding leaf of the calendar. With each date is given also the rising and setting time of the sun and moon.

## SOCIETIES AND SCHOOLS.

The central department of the Young Men's Christian Association is bringing Lieut. G. L. Carden to Chicago for a lecture on "The American Invasion of Europe." The lecture will be of importance to all who are interested in mechanics and engineering. It occurs Saturday, January 21st, at 8:15 p. m., in the association auditorium, 153 La Salle Street.

The Iowa Engineering Society held its seventeenth annual meeting in Iowa City, Iowa, last week. During the meeting interesting papers on engineering subjects were read by B. J. Lambert of Iowa City, J. B. Marsh of Des Moines, C. A. Baughman of Marshalltown, C. R. Allen of Ottumwa, C. T. Wilson of Waterloo and C. P. Chase of Clinton. The officers elected were: President, J. D. Wardle of Cedar Rapids; vice-president, Prof. L. E. Ashbaugh of Ames; secretary and treasurer, Prof. B. J. Lambert of Iowa City; directors, A. J. Cox of Iowa City and W. H. Jackson of Des Moines.

The first annual meeting and banquet of the Ohio Interurban Railway Association will be held at the Algonquin Hotel in Dayton, on January 26th. In the forenoon a business meeting will be held, followed by the election of officers. In the afternoon the subject, "Steam Power," will be taken up, and the opening addresses will be made by able speakers. The banquet will be served in the evening. As this is to be the first annual banquet of the association, Secretary J. H. Merrill requests that every member attend and also bring a friend with him interested in interurban matters.

Much progress has been made by the committees of arrangement for the annual convention of the National Electric Light Association, which will be held in Denver and Colorado Springs the week of June 6th. Both Denver and Colorado Springs are doing everything in their power to complete the arrangements early. Preparations are being made on a scale to care for several thousand members and visitors. The advertising committee has been hard at work. Before the time for the meeting of the convention hundreds of thousands of pieces of literature will have been sent out. Sets of souvenir cards giving views of Colorado scenery will be mailed by the Denver Gas and Electric Company for the advertising committee. A booklet will also be sent out containing detailed information regarding hotels in all portions of the state and other data.

## TELEGRAPH.

The Postal Telegraph-cable Company will put in an office at Vinita, I. T., using the pole lines of the Pioneer Telephone Company.

Two gangs of men have been put to work removing the Western Union wires along the line of the Philadelphia, Baltimore and Washington railroad between Wilmington, Del., and Philadelphia. All Western Union wires will be taken off this branch of the Pennsylvania road.

## SPACE TELEGRAPHY.

In pursuance of an agreement entered into between the Marconi Wireless Telegraph Company and the British postoffice authorities, it is now possible to dispatch from every Postal Telegraph office in the United Kingdom messages for transmission by the wireless system from the company's coast stations to ships at sea.

## MISCELLANEOUS.

There is much activity in rubber culture in Ceylon, Java, Sumatra, Borneo and the Maylayan Peninsula. Since the United States is a large consumer of rubber and the Philippine Islands possess in climate, latitude and soil even better conditions for the production of rubber than do the domains mentioned, the wisdom of planting Para rubber in the Philippines is strongly urged by Consul-general O. F. Williams of Singapore.

In electric hair cutting the cutting instrument is a comb over which is stretched a platinum wire connected in circuit with a source of current which may be obtained by screwing a plug into an electric-light socket. Upon closing a switch in the handle of the comb the wire is brought to a bright heat and as the comb is drawn through the hair the wire burns off the ends evenly, singeing the hair at the same operation. Since the hot wire is not a live flame, the hair cannot be set on fire, as with the ordinary singeing apparatus.

The Società Elettrotecnica Italiana of Turin, Italy, has invented and constructed devices for the application of electric power to plows and other farm machinery which is quite similar to methods that have been tentatively employed in this country. The device consists of two power cars, which are stationed at each side of the field and between which are stretched cables attached to the plow. The electric current is taken from a trolley line; a current of about 500 volts is said to be needed. The plow

is pulled by the cables from one side of the field to the other.

George Beltz was instantly killed at the plant of the Laclede Gas Company in St. Louis recently while using a telephone of the company's private system. It is thought possible that an electric light wire which had broken and fallen over the telephone wires produced the fatal electric shock.

A news dispatch from Sharon, Pa., relates that Superintendent Warren Clifton, Assistant Manager William Kromlish and Chief Electrician W. McKee of the Carnegie Steel Company, while using the electric arc recently to burn out an obstruction in a furnace, were overcome and rendered unconscious. Physicians who were called diagnosed the case as "electric sunstroke," the men suffering from symptoms similar to sunstroke.

In conclusion of the lecture series given to the salesmen of the Western Electric Company, as mentioned in the Western Electrician last week, a banquet was given on the evening of January 11th at the Grand Pacific Hotel. About 70 were in attendance and those who spoke or in some way contributed to the entertainment were: P. T. Ackerson, J. H. Dale, T. G. Grier, W. F. Hessel, H. A. Halligan, H. B. Kirkland, J. C. Kirkpatrick, C. E. Mitchell, M. A. Oberlander, E. K. Patton, A. N. Palmer, E. W. Rockafellow, E. M. Scribner, O. C. Turner and E. P. Warner.

## TRADE NEWS.

Walker & Co. have succeeded to the electrical contracting business of the Brown-Walker Company at Memphis, Tenn.

The electrical supply firm of Cramer & Rosenthal, Houston, Texas, which is now in voluntary bankruptcy, hopes to resume business again.

Neeley Bros. have purchased the business of the Ross Electric Company of Lincoln, Neb. Mr. Ross will move to Chickasha, I. T., where he will assume the management of the Chickasha Light and Power Company, and will also engage in the [illegible] line of business he has followed in Lincoln.

The electrical supply firm of [illegible] of Fort Worth, Texas, has been dissolved and Mr. Miller will continue the business.

The Cascade Gas and Electric Fixture Company of Seattle, Wash., has been incorporated with a capital of $15,000 by G. B. Swinhart and others.

Samuel Levy and J. C. Kimball, composing the Reliable Electric Company of Louisville, Ky., have dissolved partnership. The business will be conducted by Mr. Kimball.

The Virginia Electric Tool and Manufacturing Company of Petersburg, Va., is to be incorporated to manufacture an electric reciprocating hammer invented by Louis Paulero.

A. L. Ide & Sons announce that they have established a New York office at 11 Broadway, through which all export, New England and Middle States business will be transacted hereafter, the management being entrusted to Mr. J. G. Robertson. Ide & Sons make the Ideal steam engine, and their works and general office are at Springfield, Ill.

Sealed proposals will be received at the office of the supervising architect of the Treasury Department, Washington, D. C., until February 4th for the installation of an electric passenger elevator in the United States custom house and postoffice at Nashville, Tenn., in accordance with the drawings and specification, copies of which may be obtained at the office mentioned.

It is announced that Henry S. Manning had sold to his partner, Charles A. Moore, his entire interest in the firm of Manning, Maxwell & Moore and in the various manufacturing concerns owned and controlled by the firm, including the Shaw Electric Crane Company of Muskegon, Mich., which Mr. Moore now owns and controls. There is to be no change in the name or character of the firm of Manning, Maxwell & Moore, except that it is now owned and its business conducted entirely by Mr. Moore

[illegible] in the Holt [illegible] electrician.

[illegible] those of other concerns whose products are handled [illegible] customary practice of the company, and during the [illegible] which help them in their work.

## BUSINESS.

The Haberkorn Engine Company of Fort Wayne, Ind., [illegible] old engine a material saving may be made in the coal bill.

W. N. Matthews & Bro. of 603 Carleton Building, St. Louis, manufacturers of the Stombaugh guy anchor, are making an offer to telephone, electric-light and street-railway companies which is, so they say, getting many new customers for them. When they find a man who is doubtful of the holding ability of the Stombaugh guy anchor they offer to let him screw one of their anchors in alongside of a "deadman." The strain is taken off the "deadman" and put on the anchor in such a manner that if the anchor does not hold the strain will go back to the "deadman" and no damage will result. If the anchor does not hold it may be returned, freight at the sellers' expense. Matthews & Bros. expect a convert and payment for the anchor if it does hold. Thirty days is the time allowed for testing. The firm says that this test almost invariably results in a new customer.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued (United States Patent Office) January 10, 1905.*

779,427. Electromagnetic Metal-working Machine. Francis W. Jessop, Cleveland, Ohio. Application filed March 30, 1904.

The plunger of an electromagnet acts upon a toggle lever, which in turn forces together the jaws of the machine.

779,432. Polyphase Magnet. David L. Lindquist, Yonkers, N. Y., assignor to the Sundh Electric Company. Application filed May 23, 1904.

In a polyphase magnet are magnet coils, a source of single-phase current supply in circuit therewith and means for converting the single-phase current into two-phase current of 90 degrees phase difference.

779,441. Trolley Device. Henry O. Reese and Henry C. Weitzel, Baltimore, Md. Application filed June 10, 1904.

Combined with a trolley arm having a slotted head are a shoulder closing a portion of the rear side of the slot and a trolley wheel-carrying gravity-operated rocker pivoted between the upper ends of the sides.

779,443. Telegraph and Telephone Transmission Line. Eugene F. Roeber, Philadelphia, Pa. Application filed March 9, 1901.

A wave conductor comprises a substantially uniform line having sources of positive reactance and of negative resistance inserted at intervals along the line and producing a smaller attenuation of the transmitted waves than the line without these sources.

779,447. Electric Controller. August Sundh, Yonkers, N. Y., assignor to the Sundh Electric Company. Application filed June 3, 1904.

Resistances are associated with a sliding arm constructed to cut them into and out of circuit. An independent circuit-closer in circuit with the resistances and arm, a single electromagnet and means controlled by the magnet for mechanically closing the circuit-closer and actuating the arm to vary the resistances complete the apparatus. (See cut.)

779,469. Coupling for Electric Cables. John J. Dossert, New York, N. Y., assignor to Dossert & Co. Application filed July 16, 1903.

The stranded end of an electric cable having a core is provided with a coupling section surrounding the end and a collar between the core and the strands for bulging the latter, the coupling sections being provided with retaining means beyond the bulging part of the strands.

779,475. System of Electrical Distribution for Electric Railways. Josef H. Hallberg, Cincinnati, Ohio. Application filed February 26, 1904.

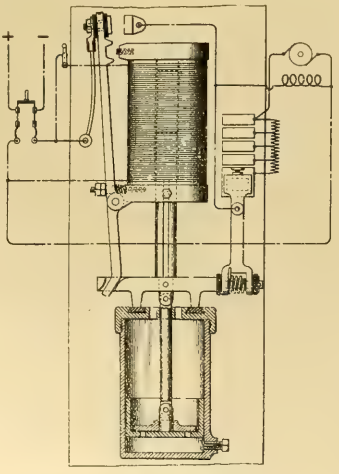
Electrical distribution for railways consists in using as a main source of energy a single-phase generator, the sources of energy which effect movement of the motor vehicles being polyphase generators actuated by, but electrically independent of, the single-phase generator. (See cut on next page.)

779,497. Apparatus for Telephone Trunk Lines. Walter O. Pennell, Philadelphia, Pa., assignor to the Western Electric Company, Chicago, Ill. Application filed November 23, 1900.

Two telephone switchboards, at each of which telephone lines are centered, are connected by a trunk line adapted for connection with a telephone line at each board. An electrically controlled ringing key at one of the boards applies current to the telephone line with which the trunk line is connected at that board, and separate means controlled at the distant board actuate the ringing key.

779,504. Telephone Bracket. Samuel J. Seifried, Chicago, Ill., assignor to the Chicago Writing Machine Company, Chicago, Ill. Application filed September 25, 1903.

A bracket for telephones consists of a vertically swinging arm, to which the telephone is pivotally attached, and flexible tapes for maintaining the vertical position of the telephone in all positions of the arm.



NO. 779,447.—CONTROLLER.

779,508. Art of Electrical Wave Transmission. Daniel M. Therrell, Atlanta, Ga. Application filed February 17, 1902.

A method of reinforcing the essential voice characteristics and thereby improving the transmission and articulation of electrically transmitted speech, consists in impressing upon the line a successive series of voice waves of the same essential form and of so arranging the phase relations of the series as to make them operate by interference to reduce the fundamental while increasing the partials of the voice waves corresponding to the essential characteristic partial tones of the sonorous voice waves electrically transmitted.

779,524. Printing-telegraph System. John Burry, Ridgefield Park, N. J. Application filed April 9, 1904.

In a printing-telegraph system there are combined with a main line, a local circuit, a polarized relay for controlling the impulses of current therein and a repeating mechanism operated by a magnet. A local circuit includes the magnet and a circuit [illegible] operated by a magnet in the main line, the repeating magnet being responsive only to prolonged impulses of current in its circuit due to correspondingly interruptions in the current in the main line. (See cut [illegible])

779,532. Connection Board for Dynamo-electric Machines. John G. Crawford, Lagrange, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed May 13, 1904.

Electrical terminals are carried by the board and a number of connecting members for the board are secured to the frame of the machine. Recesses are formed in the edges of the board and a lug carried by each member is adapted to enter one of the recesses, whereby the board is securely held in place and a maximum separation is obtained between the terminals and the connecting members.

779,533. Party-line Telephone System. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed June 15, 1903.

A bell provided with a tuned reed tongue is provided at each sub-station, the operative rates of actuation of the bells being higher than the natural rates of vibration of the reed tongues. Means at the central office impress upon the line ringing current of frequencies corresponding to the operative rates of actuation of the bells and sufficiently close to the natural rates of the tongues to start them vibrating.

779,539. Electric Arc Lamp. Walter C. Fish, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 24, 1901.

An arc-controlling mechanism cooperates with devices possessing inertia carried by the mechanism. Means allow the devices to oscillate freely relatively to the mechanism.

779,553. Protective Covering for Storage-battery Plates. Achille Meygret, Paris, France. Application filed April 6, 1904.

In a battery plate are a retaining base, an active material applied to the base and a soluble film surrounding the base and active material and furnishing a separation in applying a protective coating or covering to envelop the active material.

779,554. Trolley Bridge. Robert T. McCarroll, Columbus, Ohio, assignor to the Columbus Steel Rolling Shutter Company, Columbus, Ohio. Application filed June 4, 1904.

Combined with a doorway crossover and a flexible metallic curtain supported thereby are a movable bridge piece and means engaging with the curtain for opening and closing the bridge piece.

779,575. Polyphase Winding. Bernard A. Behrend, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company. Application filed November 6, 1903.

A polyphase winding is used in which the number of coils in each phase winding opposite adjacent field poles is different.

779,589. Electric Battery. Frederic P. Dewey, Washington, D. C. Application filed March 25, 1902. Renewed May 10, 1904.

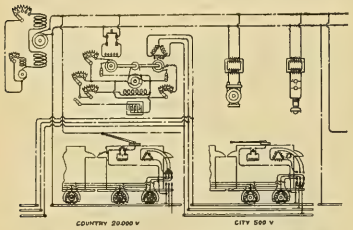
The cathode of the battery is in the shape of a thin flat strip and is maintained in contact with [illegible] of the electrolyte at one edge only.

779,592. Signal System for Elevators. Bartholomew J. Foley, Pittsburg, Pa. Application filed March 12, 1900.

A stationary push button closes the call circuit and an independent signal circuit is normally open and arranged to be set but not closed by actuating the call circuit. Means close the signal circuit after it has been set by the call circuit and an independent normally open release circuit releases the signal circuit and arranges it to be again set by the call circuit.

779,623. Electric Pump. Edwin F. Porter, Boston, Mass., assignor to the Porter Air Compressor Company, Kittery, Maine. Application filed February 9, 1903.

An electric circuit operates the pump, means operated by the flow of fluid through the pump control the motion of the pump and means operated by the pressure produced by the pump vary the action of the pump, both of the means controlling rheostats in series in the same circuit.




NO. 779,475.—SYSTEM OF ELECTRICAL DISTRIBUTION.

779,639. Method of Fastening Abrasive Material to Metal Bodies. Edson G. Case, Niagara Falls, N. Y. Application filed April 29, 1903.

The process consists in distributing a powdered or granulated abrasive material over the surface of the body and at the same time electroplating the body and abrasive material while the latter is being deposited. The plating metal is thus deposited over and around the surface and abrasive powder permanently fixing the latter to the body.

779,640. Suspension Device for Trolley Wires. Theophilus P. Chandler, Philadelphia, Pa. Application filed October 7, 1904.

Two gripping plates each has two oppositely arranged jaws adapted to extend partly around the wire on opposite sides and jointly inclose it for more than half its circumference, the plates being formed with a gap or clearance space between the jaws to receive the wire and allow it to come into the plane of the jaws, whereby each of the plates may be rotated to bring the jaws into gripping position upon opposite sides of the wire.

779,654. Trolley Retriever. Emil J. Jonas, Hamlet, Ohio, assignor of one-fourth to Philip M. Offutt, Hamlet, Ohio. Application filed April 1, 1904.

An automatic device for lowering the trolley pole when it has escaped from its normal position on the wire is described.

779,659. Insulator. Fred M. Locke, Victor, N. Y. Application filed May 31, 1904.

A device for linking two parts together to resist opposing strains comprises a metal cap having an eye on one end and a threaded socket in its opposite end, a hub of insulating material inserted in the socket and a metal rod secured to the hub.

779,670. Telegraph System. Harry Shoemaker, Philadelphia, Pa., assignor of one-half to Marie V. Gehring, Philadelphia, Pa. Application filed October 11, 1902.

Means are embodied in the system for impressing upon a circuit a number of series of pairs of impulses, the pairs of impulses of a series alternating with the pairs of another series, the impulses of each series differing in strength from the impulses of the other series. The messages represented by the impulses are recorded.

779,673. High-frequency Induction Apparatus. Charles L. Spaulding and Robert E. Austin, Kansas City, Mo., assignors of one-third to William R. Clarke, Kansas City, Mo. Application filed April 25, 1904.

Induction apparatus comprises two primaries and two secondaries, a condenser located in the circuit of the primaries, a spark gap between the condenser and one of the primaries, connections between the primaries and the ends of the secondaries, and sparking terminals attached to the other ends of the secondaries.

779,693. Battery Zinc. Frank J. Delavie, Pittsburg, Pa. Application filed July 1, 1904.

In an electric battery are a jar, a bridge piece provided with a key slot opening through the bridge piece and a battery zinc having a stem provided with a lateral projection or projections arranged to pass through the keyhole slot of the bridge piece and when given a partial turn to rest upon its upper face.

779,705. Method of Treating Alkaline Solutions of Chromate of Soda. William T. Gibbs, Buckingham, Canada, assignor to the National Electrolytic Company. Application filed February 10, 1904.

A method of treating alkaline solutions of chromate of soda consists in removing the free alkali and then treating the solution by electrolysis to produce a solution of bichromate of soda and a solution containing chromate of soda and caustic soda.

779,720. Voltage Regulator. Orra M. Lacey, Hanford, Cal. Application filed November 9, 1903.

An electric voltage regulator comprises cylinders, connected pistons of different areas and a rheostat with which the pistons are connected. Means admit a fluid under pressure to opposite ends of the cylinders controlled by valves. An electromagnet and valve-actuating armature, a source of electric energy for the magnet and a voltmeter by which the current through the magnet is controlled are the remaining parts. (See cut.)

779,733. Electrode. Edgar F. Price, Niagara Falls, N. Y., assignor to the Union Carbide Company, Niagara Falls, N. Y. Application filed June 28, 1904.

An electrode comprises a carbide and a binder of coked bituminous coal and liquid hydrocarbon.

779,735. Electrolysis. Giovanni Rambaldini, Minera di Boccheggiano, Italy. Application filed January 28, 1902.

A non-conducting vessel contains an insulating partition. Liquids are placed in the vessel upon opposite sides of the partition and an electrode in each compartment is in contact with the liquid therein. Metallic conductors support the electrodes. A lighter and conducting liquid in the vessel covers the liquid in its compartments, the partition terminating in the lighter liquid beneath the surface. A source of electrical energy is externally connected with the metallic conductors.

779,737. Shunt for Electrical Measuring Instruments. Lewis T. Robinson, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 18, 1904.

A shunt for electrical measuring instruments comprises a resistance strip having heat radiators in good thermal relation at distributed points throughout its surface.

779,739. Protective Device for Third Rails. John Ryan and Anthony C. Guntzer, New York, N. Y. Application filed November 5, 1903.

A roof-like structure covering the third rail is described.

779,779. Electric-lamp Fixture. Edwin E. Hayward, Waterbury, Conn., assignor to the Plume and Atwood Manufacturing Company, Waterbury, Conn. Application filed June 8, 1904.

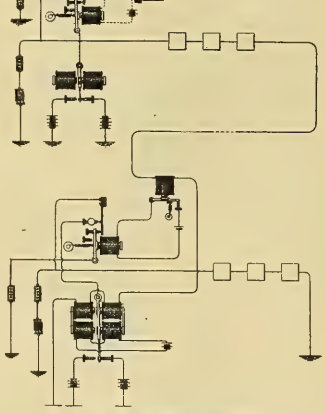
An electric-lamp fixture consists of a cluster box having a body portion adapted to be attached to a lamp standard, a removable cap for the body portion, arms extending from the body portion, lamp sockets connected to the arms, a shade holder supported by the removable cap and means for securing the shade holder to the cap.

779,791. Method of Freeing the Soil, Trees or Plants from Harmful Animals. Sigismund Lokuciejewsky, Odessa, Russia. Application filed August 6, 1903.

The method of freeing the soil and its products from harmful animals consists in subjecting the soil and its products to the action of an alternating current of high tension and frequency and low density.

779,810. Electric Branding Apparatus. David C. Sprecher, Kansas City, Kan., assignor of one-half to John E. Doran, Kansas City, Mo. Application filed November 15, 1904.

A pair of electrodes comprise the apparatus, one of which is in the form of a branding iron and of materially less contact area than the other.



NO. 779,524.—PRINTING TELEGRAPH.

779,822. Bearing for Electric Meters. Frederick M. Vogel, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 13, 1903.

In an electric measuring instrument are a shaft, a pivot secured axially to the end of the shaft, and a jewel on which the pivot rests, the pivot being of a material having natural lubricating qualities.

779,850. Trolley for Electric Railways. George C. Hohein, Norfolk, Va. Application filed September 17, 1904.

The trolley pole has an upper forked end, a harp, a trolley wheel journaled in the harp and springs secured to the harp and the forked end to flexibly mount the trolley upon the trolley pole.

779,875. Automatic Motor-starting Rheostat. Ernest Schattner and Caryl D. Haskins, Schenectady, N. Y., assignors to the General Electric Company, Schenectady, N. Y. Application filed May 13, 1904.

A starting rheostat having a self-reducing resistance is provided with means for closing circuit through the motor armature and the resistance in series and means dependent upon the counter electromotive force of the motor for short-circuiting the resistance.

779,892. Telephone Selecting System. William D. Watkins, San Jose, Cal. Application filed May 1, 1903.

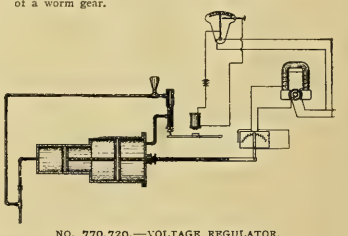
Means at the local station controlled by the energizing of the call-bell magnets place the talking circuit in communication with the main line and a selecting means is normally connected in the main line and provided with means for closing the circuit through the electromagnets of the call bell.

779,893. Selective Signaling System. William D. Watkins, San Jose, Cal., assignor to the Watkins Manufacturing Company, San Jose, Cal. Application filed November 4, 1903.

A step-by-step mechanism operated by electromagnets, in turn controlled by the signal circuit, operates the signals.

779,907. Motor Air Pump. Edward Cheshire, Milwaukee, Wis. Application filed February 13, 1904.

A motor mounted upon the pump drives it by means of a worm gear.



NO. 779,720.—VOLTAGE REGULATOR.

779,920. Track Switch for Electric Railways. George H. Fretts, Springfield, Mass. Application filed March 25, 1903.

Motor mechanism actuates the revoluble member of the switch. Electrically operating mechanism controllable at will from a movable vehicle actuates the motor mechanism.

779,940. Support for Telephone Receivers. Frank F. Howe, Marietta, Ohio. Application filed September 23, 1904.

The telephone receiver is held by a support on the telephone casing. When the receiver is pulled out and turned toward the ear levers raise the switch hook of the telephone and cut in the transmitter.

779,948. Electric Arc Lamp. Heinrich Lux, Schöneberg, near Berlin, Germany, assignor to the firm of Allgemeine Belauchtungs und Heiz Industrie Actien Gesellschaft, Berlin, Germany. Application filed June 8, 1904.

A solenoid is carried by the upper part of the frame provided with a tubular core and a plate secured to the lower part of the frame is provided with an adjustable tappet. A guide tube is secured in the core provided with a lateral projecting arm at its lower end, a carbon being slidable in the guide tube.

779,982. Selective Telephone System. Peter J. Albrecht, Marion, S. D. Application filed July 25, 1904.

Each station has a relay in its ringing circuit controlling a local circuit. A local signal circuit at each station contains means for closure and means for releasing the closing means. An electromagnet in the secondary circuit of the relay and under the influence of which the actuating means is movable out of engagement with the holding means, the actuating means being adapted for successive operation, is also provided.

779,996. Inductance Coil. Walter C. Fish, Lynn, Mass. Original application filed June 24, 1901. Divided and this application filed September 3, 1903.

The inductance coil consists of a core, a main winding carrying a unidirectional current subject to fluctuations and a countermagnetizing winding excited by direct current.

779,999. Bowling Alley. Paul A. Haberl, Denver, Colo., assignor of one-half to Leopold Kabis, Cheyenne, Wyo. Application filed February 27, 1904.

An indicator designating the position of the pins by arrows faces the bowler. The arrows are turned by electromagnetic means in circuit with a contact under each pin on the platform. When a pin is knocked down the weight is taken off from the contact, which is released, closing the circuit. In this manner the number of pins knocked down is shown to the bowler by the position of the arrows on the indicator.

## EXPIRING PATENTS.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on January 17, 1905:

376,541. Mechanism for Electrically Controlling Stamping Machines, etc. O. Mergenthaler, Baltimore, Md.

376,562. Electric Conduit. R. Van Buren and J. J. Powers, Brooklyn, N. Y.

376,567. Electric-railway System. D. G. Weems, Baltimore, Md.

376,569. Telegraphic Apparatus. S. B. Whitehead, San Francisco, Cal.

376,583. Combined Incandescent Electric-lamp Socket and Converter. E. A. Colby, New Haven, Conn.

376,615. Support for Telephone Receivers. W. E. Thurber and J. McConnell, Cleveland, Ohio.

376,617. Combined Gas and Electric-light Fixture. S. H. B. Vance, New York, N. Y.

376,639. Electromagnetic Device. C. E. Brush, Cleveland, Ohio.

376,651. Automatic Electric Valve. C. J. Hexamer, Philadelphia, Pa.

376,661. Telegraph Repeater. J. Kolzer, Duisburg, Prussia, Germany.

376,706, 376,307. Magneto Telephone. F. H. Brown, New York, N. Y.

376,709. Electromagnetic Brake. N. J. Clute, Schenectady, N. Y.

# WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXVI. CHICAGO, JANUARY 28, 1905 No. 4

## Power Development at Beznau-on-the-Aare, Switzerland.

By Franz Koester.

At Beznau-on-the-Aare is one of the largest and most important power plants in Switzerland, especially in relation to its electric features and its wide radius of distribution. Although this plant is still under construction it may be of interest to give a brief outline of the work. It is designed for 11 turbines, of 1,000 to 1,200 horsepower each, of which six are now installed, and three are under construction. The geographical situation of this plant is highly advantageous for the distribution of power in several directions through a region abounding in industries.

It was found expedient to use for the high-tension mains two voltages, one of 8,000 to serve the immediate vicinity, and one of 25,000 volts for the long lines, the one toward Lake Zurich being about 35 miles, and those leading southward to Entfelden and Lake Boniswyl, and westward to Rheinfelden being somewhat more than half as far.

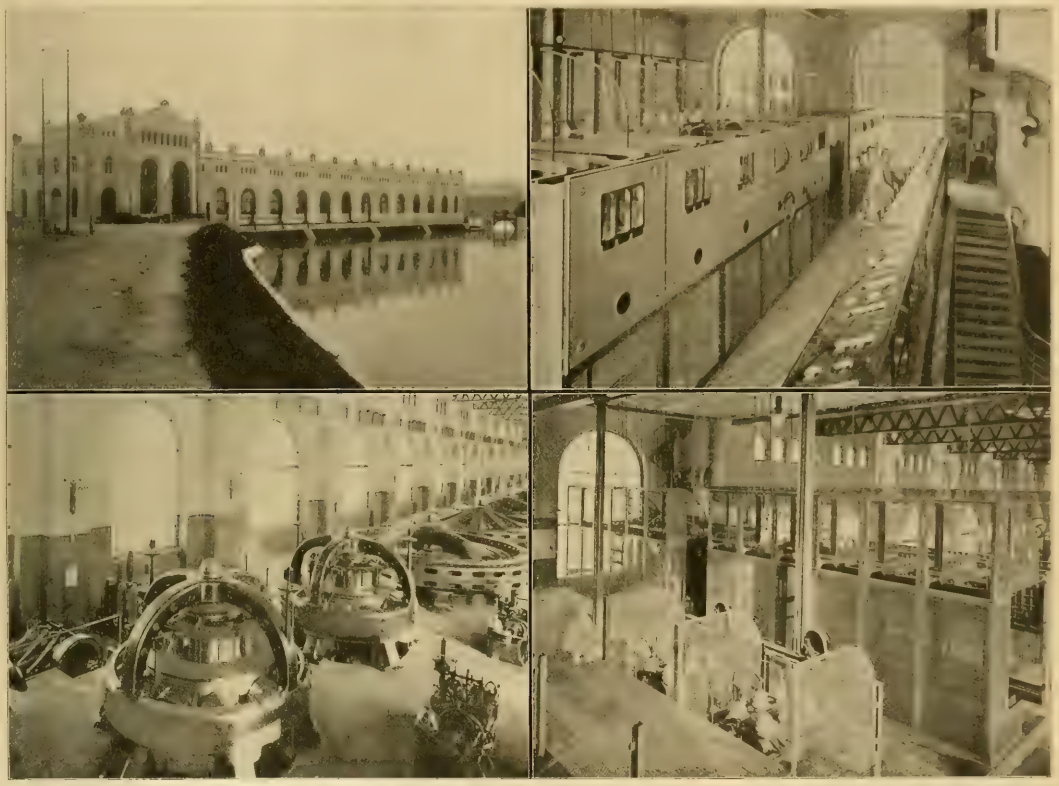
The plant is on the River Aare, about four miles from its junction with the Rhine on the northern boundary of Switzerland. An open-head canal leads from the Aare to the power house, where the fall utilized is 11 to 18 feet. The vertical turbines are in the basement, and the electric generators are direct connected to their shafts on the main floor, making 66.6 revolutions per minute. They are three-phase alternating, with 50 cycles and 8,000 volts. Two 400-horsepower separate vertical turbines drive direct-connected 200-volt exciters, on the main floor, in front of the switchboard.

There is a series of 910-kilowatt step-up transformers for converting part of the 8,000-volt current from the generators to 25,000 for the long lines. These, together with all switchboard and apparatus, are placed in a separate building adjoining the power house. As current is furnished for various industrial purposes, for street-railway service and for lighting, there are two 8,000-volt bus-bar systems, one of which is devoted to loads having greatest variation, and the other to the more uniform loads. These systems are arranged to connect in parallel, or each one direct to a generator, or to a transformer set.

One of the 25,000-volt lines running to Rheinfelden, about 28 miles distant, consists of three seven-millimeter wires, and enters a sub-station sup-

[illegible] 25,000-volt instruments for the outgoing line wires; also necessary controlling and regulating instruments, and hand levers for serving the main generator switches and exciter switches and outgoing line wires.

From the generators the current runs first to fuses placed on the generators, and then through underground conduits to the switching room, where the wires connect to instruments on a special 8,000-volt switch structure. From the switches of this system the wires pass to other sections, where they



Power House.
Interior of Powet House with Exciters in Foreground.

Switching Room
Switch Structure Showing Oil Switches in Foreground

POWER DEVELOPMENT AT BEZNAU-ON-THE-AARE, SWITZERLAND.

are distributed direct to the 8,000-volt outgoing lines, or are stepped up for the 25,000-volt lines. The switchboard consists of two parts—a vertical section, and another part, which is sloping deskwise. The vertical portion carries the instruments for outgoing wires, and the inclined part, instruments for generators. Contrary to general practice, the panels of these switchboards are of partly polished cast-iron plates, on which the nickel instruments make an attractive appearance.

All instruments are operated on low-tension current, and are well insulated from the switchboard. All hand wheels of switching instruments are insulated and entirely free from current, so that the entire system is worked with the greatest safety. There are 13 panels in the switchboards, 11 of which belong to the 11 generators, and two to the bus-bar systems. As already mentioned, all instruments carrying high-tension currents are placed in separate special compartments, and they are of the oil type. These are operated by hand wheels on the switchboard by means of "Gall chains." For additional safety there are automatic cut-outs, so designed that when the current exceeds a certain amount an aluminum disk, held in place by a small

plying 3,000 horsepower to assist the Rheinfelden hydro-electric plant. The Entfelden line is about 20 miles long, and has a branch to Boniswyl, both of 25,000 volts. There are three wires on this line eight millimeters in diameter. In both towns there are main transformer stations, each 500 to 800 kilowatts, where the current is reduced to 8,000 volts for supplying the surrounding country, where there are a number of sub-transformer stations for furnishing light and power currents. The third and largest main line runs about 21 miles to Seebach, near Lake Zürich, to a distribution and transformer station. From here there runs a 25,000-volt line to the city of Zürich, furnishing 3,000 kilowatts, and another to Grünigen, furnishing 3,640 kilowatts. There is also projected a line from Seebach to Winterthur to carry 2,000 kilowatts. The Seebach transformer station supplies 1,540 kilowatts, reduced to 8,000 volts, for use in the vicinity, where it is further reduced to suit requirements. This method is also followed in the Grünigen station.

Much care was given to the design of the switchboard system. All currents of like tension are served in separate parts of the switch structure. Controlling devices may be distinguished as, 8,000-

weight, is partly revolved and operates a relay current which throws into action an electromagnet operating a main current switch. If the current rises to the danger point slowly, the cut-out works slowly; if it rises quickly, the cut-out works correspondingly fast, and, finally, if there is a short-circuit, it operates instantly.

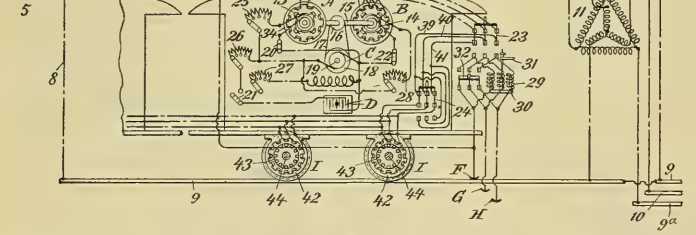
As the constructors of this plant are builders of electrical machinery they took special care to make the entire plant up to date in all respects, but most particularly as to the safety of employes. No money was spared to gain the greatest efficiency, but none was wasted in useless ornamentation. The general design of the power house is such that all the machinery may be easily overlooked from the switching room, and vice versa.

The turbines were furnished by Bell & Co., Lucerne, while the entire electrical equipment was furnished and installed by the Brown-Boveri Company, Baden, Switzerland.

## Polyphase and Single-phase Operation for Railways.

Josef H. Hallberg of New York city has been allowed a patent upon a polyphase system of distribution for electric railways in which polyphase current is generated and transmitted along the line, one phase of the current at its full voltage being used to actuate the motors in such localities wherein high voltage and speed may be used with safety. In other localities, such as in cities and towns where danger from contact is greater and lower speeds must be maintained, all the phases are used.

The accompanying diagram illustrates the railway as divided into two sections, the section at the left indicating a country section or other location where a single-phase current of high voltage may be employed, the section at the right a city section or



POLYPHASE AND SINGLE-PHASE OPERATION FOR RAILWAYS.

other location where a polyphase current may be employed.

In the diagram (5) indicates a polyphase generator, (6) (7) (8) conductors leading from it and carried along the railway. The conductor (7) serves as a contact conductor over that portion of the railway where the single-phase current is employed. A traffic rail (9) forms a portion of the conductor (8). In the city section of the railway two traffic rails (9) (9a) and a third intermediate conductive rail (10) are employed. Interposed between the source of polyphase currents and the three conductors of the city section of the railway is a polyphase transformer, which may be of any suitable type and adapted to modify the voltage of the current. Ordinarily a step-down transformer is used.

Situated upon the car is a single-phase alternating motor (A), polyphase generator (B), direct-current generator (C), storage battery (D), trolley contact (E) and contact shoes (F) (G) (H).

The rotor members (13) (14) respectively, of the single-phase motor and polyphase generator are positively connected through the shaft (15), on which is a pulley over which passes a belt which is carried over a pulley mounted upon the armature shaft of the direct-current generator (C).

The starting device embodies reactive coils (29) and iron cores (30), which can be raised or lowered by manipulating the lever (31).

The operation of the system is as follows: When it is desired to excite the vehicles upon the railway and, further, to convert a single-phase current of high voltage into a polyphase current of different voltage, the single-phase motor is brought into synchronism with the generator (5). This is accomplished by driving the small direct-current generator (C) as a motor by the current derived from a storage battery and transmitting the motion of the armature of the generator through the belt and shaft to the rotor members of the motor (A) and polyphase generator (B). When the generator (5) and motor (A) are in step the switches (20) (21) are closed. This causes current from storage battery to flow through the winding of rotor (13) of motor (A), thereby exciting it. When proper voltage of the motor has been obtained the switch (33) is thrown to connect the stator member (34) across the conductors (79). After the motor (A) has been brought up to speed it operates as a single-phase synchronous motor, driving, through the shaft (15), the rotor member (14) of the polyphase generator (B) and also by means of the belt the armature of the small direct-current generator (C), the current from which can now be used by closing switch (22) for exciting the rotor members of motor (A) and polyphase generator (B) and, further, for charging the storage battery. When it is desired to start a car the switch (22) is first closed, thereby permitting a small amount of direct current from the direct-current generator to flow through the rotor member of the polyphase generator. The effect of this small current in the rotor member is to induce a low voltage in the stator member (35), the current from which is transmitted through the starting switch (23) and reversing switch (24) to the stator members (42) of the polyphase motors (I), thereby inducing movement of their rotor members and through them motion to the car. By reversing the position of the reversing switch (24) the direction of motion of the car may be altered, and by varying the resistance through the rheostats the speed may be changed as desired. When the car moves into the section of the railway fed from the transformer (11), the shoes (F) (G) (H) make contact with the rails (9) (9a) and conductor (10) and the trolley pole (E) is drawn out of contact with the conductor. At such time the starting switch (23) has its position reversed to coact with the lower set of contacts, the current is carried through the reactance member and regulated, after which the by-pass switch (32) is thrown to cut the reactance member out of circuit.

One of the most important features of this system and one mentioned in the basic patent (No. 779,475) is the fact that no commutators are required upon the main generators or driving motors of a locomotive driven by it. It has often been questioned whether a single-phase commutator-type motor or motors of an aggregate capacity of 2,000 horsepower could ever be used on a locomotive on account of the fact that commutators and gears have to be used, and furthermore, for the reason that the possibility of starting a 2,000-horsepower, single-phase commutor-type motor equipment directly from a primary-distribution system without paralyzing the regulation of the system has yet to be demonstrated. The advantage of the system described therefore lies in the fact that the polyphase driving motors may be mounted directly upon the driving axles without the interposition of gears and can be used without a commutator.

## Merger in Kalamazoo and Vicinity.

The W. A. Foote electric-railway interests in the vicinity of Kalamazoo, Mich., are being merged into one company, which will be known as the Commonwealth Power Company. The merger will include the Battle Creek Electric Company, the Albany Electric Company, the Kalamazoo Valley Electric Company, the Jackson Light and Power Company, the Plainwell Electric Company and the Otsego Power Company. The new company is organized under the laws of Maine and has filed a mortgage of $1,200,000 in each county in which the interests lie. It contemplates making many improvements and will pay special attention to developing the waterpower from the Kalamazoo River. Mr. Foote also contemplates building a $100,000 steam-power plant in Jackson. This company now furnishes electric light and commercial power for the cities of Kalamazoo, Battle Creek and Jackson, including the street-railway systems in each of these cities.

## QUESTIONS AND ANSWERS.

W. J. Moore of Meaford, Ont., writes: "I have a two-cycle gasoline engine (four-inch bore and four-inch stroke) of 2½ horsepower, and would like to know the best speed to run a 12-inch two-blade propeller on same; or would it be wise to have a larger one and run slower? If I reduce speed of engine I lose power."

Answer.—This question can be best answered by a marine engineer, or it might well be addressed to a motor-boat manufacturer. However, perhaps some reader of the Western Electrician can supply Mr. Moore with the desired information.

From an Ohio city comes this: "We are seeking for some information regarding the use of a magnetic cut-out to blow out an induction spark occasioned by breaking the circuit of a coil carrying about one ampere of current and of about 6,000 ampere-turns at 110 volts direct current."

Answer.—Magnetic blow-outs are not usually applied to small induction sparks such as the one described; they are more frequently used in connection with heavy inductive arcs. In this case the use of a condenser in series with a non-inductive resistance may be advised. Connect a condenser of about one-half microfarad capacity in series with a non-inductive resistance of about 300 ohms, and shunt the combination around the points between which the spark passes. A 16-candlepower, 110-volt incandescent lamp will furnish a convenient non-inductive resistance for this purpose. If it proves to be too high, a 32-candlepower lamp may be used; if too low, a 16-candlepower, 220-volt lamp should be tried. The capacity may also have to be varied to secure a practically complete suppression of the spark. It is impossible to determine from the data furnished the exact capacity and resistance necessary in this particular case. But the correspondent will find the values given above to be very nearly what are required to suppress the spark in question.

A Detroit reader asks: "What is your opinion of the desirability of fiber or fiber washers where it is necessary that there should not be swelling or shrinking in fine electrical work? The work is exposed to a cold, damp atmosphere during five months of the year and to a very warm, dry atmosphere during the remaining seven months of the year."

Answer.—Fiber, as an insulator, plays a useful part in electrical work, but it is not usually recommended for what may be called fine work, as instruments, telephone switchboards, and the like. When exposed to a moist atmosphere it is apt to absorb moisture and swell, and upon drying it usually warps more or less badly. The insulating qualities of dry fiber are fair, but moist fiber is a poor insulator. Chlorine, in the form of a chloride, is found in small quantities in nearly all fiber. This, in the presence of moisture, tends to act corrosively upon metallic surfaces in contact with the fiber; and when any considerable difference of potential exists the corrosion is increased by the electrolytic action taking place. Where very high insulation, the retention of shape and size and absence of corrosion are factors in electrical work that may be exposed to moisture, fiber should not be used. In some grades of apparatus, where these features are of secondary importance, fiber is frequently employed on account of its cheapness, and in such cases it may be used to advantage. The results obtained from fiber will, of course, be best when it is in a continuously dry atmosphere free from violent extremes of temperature. Hard rubber is usually employed as an insulating medium in high-grade electrical instruments and apparatus, but where the cost of this material prohibits its use, one of the numerous substitutes now on the market may be used. Some of these artificial hard rubbers possess many of the excellent mechanical and electrical qualities of the genuine article.

## American Electrotherapeutic Association.

The next (fifteenth) annual meeting of the American Electrotherapeutic Association will be held at the Academy of Medicine, 17-21 West Forty-third Street, New York city, on September 19, 20 and 21, 1905. The present officers of the association are: President, Emil Heuel, M. D., NewYork; vice-presidents, Charles H. Hughes, M. D., St. Louis, and M. W. Brinkmann, M. D., New York; treasurer, Richard J. Nunn, M. D., Savannah, Ga.; secretary, Clarence E. Skinner, M. D., 67 Grove Street, New Haven, Conn. There is also an executive council of six members, of which Dr. Daniel R. Brower of Chicago is a member.

# NORTHWESTERN ELECTRICAL ASSOCIATION.

The annual convention of the Northwestern Electrical Association was held in the Hotel Pfister, Milwaukee, on January 18th, 19th and 20th. The attendance at the meetings was fair, and, although the programme was a somewhat long one, it was carried through on time, and much interest was shown in the discussion of the various papers. In the way of exhibits by manufacturers, not quite as much interest was taken as last year, there being not as many, though the general character of the exhibits was excellent, some of the manufacturers going to considerable expense and labor to have their apparatus show up to advantage.

The first session of the convention was called to order by President L. P. Grover of Fond du Lac, Wis., on Wednesday forenoon, in the clubroom of the hotel and, upon motion, roll call was dispensed with. The president's address and report of Secretary and Treasurer Thomas R. Mercein were read at this session.

### President Grover's Address.

I am pleased to greet you at this, the thirteenth annual convention of this association. I am also pleased to state that this is the twelfth annual meeting of this association that I have attended, and that I have profited and enjoyed each and every meeting. The first meeting of this association, I believe, was held in Milwaukee, February 17, 1893, and was for organization only, there being no papers presented at that meeting. I have therefore attended every annual meeting of the association since its organization, and am more than pleased to know that it has been a success from the beginning, and the name of the Northwestern Electrical Association is now known throughout the land as one of the leading associations of this country. The papers and discussions of this association have been published in all the technical journals from time to time and have been recognized as among the foremost. The programme prepared for this meeting I have no doubt will not only keep up the standard of the association, but increase the interest shown heretofore.

The last year, I believe, has been a successful one to the great majority of the central stations as well as to the street and interurban-railway interests. Electricity is constantly reaching out and finding new industries to conquer. At the semi-annual convention of this association held at St. Paul in 1894, as I remember, the attendants wore a badge on which was inscribed, "The man who says electricity is in its infancy shall be hanged by his neck until dead, dead, dead!" Very few of us at that time, however (although but 10 years ago), realized the steady advance that would be made in electrical industries.

The last year will go down in history as an eventful one in electrical industries. One of the more important achievements being the [illegible] great New York subway, which would not have been possible without the aid of electricity, perfecting of the single-phase railway motor has done much for the interurban railway, as it permits the transmission of electrical energy for greater distances, and by the use of trans[illegible] with expensive sub-stations and opens the way to the speedy conversion of steam railways to electric.

These I mention as a few of the electrical achievements during the last year, many of which were to be seen at the great exposition held at St. Louis, at which city a pleasant and profitable meeting of the association was held, September 12th to 16th last. No papers were presented at this meeting, as it was assumed the members would prefer to attend the meeting of the Electrical Congress and inspect the exhibits at the Fair in a body, which programme was carried out and profitably enjoyed by all in attendance.

At this meeting it was voted to include street and interurban railways in this association. While I believe the by-laws of the association did permit and include these interests, it was not generally so understood. Many of our members now operate street railways in connection with their lighting [illegible] have so generously furnished papers for this meeting [illegible]

[illegible] things he said: "It was decided at St. Louis to make an effort to interest the street-railway men [illegible] tion, and after our return at the suggestion of the president I drafted a circular and mailed it with a [illegible]

SOME OF THOSE IN ATTENDANCE AT LAST WEEK'S CONVENTION OF THE NORTHWESTERN ELECTRICAL ASSOCIATION IN MILWAUKEE

But little has been heard of municipal ownership in the territory covered by this association during the last year. Municipal plants now in operation have failed to show the large profits predicted, and it is easily to be seen by all fair-minded business men that a corporation, properly managed, operating commercial lighting, power and railway plants, can, and does, furnish better and cheaper street lighting than can be furnished independently by any political body.

The officers of the association have endeavored to secure, and I believe have secured, a number of valuable papers which will be presented at this meeting, and I trust the members will discuss them freely, as it is from discussion that we receive the greatest benefit.

There are still a number of railway and lighting plants throughout the Northwest that are not members of this association. With the moderate dues, there is no reason why the smallest company should not be represented in this association and attend all its meetings, thus promoting its own success and contributing to the welfare of the community in which it is doing business. I would suggest that a committee be appointed on membership, consisting of three members, together with the secretary, and that the members be selected from both railway and lighting companies.

In pursuance of the by-laws of the association, the annual meetings have always been held in Milwaukee, later with a reminder postal. The result, however, was not very satisfactory. Nevertheless we have had 22 applications for membership during the year."

### Reports of Committees.

Very little of moment to electrical interests has been enacted or proposed by the various state legislatures of the Northwest during the last year as reported by the legislative committee, of which S. B. Livermore is chairman. Sub-committees in each state keep in touch with legislative affairs and do what is in their power to bring about legislation favorable to electrical interests. The committee from Iowa reported an act covering malicious mischief and trespass. The committee from Illinois reported no bills passed detrimental to electrical interests. The committee from Indiana reported a bill for an act concerning municipal corporations pending before the state Legislature of Indiana. The committee from Michigan did not reply with any report. The committee from Wisconsin also made no report, athough ample time had been given it to reply. The committee from Minnesota reported no meeting of the Legislature last winter, and so far as can be learned nothing important has been introduced this term.

H. J. Gille of St. Paul, chairman of the committee on uniformity of advertising matter, had been East and was not able to be present, but Mr. Harold Almert of Oak Park, Ill., a member of that committee, had something to report for the committee. He said:

"I submitted the observations I have made during the year to the chairman of the committee about

two weeks ago, and I supposed that he would be present at the convention and submit that report or send it in. My observations were simply in handling the advertising after we have gotten it, and I made some suggestions from what I had seen during the year, from people I had spoken with and from methods I had personally used. Mr. Gille will no doubt submit the matter and we will get it in the regular proceedings.

"I have found a very satisfactory system, so far as my own business is concerned, to care for the great variety and forms of advertising matter that we receive. Personally I have not seen much progress made in changing the prices and I plead the excuse that I have been hurried and have not had time to give the matter much attention in that line. But I have found a very satisfactory system as I say, for taking care of every piece of advertising that ever comes into the office and having it arranged for ready reference whenever it is needed, not only taking care of it but keeping up the dates, so that obsolete matter is disposed of or kept for such time as we choose to dispose of it. I would not report anything further, but wait until we get the report of the chairman of the committee in the proceedings.

### New Members.

The following applications for membership were received and granted:

Active.—John Powers, superintendent, S. D. and E. E. railway, Sterling, Ill.; George P. Dravo, mechanical engineer, Milwaukee; J. Carson, chief engineer Duluth Street Railway Company, Duluth, Minn.; J. B. Hirst, superintendent Kenosha Gas and Electric Company, Kenosha, Wis.; John Wright, owner of the electric-light plant at Antigo, Wis.; W. E. Haseltine, superintendent Ripon Light and Water Company, Ripon, Wis.; Mt. Morris Electric Light and Power Company, Mt. Morris, Ill.; Oak Park Yaryan Company, Oak Park, Ill.; La Crosse City Railway Company, La Crosse, Wis.; H. B. McMeal, editor Telephony, Chicago; C. J. Schram, superintendent Equitable Electric Lighting Company, Lake Geneva, Wis.

Associate.—Jewell Belting Company, Chicago, Ill.; Kaukauna Electric Light Company, Kaukauna, Wis.; Allis-Chalmers Company, Milwaukee, Wis.; Western Display Company, St. Paul, Minn.; Nernst Lamp Company, Pittsburg, Pa.; Burton C. Dinius, manager electric and power departments, Zion City, Ill.; Bullock Electric Manufacturing Company, Cincinnati, Ohio; W. D. Keuz, M. and M. Light and Power Company, Marinette, Wis.; Edward B. Kirk, general manager Winnebago Traction Company, Oshkosh, Wis.; Daggett Trolley Equipment Company, Chicago, Ill.; W. W. Winter, Darlington, Wis., and L. L. Tessier, De Pere, Wis.

### Papers and Addresses.

The first paper on Wednesday afternoon was by Mr. W. B. Jackson of Madison, Wis., upon the "Successful Joint Utilization of Several Small Waterpowers by the Janesville Electric Company." In the course of the paper Mr. Jackson made reference to the fact that it not infrequently happens that old apparatus is thrown aside in the reorganization of electric plants to be replaced by slightly more efficient modern machinery when the actual net returns thus derived are not increased to an extent to warrant the change. This statement was not, however, to be construed as a reflection upon the manufacturing or supply companies for the reason, as the author remarked, that "every successful electric company means the addition of many others, and every unsuccessful electric company of course deters capital from entering that class of business. Consequently it behooves not only the people who expect to operate a plant that it should be made the most economical and most satisfactory plant, but it also behooves the manufacturers and supply men to see to it that plants are the most satisfactory and economical possible."

Following Mr. Jackson the secretary read a paper prepared by Prof. G. D. Shepardson of the University of Minnesota upon "The Rating of Street Lights."

Mr. O. M. Rau of Milwaukee then read his paper upon "Alternating-current and Direct-current Distribution." The paper contained the results of an extensive investigation relative to this subject which the author had carried out.

The next subject in order was a talk by Mr. W. T. Goddard of Victor, N. Y., upon "High-tension Practice," but as the lecture was to be illustrated by lantern slides and the lantern was not ready Mr. C. H. Williams' paper upon "Distribution and Dollars" was substituted in its stead. This paper was an excellent one, and as the time was somewhat limited its discussion was deferred till the next morning.

In concluding the proceedings Wednesday afternoon Mr. Pogue of the Sheldon School of Scientific Salesmanship delivered a lecture, in which he presented the ideas of the school which was organized by Mr. Arthur F. Sheldon of Chicago. In taking up the question of salesmanship itself the speaker said:

"Salesmanship is a distinct profession, made so by the science which underlies it. Science, as you have found in the electrical world, is simply the bringing together of those things which enter into your particular business—facts and truths that have always existed, facts and truths that existed long before Franklin ever flew his kite and brought the lightning from the sky, facts and truths that we have not altered one whit, that no man can explain—not Edison himself can tell what electricity is—but these facts and truths have been collated and brought together; and that is exactly what Mr. Sheldon has attempted to do and has succeeded in doing to so large a degree in the science of salesmanship.

"Salesmanship has been defined by an exceedingly intelligent business man as the art of disposing of that which you have to sell, and yet that is not salesmanship at all. For if there were rival companies, for instance, in the town of Madison, Ind., and each of those companies had light, heat and power to sell and each of those companies were fighting the other until by cutting and slashing prices they were selling light, heat and power for less than it cost to produce, the inevitable result of that would be failure for one of those concerns—that is not salesmanship.

"Salesmanship is the power to persuade people to purchase at a profit that which we have to sell, and if the element of profit is lacking, then there has been no salesmanship exhibited whatever. We may have all of the peas in that pod (and they are five—power, persuade, people, purchase, profit) except the last and there will certainly not be any soup. It is the profit that is worth while, and it is the profit we are after.

"The power of suggestion from man to man is just as certainly a law as the law which underlies electricity. The law of conveyance of thought over the wire, under the ocean, or the law of the conveyance of thought through the air by the marconigram is no more certain than the law of the electrical conveyance of thought from mind to mind."

At the opening of the session Thursday morning Mr. Almert had a suggestion to offer regarding the

C. H. WILLIAMS, THE NEW PRESIDENT OF THE NORTHWESTERN ELECTRICAL ASSOCIATION.

scarcity of discussion of many of the papers which were really important. He said: "It has been repeated time and time again here that the greatest value of papers is received from the discussion. I believe the fact was mentioned last year, but no action taken. Would it not be feasible to have one or more people see a copy of the papers before they are read, to have some sort of a formal discussion prepared? It is pretty difficult to take any paper and just hearing it read pick out the important points and discover questions you would like to ask. Most of us see these points after we have been home about a week or so, and I would like to make a suggestion, if it seems feasible to the rest of the members, that hereafter the secretary send a copy of the paper to one or more members interested in the particular matter covered by the paper and have a discussion prepared beforehand."

This question was argued at some length. Some of the members thought that advance copies of the papers should be sent to everyone.

To this argument C. H. Williams of Madison, Wis., replied that if one individual paper were delegated to one or two men whose business it would be to prepare themselves on that paper and criticise it, the criticism would lead up to discussions from all the rest of the members or from many of them. In that case there would be leaders in the discussion, whereas if the papers were sent out to all the members each would think the other fellow would argue it and would thus shift the duty from himself. This argument created a favorable impression and Mr. Williams finally moved that the president and secretary be empowered to delegate one or two members, as they may see fit, to lead the discussion on each individual paper that is presented before the convention and that the selection be made in advance so that those appointed may prepare themselves on the particular work. The motion was carried unanimously.

### Stenographic Report of Discussions Not to be Supplied to the Press.

At this point a question of considerable importance to the association was brought up. It related to the publication by the technical press of stenographic reports of the discussions of papers. Some remarks had been made earlier in the meeting which, from their nature, it was deemed advisable to have stricken from the official report of the proceedings. The secretary then stated that, as far as the printed proceedings of the association were concerned, this was very easily done, but that the stenographic report of the meeting had been sent, according to contract, to several technical papers. This statement brought forth expressions of opinion on the part of many present.

Secretary Mercein said that he had frequently urged upon members the necessity of being careful in the heat of discussion not to pass remarks for which they would be sorry later.

Mr. Rau of Milwaukee thought that the typewritten reports of all discussion of papers should be submitted, to those taking part, for revision.

The secretary then contended that this would not be a practical procedure. A small percentage of those taking part in the discussion would take the pains to revise their words, but the majority, after they had once spoken, would not give the matter a second thought, and for the secretary to attempt to "round them all up" and have them go over the discussion would be an almost hopeless task.

It was then suggested that, if the discussions were not given to the press at all, members would be more free to speak in the conventions upon matters concerning prices and things of a like nature which they would not care to have published broadcast.

After considerable argument along these lines it was finally moved and carried that after the present convention (reports for which had already been contracted for with the papers) the reports of discussions shall be withheld entirely from the press.

### Thursday's Papers.

An interesting and important paper of Thursday morning was by Mr. E. P. Warner of Chicago on "Series Alternating Arc Lighting."

The afternoon programme for Thursday was a long one, including the remaining four papers on the programme.

Mr. W. T. Goddard gave his lecture upon "High-tension Practice," which was very interesting, being illustrated by numerous lantern slides representing the great variety of line apparatus and construction.

Clarence Renshaw of Pittsburg read a carefully prepared paper upon "Single-phase Railways and Their Possibilities," which was also illustrated with stereopticon slides.

"The American Diesel Engine" was the subject of an important paper by Mr. Norman McCarty upon this new (in practical development) type of prime mover.

Mr. J. W. Schuster of the University of Wisconsin read the last paper upon "Motor Adaptability." Mr. Schuster during several years of teaching at the university has had to do more especially with motor work, and his paper showed that he was well informed on his subject. It brought up considerable discussion, which was, however, cut off, owing to the lateness of the hour.

### Election of Officers and Closing Proceedings.

President Grover appointed as the nominating committee, on Wednesday, Messrs. J. H. Harding, O. M. Rau and R. N. Kimball. The gentlemen named for the membership committee were S. B. Livermore, P. H. Korst and W. B. Jackson.

On Thursday morning the nominating committee submitted the following names for the officers and directors for the ensuing year:

President—C. H. Williams of Madison, Wis.

First Vice-president—R. N. Kimball of Kenosha, Wis.

Second Vice-president—Harold Almert of Oak Park, Ill.

Directors—P. H. Korst, Janesville, Wis.; Ernest Genzenbach, Sheboygan, Wis., and H. J. Gille of St. Paul, Minn.

The secretary was instructed to cast the unanimous vote of the association for the gentlemen named.

The convention was called to order on Friday, January 20th, at 10 a. m., and there being no further business adjournment was taken.

### The New President.

Mr. C. H. Williams of Madison, Wis., the new president of the association, is a man young in years but possessed of those qualities which will fit him successfully to meet the responsibilities of his position. He was born in 1873 and is therefore only 32 years of age. His education outside of preparatory work was obtained at the University of Wisconsin and he now holds the degrees of M. E. and E. E., the latter having been conferred upon him without his having received his bachelor's degree. These things speak highly of his scholastic ability. After leaving the university Mr. Williams became assistant engineer of the Madison Gas and Electric Company, from which position he has worked himself up to general superintendent.

It will be remembered that Mr. Williams read a paper at the Cincinnati meeting of the National Electric Light Association in 1902 on gas engines which created much comment at the time, since the Madison plant, concerning which the paper was written, was the first gas-engine plant of the kind in the country. Mr. Williams was also the able editor of the "Wrinkles" department of the Boston

[Continued on page 74.]

## Recent Improvements in Nernst Lamps.

To the casual observer probably the Nernst lamp would represent the same appearance now that it did on its introduction to the American public at the Buffalo Exposition in 1900, although improvements, many of which are of vital importance, have been constantly going on. The fact that the standard lamp is practically the same in its main features as well as in external appearances as it was four

FIG. 1 THREE-GLOWER NERNST LAMP WITH CONVERTER COIL.

years ago is a distinct compliment to the handiwork of the original designers.

The improvements have been largely in the direction of perfecting the internal working parts, such as the ballast and cut-out, making them more efficient and effective and in shaping the housing to protect it from dust and insects. Aside from these improvements, mostly of a mechanical nature, which have been embodied in the standard lamps for some

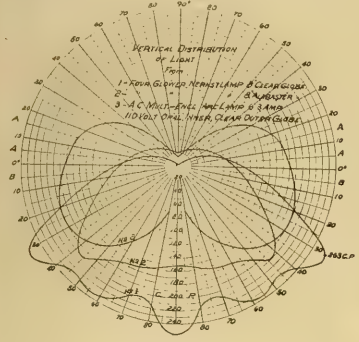



FIG. 2. DISTRIBUTION CURVES OF FOUR-GLOWER LAMP.

time past, a brief description of a number of recent developments will be of interest.

Converter Coil.—The demand for vertical-glower lamps for 110-volt circuits, coming mostly from a class of small consumers, has been met with the "converter coil," which, being used in connection with the standard 220-volt lamps, adapts the latter for use on 110-volt alternating-current circuits. This finds its greatest use in small installations, where

FIG. 3. INVERTED NERNST LAMPS FOR ORNAMENTAL WORK.

it is desirable to use [illegible] without altering the [illegible] device, which is similar in [illegible] the ordinary ballance coil [illegible] mounted above the lamp on the [illegible] a neat appearance similar to that [illegible] canopy, as shown in Fig. 1.

Four-glower Lamp. For interior [illegible] standard six-glower Nernst lamp [illegible] nating power than the 6.6-ampere alternating-current multiple arc, while the latter is somewhat brighter than the three-glower Nernst lamp. The demand for a Nernst lamp [illegible] standard arc lamp has led to the development of the four-glower lamp, having the same external appearance as the six-glower lamp. This has already proved to be a popular lamp for [illegible] The design of the holder for this lamp is such as to give the light distribution a very flattened shape, as may be seen from the curves shown in Fig. 2. For this reason the illumination furnished by this lamp is more uniform than that obtained from the other types.

Inverted Type. For ornamental purposes, both in outdoor and indoor work, it is frequently desirable to use fancy newel posts which terminate at the top in a globe of light. It is therefore obvious that to gain this effect with the Nernst lamp, it must be inverted, so that the globe is uppermost and the lamp body concealed in the upper portion of the post. Such a design has recently been perfected, and any of the standard units are now available for this purpose. The accompanying picture (Fig. 3) is a view of the first installation of Nernst lamp for this kind of service.

Composite Lamp.—With a view toward assisting the customer in gaining maximum economy in the operation of his Nernst system, a special switch attachment has recently been brought out, which is intended for use in connection with the four and six-glower lamps. At times, when only a portion of the total light is required, it becomes possible through the use of this attachment, to throw half the total number of glowers out of operation, and thus effect a material saving in the current bill. This will be of greater value to the small consumer, using three and four lamps, where it is not so easy to arrange the lamps on separate circuits, so that alternate lamps may be thrown off, without seriously affecting the general distribution of the light. With the exception of a third binding terminal post on the top, the external appearance of this lamp does not differ from that of the standard type. The lamp is put forth as the only one on the market in which the light can be lowered without inserting resistance

material [illegible] led to [illegible] trated in [illegible]

FIG. 4. SINGLE-GLOWER HOLDER WITH [illegible]

fastened to and supported by the lamp in the same manner as the standard shade. The planes and angles of the reflector are so designed that when installed as indicated by the accompanying diagram (Fig. 6) the direct rays falling on the exhibit which occupies the wall space are reinforced where necessary by reflected light and the resultant illumination is practically uniform from top to bottom of the exhibit. Fig. 5 shows one of the standard units as used for lighting the exhibit of fine arts at the St. Louis Exposition, and a modification of the type shown will be used extensively in the new Albright Art Gallery at Buffalo.

Immediate-light Lamp.—To meet the requirements of residence or office installations where light

Fig. 5. Three-glower Lamp with Art Gallery Reflector.

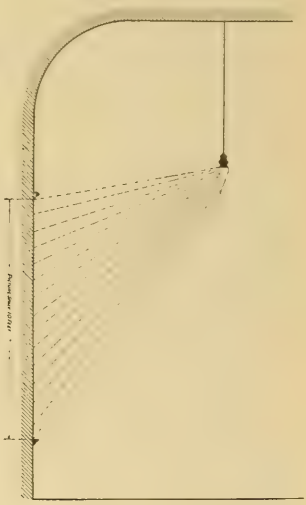


Fig. 6. Diagram of Art Gallery Reflector

RECENT IMPROVEMENTS IN NERNST LAMPS.

and where a lessening of the amount of illumination is accompanied by a proportionate reduction of current consumption.

Thermo Heater Cut-out.—Fig. 4 shows the standard single-glower holder equipped with the thermo heater cut-out, which simply consists of a special plug for connecting the heater lead wire to the heater terminal post, and thence to the central-contact prong. This plug is composed of a metal having a low melting point, so that when the glower breaks and the heater has been in operation about five minutes, sufficient heat is generated to fuse the plug and disconnect the heater, thus saving it from further deterioration. Experience shows that this simple device has affected quite a saving in maintenance cost, as ordinarily the failure of the glower is desired immediately upon turning the switch, a combination lamp has been designed having incandescent lamps in parallel with the heaters of the Nernst lamp. The two incandescent lamps are operated in series and a cut-out breaks the incandescent circuit at the same time that the heaters are cut out. The design is quit simple and any of the standard lamps can be changed over to this type at a very small expenditure. The fixtures used are of the ordinary standard pattern, two 110-volt Sawyer-Man incandescent lamps being used.

Although it is not probable that the standard Nernst lamps will be materially altered, special attachments such as the above are to be expected from time to time, as the many special uses for light and conditions of trade present themselves.

# WESTERN ELECTRICIAN

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## DATES AHEAD.

American Institute of Electrical Engineers (annual dinner), ballroom of the Waldorf-Astoria, New York city, February 8th.

Ohio Independent Telephone Association (annual meeting), Columbus, March 30th.

National Electric Light Association (annual convention), Denver, June 6th, 7th and 8th, and Colorado Springs, June 9th and 10th.

Ohio Electric Light Association (annual convention), Hotel Victory, Put-in-Bay, August 16th to 18th.

Iowa Telephone Association (annual meeting), Des Moines, March 13th and 14th.

American Electrotherapeutic Association (annual meeting), Academy of Medicine, New York city, September 19th, 20th and 21st.

IT IS a relief and a pleasure to be assured by the medium of private advices that the newspaper accounts of the gravity of the surgical operation recently performed on Thomas A. Edison were exaggerated. We are informed that the operation was not at all dangerous and that its results were entirely satisfactory. This is good news indeed. Mr. Edison will be 58 years of age on February 11th, and has, we sincerely hope, many years ahead of him in which to give the products of his ripened inventive genius to his countrymen and to the world.

A STRONG and influential telephone association should result from the combined National and Interstate associations, the amalgamation of which appears to be now practically accomplished. The blending of the two societies promises to be a good thing for all concerned, and we wish for the National Interstate Telephone Association (a rather odd name, by the way, for if a telephone organization is of national scope, is it not necessarily interstate?) a long and prosperous career. We hope that the technical and practical aspects of telephone design, construction and operation will be given more attention by papers, discussions, committee reports and question boxes than has heretofore been bestowed upon them by the Independent associations. We note that the first convention of the amalgamated organization is scheduled to be held in Chicago—always a good place for any kind of a convention—on June 14th and 15th. This date, it will be observed, is in the week immediately following the Denver-Colorado Springs convention of the National Electric Light Association. As there is no doubt a considerable number of persons who will wish to attend both conventions without being away from home or business for practically two weeks, it might be well to consider the advisability of fixing the telephone convention for a somewhat later date.

FLOUR is sometimes bleached and "purified," as it is said, by certain gases, and of late the electric arc has been employed for the production of the gaseous medium used for this purpose. An interesting description of Mr. James N. Alsop's process for the electrical treatment of flour in this manner was given in the Western Electrician of May 28th last. It now appears that Mr. Balland has analyzed some specimens of flour before and after treatment with the new electric bleaching process, which has been recently introduced in Paris. It is described there as a treatment with "electrified air." It is evident at first sight that the treatment improves the whiteness of the flour, but the product suffers in the matter of odor and taste, it is declared. Analysis shows that the only constituents of the flour affected by the treatment are the fats and the acids. The acidity increases some 30 per cent. The fatty matters become slightly rancid and are less fluid and less colored. The yellow wheat oil, which produces the aromatic flavor in malting, is oxidized and partly transformed into white fatty acids, soluble in absolute alcohol. Moist gluten loses its delicate odor to some extent, while dry gluten is less colored. Mr. Balland describes the effect concisely as an artificial aging and whitening. The process is worthy of the attention of electricians mainly as demonstrating an unusual possibility of the electric current.

SHIPPERS and buyers of electrical apparatus have frequently complained of classification discriminations in freight rates against electrical machinery and appliances, when compared with other machinery and similar apparatus, on the part of the railroad companies. The matter has been brought up frequently in electrical conventions. Therefore, electrical men are particularly interested in the present discussion of freight rates in Washington. Among other things, they will follow with attention a bill introduced by Representative Shackleford in the House. It provides that the Interstate Commerce Commission shall compile and publish a "National Freight Classification" by January 1, 1906, which shall classify freight articles and the necessary rules, regulations and conditions for their transportation. For a period of three months after that date the commission would be expected to hear promptly complaints made by any carriers or shippers against any of the classifications, and after hearing to amend any part that would work an injustice to such shippers or carriers. At the expiration of three months the classification, as amended, would become effective, and would be invariably applied to interstate freight transportation by all common carriers. A failure on the part of any carrier to apply such classification would be considered a violation of the Act to Regulate Commerce of February 4, 1897, and would be punishable under section 18 of that act. The bill is now in the hands of the committee on interstate and foreign commerce.

WHAT is the matter with our good friends of the Northwestern Electrical Association? At the convention in Milwaukee last week they adopted a resolution providing that hereafter the report of the discussions at the meeting shall be entirely withheld from the press, technical and otherwise. This is a very unusual and drastic procedure, and, so far as we are aware, has no precedent in the history of any other technical organization. The technical press has done well by the Northwestern Electrical Association, and in its mission of disseminating information that makes for the welfare and advancement of the industry, we trust that it will have the co-operation of this association in the future as in the past.

We believe that the association and its members have suffered no ill, but on the contrary have been benefited substantially in reputation and prestige, by the publication of the reports of the meetings in the technical journals. Why these mutually pleasant relations should be so summarily severed passes our comprehension. If the members desire to discuss confidential matters of no particular interest to anyone but themselves, they can easily hold an executive session during the session, after the manner of the National Electric Light Association. But to draw the veil of secrecy and mystery over the general discussion of the technical papers presented appears to us, we confess, scarcely less than absurd; it puts the Northwestern Electrical Association in a class all by itself.

We hope that this precipitate action will be rescinded at the next annual meeting.

PUBLIC and technical interest in Germany, aroused by recent experiments, is directed toward the proposed high-speed electric railway between Hamburg and Berlin, a distance of 177 miles by the present steam route, but which could be shortened to 155 miles by a new and more direct line lying over a region well adapted to the construction of a high-speed road. Ever since the Berlin-Zossen tests were made and it was found possible to operate cars safely at a speed of 120 miles and even more, the problem of utilizing this experimental knowledge has appealed to the German imagination and to German pride. According to a report from Mr. Mason, the United States consul-general at Berlin, two definite propositions have already been submitted for such a line, one by Siemens & Halske and the other by the General Electric Company of Berlin. Siemens & Halske propose a single-track line, on which a train would be dispatched from either terminus every two hours or oftener, if found necessary, the two meeting and passing each other at the midway station of Wittenberg, and making the through run in one hour and 55 minutes. Such a line, equipped for service, would cost, according to the estimates submitted, $16,660,000, and, in the opinion of Messrs. Siemens and Halske, such a road, carrying 520,000 passengers a year, each paying $3.57 for a uniform first-class fare, would earn a profit above interest and working expenses.

The proposition of the General Electric Company is for a double-track line, on which trains traveling at 100 miles an hour would make the through trip in one hour and 25 minutes. For that speed the road could be built and equipped for $29,750,000. If a speed of 125 miles an hour were to be maintained, the road and equipment would cost $35,700,000, and at the proposed rates of fare—$3.57 for an ordinary seat, and $1.19 extra for a section de luxe—would require 850,000 passengers yearly to earn a profit over interest and running expenses. This proposition contemplates trains of from two to four cars, according to the requirements of travel, and it is to be assumed that each car would carry its own motors and converters and be in all technical respects an independent unit.

## Electrical Features of a New Chicago Amusement Park.

A new amusement park to be known as the "White City" and which promises to rival if not surpass in electric lighting effect "Dreamland" at Coney Island, is to be opened in Chicago on May 27th. The promoters assert that about a million dollars is being expended on the ground and buildings, which are found at the corner of Sixty-third Street and South Park Avenue, Chicago.

An estimate from the detail plans to be followed in illuminating the large grounds, buildings and other features places the number of incandescent lights to be used at 123,700. Most of the 40 buildings will be outlined in incandescent lamps and each will have a novel electric sign indicating the character of the amusement within. The massive arcade entrance will have 10,000 electric lights arranged in attractive design and artistic effect. The designs will be done in incandescent bulbs, ranging from four to 16 candlepower.

The principal electrical feature will be a huge electric tower of pleasing architecture, near the center of the grounds, illuminated by 20,000 incandescent lamps. This tower will be nearly 300 feet high and is expected to be visible for many miles. One feature of the tower will be the fact that although it will be extremely brilliant, there will be no unpleasant glare to the eye at close range. This effect is to be produced, it is said, from a scientific arrangement and distribution of the lights.

THE "WHITE CITY" AS IT WILL APPEAR WHEN COMPLETED. (ELECTRIC TOWER IN CENTER.)

The accompanying illustration, reproduced from the architect's drawing, gives a general view of the park. The large tower is shown in the center. Many of the buildings shown are nearly completed. The following table gives an idea of the attractions to be offered. The number of electric lights for each—interior, exterior and total—is also shown.

ATTRACTIONS AND NUMBER OF INCANDESCENT LIGHTS.

| Building. | Interior. | Exterior. | Total. |
|---|---|---|---|
| Arcade Entrance .......... | 5,000 | 5,000 | 10,000 |
| Fire Show .................. | 1,000 | 2,500 | 3,500 |
| Electric Tower ............ | | | 20,000 |
| Canals of Venice .......... | 3,000 | 5,000 | 8,000 |
| Scenic Railway ............ | 1,000 | 2,500 | 3,500 |
| Baby Incubators ........... | 200 | 2,000 | 2,200 |
| College Inn ............... | 2,500 | 3,000 | 5,500 |
| Band Stand ................ | | | 4,000 |
| Flying Airships ........... | | | 500 |
| Ball Room ................. | 5,000 | 4,000 | 9,000 |
| Chilkoot Pass ............. | 1,500 | 2,500 | 4,000 |
| Midget City ............... | 1,000 | 2,000 | 3,000 |
| Shoot-the-Chutes .......... | | | 10,000 |
| Johnstown Flood ........... | | | 2,500 |
| Simian City ............... | 1,000 | 1,500 | 2,500 |
| Automatic Vaudeville ...... | 2,000 | 2,000 | 4,000 |
| The Midway ................ | 1,000 | 2,000 | 3,000 |
| Fun Factory ............... | 500 | 500 | 1,000 |
| Giant Carrousel............ | | | 1,500 |
| The Producoscope .......... | | | 1,000 |
| Observation Wheel ......... | | | 2,500 |
| Speed Toboggan ............ | | | 2,500 |
| Miscellaneous ............. | | | 20,000 |
| Total ................. | | | 123,700 |

All machinery and moving parts on the grounds will be operated by electricity. For this purpose direct-current motors of various sizes are being installed. The cars on the chutes will be drawn up the incline to the starting point by a cable operated by a small electric motor. The observation wheel and other moving attractions, except those operated by gravity, such as the speed toboggan and scenic railway, will have individual motors.

The current for lighting the "White City" will be taken from the mains of the Commonwealth Electric Company, which will thus secure a notable addition to its load. The management of the company which is building the "White City" discussed the advisability of establishing an electric plant of its own but finally decided to [illegible] the power, believing the course to be the most [illegible] reliable and convenient.

The enterprise is owned and projected by the White City Construction Company, composed of Chicago business men, with the exception of the architect, Edward C. [illegible] of New York city [illegible] vice president, Jo[illegible] [illegible] secretary [illegible] J. Jones, secretary and treasurer, and Paul D. Howse, who conceived the idea, is general manager. The electrical installation is in charge of Mr. G. H. French.

The park is easily accessible, having the South Side elevated-railway station at its door and several surface lines which reach the suburbs. The Sixty-third Street crosstown line also passes the door.

## Electrical Exhibits at the New York Automobile Show.

At the automobile show held in New York last week there were more exhibits and a larger attendance than at any of the four previous shows. Electric vehicles were numerous and of sufficient variety of size and price to suit every possible need, from the two-passenger runabout at $850 to the eight-passenger private bus at $6,000, and from the light delivery wagon at $1,400 to the five-ton truck, selling at $4,250.

Many improvements but no striking innovations were discernible. The perceptible tendency in pleasure vehicles is toward grace and luxury, and in commercial vehicles toward simplicity and economy of operation. The representative of the Electric Vehicle Company of Hartford, Conn., said that his company's Columbia cars had been perfected in several details—in design, in lightness and in range of operation—and with an experienced driver it is possible to run a car with one charge slightly over the 40-mile limit. The company has developed its own design for light and efficient motors, and is only waiting for improvement in battery construction to obtain more mileage. Columbia pleasure cars are now extremely luxurious. They have incandescent lamps inside and out, electric signals between the occupant and driver, electric cigar lighters, electric heaters and electric fans, as well as all the fittings usually found in the finest private carriages. The feature of the same company's commercial vehicles is the chassis, all the batteries, motors, gear and wiring being beneath the frame. A typical Columbia truck has been supplied to the New York Edison Company which has a load capacity of 5,000 pounds, a speed of eight miles an hour, and a radius of 35 miles for a single charge. There are two direct-gear motors and a battery of 42 Exide cells of 15 plates. A lighter vehicle, supplied to the Philadelphia Electric Company, has a capacity of 2,000 pounds, a speed of 11 miles an hour, and a similar motor and battery outfit.

The Vehicle Equipment Company showed a number of trucks and wagons of from one to five tons capacity, and with a maximum speed of from six to 10 miles an hour. Nearly 200 of these trucks and wagons have been sold recently in New York city, one large department store having purchased as many as 17 cars, and hundreds of others have gone to all the important cities of the United States. The Adams Express Company, for instance, uses these trucks exclusively for local service around Buffalo and Rochester; and Montgomery Ward & [illegible]

[illegible] axle. The Studebaker two-passenger electric trap, [illegible] capacity of 7,000 pounds and priced at $3,500, has two motors of 80 volts and 35 amperes each, driven from a [illegible] cells each, and having a speed of from two to eight miles an hour. The Pope-Waverly electric cars, made at Indianapolis, have several unusual mechanical features, such as herringbone gearing. This company builds its own motors, but uses Edison or National cells. Its new $900 road wagon is driven by a three-horsepower motor of improved design, with an overload capacity of an additional three horsepower, from 30 seven-plate C. B. National cells, and capable of a speed of 18 miles an hour. This company also supplies a compact independent recharging plant.

Electrical accessories on exhibition were numerous, but none was particularly novel. The General Electric Company has improved its recharging equipments and showed an interesting 30-ampere mercury-vapor rectifier panel for charging batteries from alternating currents, and sundry motor-generator charging set. The American Electric Novelty and Manufacturing Company exhibited its new "Ever Ready" dry battery, for which it lays claim to a current of 30 amperes and improved voltage, life and recuperative powers. The United Electric Manufacturing Company of New York introduced its Crescent dry cells, with an amperage of from 12 to 22, and an alleged abnormally long life for intermittent service. Its diagrams showed practically parallel curves of polarization and recuperation. The Edison storage battery was not so prominently shown as in last year's show, but diagrams demonstrated a very high degree of efficiency. One of the novelties was a simple battery connector, with spring clips for the terminals, and marketed by the Eastern Carbon Company of Jersey City.

The Apple Ignition Company of Dayton, Ohio, showed a new small dash-board dynamo for combined ignition and lighting, the dynamo being dust-tight and waterproof. The Warner Instrument Company's Autometer from Beloit, Wis., was a clever and compact device to indicate mileage and speed at the same time. It is of somewhat complicated interior construction, the speed indicator being controlled by a revolving magnet which operates a dial. The Standard Welding Company of Cleveland, Ohio, exhibited some interesting samples of electric welding, including a 13-inch cylinder. Sparking plugs, coils and meters were many, as well as some ingenious switches, one of which was fitted with a combination lock. D. W. W.

## The Institute Election.

Nominations for officers of the American Institute of Electrical Engineers will be made shortly and interest is already shown in the approaching election. By the constitution of the society the president cannot succeed himself, and there is naturally some conjecture as to who will follow Mr. Lieb. Dr. Schuyler S. Wheeler of Ampere, N. J., is the one who seems to be named most frequently as a presidential candidate. Dr. Wheeler is treasurer of the board of conferees having in charge the United Engineering Building, and as the construction of this building will be under way during the administration of the next president his friends think him particularly well qualified for the position.

The city of Martinsville, Va., has used part of the proceeds of its recent $60,000-bond issue in the purchase of the waterpower of the Smith River, two miles distant. A power dam will be erected for the development of electricity to be transmitted to the city for public and private lighting and power purposes.

## Inter-pole Variable-speed Motor.

An essentially variable-speed motor, but one that can also be used for constant-speed duty, has been developed by the Electro-Dynamic Company of Bayonne, N. J. It is designed especially to drive machine tools, pumps, blowers, woodworking machinery, laundry machinery and all other classes of machines, either driving direct or in groups. The motor will operate on any two-wire direct-current circuits from 110 to 500 volts, thus obviating the use of three or four-wire circuits.

Fig. 1 is a picture of the motor with the armature and bearings removed and illustrating to advantage the "inter-pole" feature from which it de-

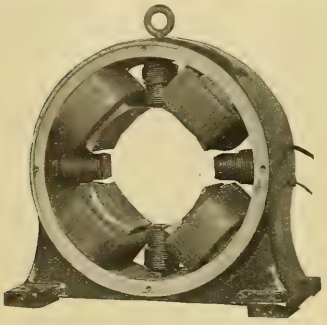


FIG. 1. VIEW OF YOKE AND POLE-PIECES OF INTER-POLE MOTOR.

rives its name. Fig. 2 is a view of the commutator end of the motor with the end frame removed, showing the ball-bearings with which the armature shaft is provided and also the general compactness and symmetry of the machine. The ball-bearing feature is said to add much to the efficiency of the motor. Fig. 3 is a wiring diagram explaining clearly the connections.

Auxiliary field-pole pieces are provided, as shown in Fig. 1, which are small as compared with the main-pole pieces. They are located between the latter and are provided with coils connected in series with each other and in series with the armature, so that all of the current taken by the latter flows through the coils in the auxiliary field, which are so proportioned and arranged as to give the proper field for commutation. All of the coils of the auxiliary field being connected in seies with the armature, weakening of the field of commutation by an increased load is prevented and the auxiliary poles produce the compensatory field of commutation independently of the main fields, which with an increased number of revolutions of the armature must be correspondingly weakened. Moreover, the function or effect of the auxiliary poles is independent of

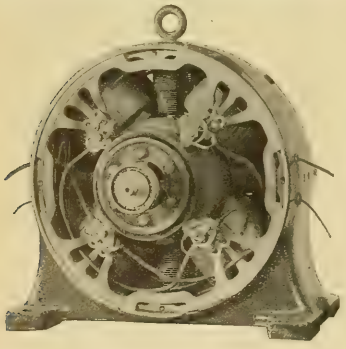


FIG. 2. END VIEW OF INTER-POLE MOTOR WITH FRAME REMOVED.

the direction of rotation of the armature, because if the latter is reversed the current in the auxiliary field is also reversed.

The construction and arrangement of the motor provide that the brushes be placed equidistant between the poles, and it is capable of reversing its direction of rotation without detriment and effects commutation in either direction of rotation without sparking with variable load as well as with variable speed.

When a brush is in contact with two adjoining commutator segments the coil connected between the segments is short-circuited on itself. The resistance of the short-circuited coil, together with the connections to the commutator, being very small as compared with the contact resistance of the brush pressing on the commutator, the strength of the currents flowing toward the brush from the respective commutator segments will be dependent upon the relative value of the contact resistance, and the larger the latter the smaller will be the currents.

As the commutator rotates the contact surface between any one segment and the brush becomes continually smaller the contact resistance increases and the current flowing from that segment to the brush becomes correspondingly smaller and finally reaches zero in value, whereas the reverse occurs at the adjoining segment, in which the current gradually increases from zero to its maximum value. The current thus varying in the coil short-circuited between the segments generates in the coil an electromotive force tending to maintain the varying current, and it is this maintaining electromotive force which causes sparking under the brushes under ordinary circumstances. Moreover, the maintaining electromotive force increases as the speed of rotation increases because the strength from plus to minus in the coil will be correspondingly less.

It is unusual to minimize the maintaining electromotive force by causing the commutation (reversal of current in the short-circuited coil) to take place in a weak magnetic field so constructed or arranged that it produces in the short-circuited coil an electromotive force which is opposite in direction to the maintaining electromotive force and intended to be equal to it in value. Ordinarily it is possible to bring the short-circuited armature coils in such a compensating field by shifting the brushes, and if under such circumstances the armature speed increases the compensating field generates an increased electromotive force which counterbalances the maintaining electromotive force, which also increases with the speed. However, in the ordinary method of commutation another disturbing condition arises from the fact that the armature coils which carry the electric current also react and generate a magnetic field whose influence is opposite to that which is necessary to counteract the short-circuited current and accordingly weakens the compensatory or commutation field. Moreover, such weakening of the commutation field is not of constant value, because it is determined by the armature current,

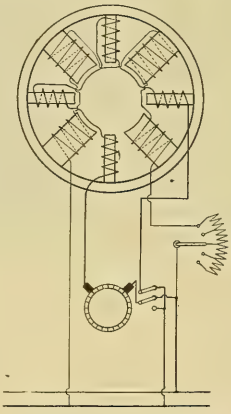


FIG. 3. WIRING DIAGRAM OF INTER-POLE MOTOR.

which varies with the load, so that if the load becomes greater the armature reaction increases, and with an increased load a commutation field is produced which is insufficient to effect the required compensation and sparking results.

The motors have been designed to permit of their being mounted with the shaft vertical. They are also readily adapted to operate open, semi-enclosed or enclosed. They lend themselves readily to the four principal methods of machine-tool drive, that is, direct connected, gearing, chain drive and belt drive. They may be run at any speed between 275 and 1,400 revolutions a minute and will maintain this set speed without perceptible variation whether operating under no load or full load.

## Hofmann Wire Coupling.

The method of coupling or connecting wires illustrated herewith is a foreign invention, but will be of interest to American electricians. The invention has for its object the arrangement of a tubular sleeve consisting of a tube of oval section and provided

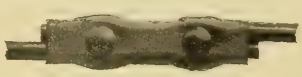


FIG. 1. HOFMANN WIRE COUPLING.

with oppositely disposed protuberances or chambers in which the wires to be coupled or connected are bent or pressed by means of rivets, pins or wedges, the narrow parts of the tube being hardened by compressing the metal and reducing the size of the tube. In this way the wires are secured to the sleeve and may be held securely in it without soldering.

Fig. 1 shows a completed joint, riveted, while Figs. 2 and 3 clearly illustrate the method of operation. First, it is necessary to clean the two ends of wire and place them in parallel into the sleeve. The sleeve has holes, and through them a sharp-pointed tool is used to force the wires into the recesses. Rivets are introduced and quickly fastened into place by the aid of a hammer and riveting block, the joint resting on the latter as shown in Fig. 2. For making an ordinary joint the time consumed is said to be two minutes. The wires are thus securely fixed in place by two or more rivets, within the protuberances, and even a considerable pull or push on the wires will not withdraw them from the sleeve. The strength of the sleeve is secured by the fact that the thickness of the wall on the protuberances is precisely the same as the original thickness of the wall of the tube. For connecting two single wires oval-shaped sleeves are used, as shown in the cuts. But for connecting cables consisting of several wires it is preferable to use sleeves of circular cross-section. As to the electrical con-

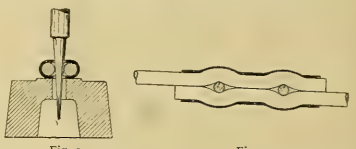


Fig. 2. Fig. 3.

HOFMANN WIRE COUPLING.

ductivity of this rivet joint, it is asserted that it is excellent—even better than that of a wire spliced in the ordinary way—and comparable to that of a first-class rail bond.

The Hofmann joint, which has been awarded a gold medal at the St. Louis Exposition, is made in Paris by Belliol & Reiss, who are represented in the United States by Paul Letheule of 4808 Delmar Boulevard, St. Louis.

## Indiana Single-phase Road Opened.

The Indianapolis and Cincinnati Traction Company has opened its line between Rushville and Morristown, a distance of 14 miles. The company was organized February 4, 1903, and no time was lost in beginning operations. From Indianapolis to Rushville the grade is scarcely 1½ per cent., and the entire distance is double-tracked. The road parallels the Cincinnati, Hamilton and Dayton the greater part of the way to Connersville, from which point it takes an air line to Oxford, Ohio. It is the intention of President Henry to have the speediest cars in use in Indiana. They will have a speed capacity of from 65 to 90 miles an hour, and are controlled by the multiple system, which permits the motorman of the front car to control a train of several cars. The power equipment of this road and its transmission are different from that of any road in the state. The power house and generating equipment are situated in Rushville and are attracting attention and comment because of their artistic beauty, as well as innovation. The equipment consists of two 750-kilowatt generators, direct connected to and carried on the flywheel shaft of the engines, each having approximately 1,000 horsepower. Two new steam-turbine units are also in place. All of the ceilings, floors and roofs of the power house are made of cement. The sub-stations are of brick, and located every 11 miles and will not require attendance. The direct single-phase alternating-current system is used. The trolley wire is carried by a steel cable suspended on top of the porcelain non-conductors. The high-current cables are carried on a separate line of poles placed on the extreme east side of the right-of-way.

The officials of this company expect great things from the new system in the matter of speed and economy. With its double track and especially heavy motor equipment, the trips will be made in the same or less time than is made by the steam roads. President Henry feels justly proud of his enterprise and looks forward to the practical completion of the dream of his life—a double-track, rapid-speed electric line connecting Indianapolis and Cincinnati, to which he has given so much of his time, means and energy. The preliminary tests, previous to opening this division of the road, developed easily a speed of 50 miles an hour. The company is now giving service on a two-hour schedule. The few miles between Indianapolis and Morristown will now be completed, and in a short time the new single-phase cars will enter the terminal station in Indianapolis. S. S.

## Death of E. H. Mullin.

E. H. Mullin of New York, who had charge of the advertising department of the General Electric Company, died suddenly on January 25th of heart disease, following grip. Mr. Mullin was widely known to the electrical fraternity and was an active associate of the American Institute of Electrical Engineers. A more extended notice will be given next week.

## Lundell Universal Motor.

Illustrated herewith is a new type of direct current motor which has been developed by Mr. Robert Lundell, the well-known inventor, and which the National Electric Company of Milwaukee will manufacture and market by special arrangement with the inventor. In its design it embodies some radical departures from the general practice, and the manufacturer lays claim to unusually high efficiency and consequently cool operation. The machine was on exhibition at the convention of the Northwestern Electrical Association in Milwaukee last week and attracted much attention. Fig. 1 is a view of the

Fig. 1. View of Commutator End of Machine.

Fig. 2. Side View.

LUNDELL UNIVERSAL MOTOR.

commutator end of the new motor and Fig. 2 is a side view.

The cast-iron frames or housings which contain the laminated yoke rings and support the bearing brackets consist of a rigid open casing made in two parts (front and rear). The rear has four hollow extension arms of strong cross-section, accurately bored to engage and support the laminations assembled therein. The front frame is identical with the rear frame, except that the extending arms are omitted. Bolts pass through these arms, securing the frames together, insuring rigid construction.

It has long been desired to use laminated yokes in direct-current motors and generators, as this form of construction insures uniformity of the magnetic circuits, a greater flexibility of speed control, quick field regulation and a more compact structure. In fact, it seems to represent finality in design, because

Fig. 3. Pole-Piece and Method of Mounting.

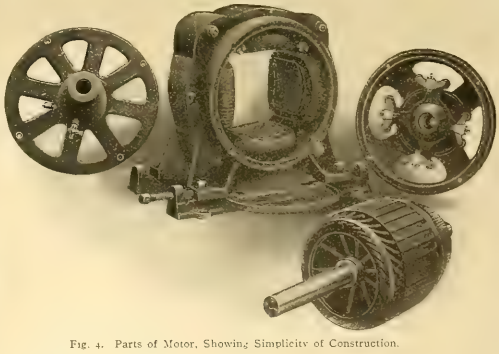


Fig. 4. Parts of Motor, Showing Simplicity of Construction.

LUNDELL UNIVERSAL MOTOR.

laminated mild steel for the entire magnetic circuit in yoke, pole-pieces and armature body, and copper for the conductors embody the most desirable materials for their respective purposes. The Lundell laminated yoke is built up of punched mild steel rings secured and accurately centered in the rigid frame just described. The outer and inner diameter of these rings are absolutely concentric.

The pole-pieces (see Fig. 3) are separately punched from the same material as the yoke rings. These pole-pieces are provided with end plates so constructed as to provide ventilating ducts to carry off the heat generated in the field coils. Until recently this idle space has not been made use of. The end plates are tapped, and retaining bolts pass through the frames, accurately seating the pole pieces, causing them to make good contact with the inner diameter of the yoke rings. By removing these bolts the pole-pieces and field coils can then be readily taken off.

In machines up to 60 horsepower it is not necessary to introduce ventilation into the center of the armature, as the losses are exceptionally low. The low losses make it possible to enclose these motors at lower temperature rises than is possible with other motors in which the losses are greater.

The armature coils are all form-wound on the latest types of frames and are separately insulated independently of slot insulation, the insulation of the coils being assured from the start. These coils are of standard proportions and provide for ample room at both the back and the front ends. Supporting rings cast in one piece with the end plates of the core serve to hold the ends of the armature coils firmly in place.

The commutators are built on the lines of standard street-railway practice, giving a rigid support to the bars, which are made of hard-drawn copper, insulated by selected mica. The commutator shells are ventilated through their centers, which construction aids in bringing about the remarkably cool running of the commutators.

A new principle is involved in the brush device of the motor. It has not only important commutation features, but has an operative bearing upon the running of the brush. It has been customary to see the brushes placed on a stud side by side in a line parallel to the commutator bars and mica. With the Universal apparatus, one brush is placed directly in front of the other (in tandem). The total brush surface is equal to the commutator space occupied by the side-by-side brushes, and each brush has its independent tension spring. With the old-style brushes, any irregularity of the commutator surface causes both brushes to jump together. This instantaneously opens the circuit at that point as each irregularity passes a brush stud. With the

[illegible] of the sparking conditions, and the other brush of [illegible] manner both conditions of service, which are ordinarily opposed to each other, are successfully performed by this dual brush. Fig. 4 shows the various parts of the machine and illustrates the simplicity of its construction.

Magnetization losses in the iron, and resistance losses in the winding, commutator and brushes are so low, due to the economical proportioning of these parts, that the motors run cool independent of forced ventilation. The proof of this is to be found in their performance. When running under full load continuously, the temperature rise is so low that the quality of the insulation is said not to be impaired in the least. In fact, the motors have such ample temperature margins as to permit of heavy overloads being carried for long periods without injury.

Full loads are carried continuously without sparking, and, because of the peculiarities of the tandem brushes, heavy overloads are carried without injury to the commutator or the brushes. One important feature of this type of brush holder is that the commutator is given a fine high polish, while the face of the brushes is always worn down to a true bearing surface. Pigtails are not necessary to carry off the current from the laminated brushes, because they have twice as much contact surface against the holder as the ordinary solid brush.

Variable speeds of standard fixed-speed motors, obtained by field control, are permissible within certain limits. For broad ranges of speed, motors of properly selected capacities are used. A range of speed, the lowest and highest points of which are represented by a ratio of three to one, meets most practical cases, and it is recommended as the ratio of speed to be obtained by field control.

## Indiana Engineering Society.

The twenty-fifth annual convention of the Indiana Engineering Society was held in the Commercial Club rooms, Indianapolis, on January 12th to 14th. Technical education was the subject of the annual address delivered by President R. L. Sackett. He said the relation of the engineer to natural development, more particularly in regard to the use of steam and electric power and machinery, was apparent on every hand. In regard to technical education, he approved of government assistance in research which is too extensive for private capital, and cited Germany as maintaining positions in industries involving technical chemistry largely through the work of its government experts.

A number of interesting and well-prepared papers were read and discussed on the various subjects of interest to the engineer. The report of the committee on railroads noted some of the work done in Indiana in 1904, and referred especially to the use of the single-phase system installed on the Rushville division of the Indianapolis and Cincinnati Traction Company's line.

Robert P. Wood, general engineer on the Indianapolis and Northwestern Traction Company, was elected president; W. F. M. Goss, vice-president, and C. C. Brown, secretary. The secretary reported that the membership had grown to 120 and that the organization was self-supporting.

## Northwestern Electrical Association.

[*Continued from page 68.*]

convention of the National Electric Light Association held last May. He is a member of the National Electric Light Association, Ohio Gas Association, Wisconsin Gas Association and Northwestern Electrical Association.

ENTERTAINMENT FEATURES.

The entertainment offered to those at the convention was as usual of a character to make the members determined not to miss attending the meeting the next year. Wednesday night all attended the Alhambra Theater, where a section of seats had been reserved. Thursday evening instead of the banquet which has been customary heretofore a "vaudeville smoker" was indulged in, and judging from the manner from which this entertainment seemed to "take" with those present the smoker is likely to become a permanent feature of the conventions. Mayor Rose of Milwaukee was present at the smoker and was enthusiastically received.

The Citizens' League of Milwaukee officially extended a cordial invitation to the association to hold its convention there the coming year.

Finely engraved invitations were distributed by the National Electric Company for all to visit its factory, where there are at present under construction a number of large machines.

## Members and Visitors.

Following is a list of the names of those in attendance at the Northwestern convention last week:

Almert, Harold, Cicero Light, Heat and Power Company ..... Oak Park, Ill.
Andrae, H. P., Julius Andrae & Sons Company ..... Milwaukee
Atkin, G. H., Electric Storage Battery Company ..... Chicago
Baker, Frank J., North Shore Electric Company ..... Evanston, Ill.
Barr, Edward L., Stanley Electric Manufacturing Company ..... Chicago
Beggs, John I., Milwaukee Electric Railway and Light Company ..... Milwaukee
Brooks, John W., Pass & Seymour ..... Sölvay, N. Y.
Burch, L. W. ..... Madison
Byrne, Harry, Allis-Chalmers Company ..... Chicago
Clark, C. S. ..... Milwaukee
Coale, James B., Columbia Incandescent Lamp Company ..... St. Louis
Coates, A. R. ..... Kaukauna, Wis.
Colles, George Wetmore ..... Milwaukee
Collins, W. F., Wausau Electric Company .... Wausau, Wis.
Cravath, J. R., Electrical World and Engineer ..... Chicago
Cutter, George, George Cutter Company ..... Chicago
Davenport, P. E., Porter & Berg ..... Chicago
Dickson, E. N., Allis-Chalmers Company ..... Milwaukee
Diniss, Burton C. ..... Zion City, Ill.
Duel, E. R., Reynolds Manufacturing Company ..... Chicago
Dull, E. R., Reynolds Manufacturing Company ..... Chicago
Eastman, E. C. ..... Marinette, Wis.
Eldred, H. M., Standard Telephone and Electric Company ..... Milwaukee
Ely, Leon, Porter & Berg ..... Chicago
Etheridge, Locke, Stanley Electric Manufacturing Company ..... Chicago
Fisher, E. B., Waupaca Electric Light and Railroad Company ..... Waupaca, Wis.
Foster, George B., Allis-Chalmers Company ..... Milwaukee
Fralick, S. R., Benjamin Electric Company ..... Chicago
Francis, R. B., Federal Electric Company ..... Chicago
Friend, A. L., M. B. Austin & Co. ..... Chicago
Gairnes, W. A., American Steel and Wire Company. Chicago
Genzenbach, Ernest ..... Sheboygan
Goddard, Walter P., The Locke Insulator Manufacturing Company ..... Victor, N. Y.
Goldschmidt, E. L., Northern Wire and Cable Company ..... South Milwaukee
Goodwin, H. D., reporter ..... Milwaukee
Gould, L. S., Street Railway Review ..... Chicago
Gray, George A., Thomas G. Grier Company ..... Chicago
Griffin, G. Brewer, Westinghouse Electric and Manufacturing Company ..... Pittsburg
Grover, T. F., Eastern Wisconsin Railway & Light Company ..... Fond du Lac, Wis.
Hamacek, A. F. ..... Chicago
Harden, James H., Fairbanks-Morse & Co. ..... Chicago
Harding, J. H., La Porte Electric Company .... La Porte, Ind.
Hawkins, J. F., Cutler-Hammer Manufacturing Company ..... Milwaukee
Holeman, L. E. ..... Fond du Lac, Wis.
Horsfall, C. R., Shelby Electric Company ..... Shelby, Ohio
Howe, C. A., Holophane Glass Company .... New York city
Hunter, W. H., Darlington Electric Light Company .... Darlington, Wis.
Jackson, D. C., University of Wisconsin ..... Madison
Jackson, F. S., Pass & Seymour ..... Madison, Wis.
Jackson, W. B. ..... Madison, Wis.
Kimball, R. N., Kenosha Light and Power Company .... Kenosha, Wis.
Korst, P. H., Janesville Electric Company .... Janesville, Wis.
Kurz, W. D. ..... Marinette, Wis.
Lapp, John S., The Locke Insulator Manufacturing Company ..... Victor, N. Y.
Livermore, S. B. ..... La Crosse, Wis.
Loose, R. C., National Electric Company ..... Milwaukee
Loose, R. W., Standard Electric Manufacturing Company ..... Niles, Ohio
Lord, Irving P., Waupaca Electric Light and Railroad Company ..... Waupaca, Wis.
Lozier, Robert T., National Electric Company .... Milwaukee
Lukes, George D., North Shore Electric Company .... Evanston, Ill.
Mallalieu, H. S., Allis Chalmers Company .... Milwaukee
Mankowitz, Samuel, Monarch Electric Company .... Chicago
McDonald, D., Westinghouse Electric and Manufacturing Company ..... Chicago
McMeal, H. B., Telephony ..... Chicago
McMullin, J. B., Electric Appliance Company ..... Chicago
Mercein, Thomas R., secretary of the association .. Milwaukee
Messer, Charles, Dearborn Electric Company ..... Chicago
Millard, A. L., Westinghouse Electric and Manufacturing Company ..... Chicago
Morton, A. A., Stanley Electric Manufacturing Company ..... Pittsfield, Mass.
Murphy, Fred ..... Milwaukee
O'Connor, Wallace, National Carbon Company .... Chicago
Owen, D. ..... Peoria, Ill.
Padget, William, Street Railway Review ..... Chicago
Pearce, H. L. ..... Negaunee, Mich.
Peck, A. P., National Electric Company ..... Milwaukee
Perry, F. L., Western Electrician ..... Chicago
Pietzcker, E. J., Standard Underground Cable Company ..... St. Louis
Pomeroy, J. G., Adams-Bagnall Electric Company .... Chicago
Putnam, W. R., Red Wing Gas and Electric Company ..... Red Wing, Minn.
Rains, L. F., Allis-Chalmers Company ..... Milwaukee
Rau, O. M., Milwaukee Electric Railway and Light Company ..... Milwaukee
Raymond, Francis, General Incandescent Arc Light Company ..... Chicago
Reiners, P. E., Western Electric Company ..... Chicago
Richmond, F. S., Oak Park Yaryan Company .. Oak Park, Ill.
Ross, C. A., Westinghouse Electric and Manufacturing Company ..... Chicago
Schmidtbauer, J. C. ..... Milwaukee
Schutt, H. S. ..... Beloit, Wis.
Scribner, J., General Electric Company ..... Chicago
Sedgwick, C. E., Allis-Chalmers Company ..... Milwaukee
Seymour, E. E., Wagner Electric and Manufacturing Company ..... Chicago
Shuster, J. W., University of Wisconsin ..... Madison, Wis.
Skeel, F. F., Crouse-Hinds Company ..... Syracuse, N. Y.
Sinks, William H. ..... Lafayette, Ind.
Smith, Albert ..... Milwaukee
Timmerman, A. H., Wagner Electric Manufacturing Company ..... St. Louis, Mo.
Tingley, John B. ..... Chicago
Underwood, H. G. ..... Milwaukee
Upham, W. P., Electric Appliance Company ..... Chicago
Viles, B. D., Chippewa Falls Waterworks and Lighting Company ..... Chippewa Falls, Wis.
Ward, A. V., National Carbon Company ..... Cleveland
Waring, J. M. S., Electric Storage Battery Company .. Chicago
Warren, Arthur, Allis-Chalmers Company ..... Milwaukee
Watson, H. E., Holophane Glass Company .. New York city
Wells, H. L., Allis-Chalmers Company ..... Milwaukee
Westover, George D., Cummer Electric Company ..... Cadillac, Mich.
White, John A., Electric Storage Battery Company .. Chicago
Whyte, George S., Macomber & Whyte Rope Company ..... Chicago
Wiley, J. R., Standard Underground Cable Company .. Chicago
Wilkins, J. ..... Mt. Morris, Ill.
Williams, C. H., Madison Gas and Electric Company .. Madison, Wis.
Willwerscheid, T. R. ..... St. Paul
Wolff, James, New York Insulated Wire Company .. Chicago
Wright, John ..... Antigo, Wis.
Wynn, R. D., North Shore Electric Company. Waukegan, Ill.
Young, Henry W., Western Electrician ..... Chicago

## Convention Notes.

Mr. Horsfall appeared for Shelby lamps.

C. W. Bacon of the Dearborn Electric Company came in from Madison.

The Stanley Instrument Company appeared in the person of F. J. Alderson.

Frederick S. Richmond did the honors for the Oak Park Yaryan Company.

M. B. Austin & Co. were energetically represented by Arnold H. Friend.

"King" Coale from Minneapolis came down to look after the Columbia's lamp.

The Dearborn Electric Company was well represented by President Charles Messer.

W. H. Gairns most efficiently took care of the interests of the American Steel and Wire Company.

President Samuel Mankowitz looked after the interests of the Monarch Electric and Wire Company.

Western Sales Agent Francis Raymond of the General Incandescent Arc Light Company was, as usual, decidedly in evidence.

Prof. D. C. Jackson and his brother, William B. Jackson, engineers and experts of Madison, Wis., were among those most welcome at the convention.

Norman McCarty and the Diesel engine are one; and, as usual, Mr. McCarty distinguished himself by his masterful exposition of the merits of this departure in power engineering.

President George S. Whyte of the Macomber & Whyte Rope Company came up with the delegation on the special car. Mr. Whyte is one of the old-timers at Northwestern conventions.

President W. W. Low of the Electric Appliance Company, Chicago, put in an appearance on Wednesday. Mr. Low, as usual, was assisted by his handsome and energetic representative, W. S. Upham.

Secretary E. L. Goldschmidt of the Northern Wire and Cable Company, South Milwaukee, was daily in attendance. Incidentally it may be mentioned that Mr. Goldschmidt is a man with a hobby—fine poultry.

George Cutter, the youthful sage of the electrical business, with characteristic modesty declares that his large and handsome new factory at South Bend, Ind., is merely a "small monument of my middle age."

"Smith" is not an uncommon name, but in one case it is synonymous of all that is good in wire. Of course reference is made to Mr. Smith of the Chicago Insulated Wire Company, who was at the convention.

General Lamp Agent Clarence A. Ross of the Westinghouse Electric and Manufacturing Company was one of the most welcome guests at Milwaukee. Mr. Ross is one of the indefatigable workers of the lamp field and his friends are a legion.

"Chloride Accumulator" appeared in the person of Manager Godfrey H. Atkin of the Electric Storage Battery Company's Chicago office. He was accompanied by J. M. S. Waring and John A. White of Chicago and J. Lester Woodbridge of Philadelphia.

The popular and ubiquitous "Harry" B. Kirkland was one of the most warmly welcomed at the convention. Mr. Kirkland arrived Wednesday, and although able to remain only during the day made his usual impression in favor of American Circular Loom Conduit.

The Westinghouse Electric Manufacturing Company was, as usual, capably represented. The honors of the sales department were carried by W. D. MacDonald, C. A. Ross and A. L. Millard, while supply dealers were taken care of Messrs. H. Brewer Griffin and Electrical Engineer Renshaw. The Westinghouse company made no exhibit, but it is needless to say that the above-mentioned gentlemen were in attendance day and night at the sessions of the convention and during the "recreation periods."

George A. Gray did the honors for the Thomas G. Grier Company. Mr. Grier himself has been under the weather for some time and is preparing for an extended ocean voyage. It was a matter of regret that "Tom" was prevented from putting in an appearance.

J. C. Schmidtbauer, as usual, did himself proud for the Julius Andrae & Sons Company, at the same time looking after the interests of the Bryan-Marsh Company and the G.-I. Arc Light Company. The Andrae display was one of the most attractive at the convention.

The Colonial Sign and Insulator Company of Akron, Ohio, made no exhibit, but saw that its literature and descriptive circulars of its porcelain electric signs were distributed throughout the parlors of the convention and into the hands practically of everybody present.

Porter & Berg, western agents for Locke insulators, made an interesting exhibit of this company's high-tension petticoat insulators. In attendance from Victor, N. Y., were J. L. Lapp and W. T. Goddard, while from Chicago came Messrs. Porter, Leon Bly and P. E. Davenport.

The Wagner Electric Manufacturing Company occupied a handsome parlor, but made no display of apparatus of any sort. The company's staff present at the convention consisted of Chicago Agent George B. Foster, Arthur H. Timmerman, general superintendent of the Wagner factory, and E. K. Seymour of the Chicago office.

The Cutler-Hammer Manufacturing Company made no attempt at an exhibit at the convention, but the company was personally well represented nevertheless. Mr. Beresford, Mr. Knight, Mr. Wilhoit of the engineering department and Manager of Publicity J. F. Hawkins did the honors and helped receive the delegates on Wednesday morning at the Pfister.

Manager A. L. Severance of the Pfister this time, as ever, distinguished himself by an unfailing courtesy and attention to the wants of the visiting delegates. Again, as has been the case for years, Mr. Severance was voted "the best of good fellows," and as an evidence of his popularity it may be mentioned that he was a special guest at the smoker on Thursday evening.

Syles R. Fralick distinguished himself by his energetic and skilful work for the Benjamin Electric Manufacturing Company of Chicago. Mr. Fralick exhibited with the Andrae display an arc burst cluster, recently described in the Western Electrician. Mr. Fralick has done most excellent work for the Benjamin company, as is shown by that institution's present prosperous business.

Of course the Fort Wayne Electric Company did itself proud by its usual contingent of men. The Fort Wayne lamps and meters were shown, but no extensive exhibit was made. On hand were Manager Walter S. Göll, C. E. Searle and C. C. Sedgwick. Mr. Goll had only recently returned from the company's convention at Fort Wayne, reported in the Western Electrician last week.

The Federal Electric Company of Chicago presented a working display in charge of R. B. Francis. Two large double-faced sectional signs were shown and were operated in connection with a Dull flasher of the Reynolds Manufacturing Company, Chicago. This latter device has earned for itself an enviable reputation, as it is one of the most efficient devices for flashing signs in the market.

Among those most warmly welcomed at the Milwaukee convention was General Manager of Sales W. H. Jacobs of the Triumph Electric Company of Cincinnati. Mr. Jacobs was accompanied by Manager David D. Gill of the Triumph company's Chicago office. Mr. Jacobs reports that the Triumph factory is full of work and that prospects for the coming year are most encouraging.

The Crouse-Hinds Electric Company's western office was, as usual, represented by its indefatigable and energetic manager, F. F. Skeel. Mr. Skeel made his debut as a westerner at the Northwestern convention two years ago and at that time distinguished himself by a graceful response to a toast of welcome to the West. Under Mr. Skeel's management the Crouse-Hinds business has increased enormously.

It was a matter of great disappointment to the Nernst Lamp Company that it was unable to obtain alternating current with which to operate its lamps. However, under the skilful explanation of its representatives the many features of the Nernst lamp were well brought out to those interested. For inspection were presented Nernst lamps of from one to six-glower capacity. Representing the Nernst interests were A. E. Flemming and A. C. Wales of Pittsburg.

James Wolff was decidedly "there" for the united interests of the New York Insulated Wire Company and the H. T. Paiste Company's switches. Mr. Wolff this time gave decided evidence of his great versatility as a skillful advertiser by chartering the private car on the convention train from Chicago to Milwaukee and inviting the entire Chicago delegation to go to Milwaukee as guests of the Paiste company. The Paiste company's business under his guidance during the last year has progressed with

remarkable strides, largely due to Mr. Wolff's successful methods in salesmanship and the co-operation of his host of friends among the western people. It has been said that Parste's specialties were "jewels," but Wolff certainly knows how to put them in proper "settings."

A. F. Hamacek made a most interesting exhibit of his ingenious automatic series arc cut-out. The peculiar feature of this little mechanism is that it serves automatically to close any open circuit incidental to series arc lighting, such as broken loops leading to arc lamps at street intersections, or in fact any open circuit whatever that may occur, even within the lamps themselves. It also protects the shunt coils in lamps. Mr. Hamacek's parlor was visited by many interested central-station men.

Under the skillful manipulation of General Sales Manager C. A. Howe and H. E. Watson of the Holophane Glass Company, Holophane globes and shades made a great impression. Mr. Howe's "just three minutes" "caught" and the temporarily erected photometer in the company's parlor at the Pfister was continually under inspection. Mr. Howe had devised an ingenious test which illustrated most conclusively the advantages of the Holophane reflectors. This exhibit was one of the best at the convention.

It has been repeatedly said that no electrical convention is ever complete without the only "Kirkpatrick" of the McRoy Clay Works. Mr. Kilpatrick came to Milwaukee Wednesday and spent the day with the delegates at the Pfister. "Kirk" reports the business of the McRoy Clay Works for the last year as being a phenomenal one, and it was whispered that no little credit is due "Kirk" himself for his energetic work in disposing of the product of his company's large factory and helping make such a good record.

President Thomas Duncan of the Duncan Electric Manufacturing Company, assisted by Traveling Representative W. A. Sinks, made an interesting exhibit of the Duncan meter. The peculiar feature dwelt upon at the Milwaukee convention was the "Duncan visual bearing." The particular point in this portion of the mechanism of the meter is that its construction permits of the lower end of the shaft or spindle point and the jewel bearing being inspected while the meter is in operation. It also facilitates the removal and insertion of spindle points without having to use a special tool through the bottom casting of the meter.

As usual, the General Electric Company came to the front with its coterie of energetic representatives. The following list tells its own story: F. N. Boyer, manager supply department, Chicago; S. F. Dibble, manager small motor department, Chicago; J. Scribner, manager lighting department, Chicago; F. W. Hild, assistant engineer, Chicago; J. B. Tingley, Wisconsin agent; E. P. Edwards, switchboard department, Schenectady. A fine line of direct-current circuit-breakers was shown as an exhibit and attracted much attention. Handsome souvenir scarf-pins in the form of tiny incandescent lamps were given away by members of the staff.

One of the most welcome guests at the Northwestern convention was T. R. Willwerscheid of the Western Display Company, "sign advertisers," St. Paul, Minn. This convention was Mr. Willwerscheid's first, but he "caught on" all right. The Western Display Company presented an interesting exhibit in the form of its "reflectric" day and night sign. It is claimed for this sign that it can be read further than any electric sign in existence and requires for this service a minimum of current. The light is thrown upon the sign rather than into the eyes of the onlooker. Mr. Willwerscheid is on his way East to establish agencies throughout that section of the country.

J. G. Pomeroy, who has been for 12 years Chicago sales agent of the Adams-Bagnall Electric Company of Cleveland, came up from Chicago with the western delegation. Mr. Pomeroy, it has lately been announced, has been appointed to take charge of the entire western territory for the Adams-Bagnall company as well as to continue to handle all matters centered in Chicago. This appointment is a tribute to Mr. Pomeroy's management and executive ability and will without doubt redound not only to his credit but to that of the company as well. Arc lamps have been Mr. Pomeroy's specialty for years, and well he knows how to talk them. A St. Louis office will be opened immediately and shortly other offices in the larger western cities.

Sales Manager John W. Brooks of Pass & Seymour, porcelain manufacturers of Solvay, N. Y., came in from the East on the Twentieth Century Limited in time to join the Chicago delegation on the special car over the St. Paul railway to Milwaukee. Mr. Brooks was most prominent in all matters appertaining to both the business and social side of the convention. On his return to Chicago he expects to make several local trips from Chicago as a center and then leave for an extended southwestern trip. Mr. Brooks has been exceedingly active in the porcelain business during the last year, for the moving of his headqarters as manager of sales to Solvay has placed additional burdens on his shoulders. He reports a most excellent business in the porcelain field; in fact, the Pass & Seymour factory has been overrun with orders during the past six months to the extent that another extension may soon be a necessity. Western Sales Agent Julian S. Jackson accompanied Mr. Brooks to the convention and was likewise most energetic in adding to the already large list of friends of Pass & Seymour.

The Allis-Chalmers Company and the Bullock Electric Manufacturing Company presented [illegible] army of representatives, each one of [illegible] himself "felt" in more ways than one. [illegible] charge of all matters appertaining to the [illegible] department was Manager Arthur Warren. Assisting Mr. Warren was Advertising Designer W. L. [illegible], H. C. [illegible] and L. F. [illegible]. Purchasing Agent E. N. Dickson was also on hand, while from Chicago came General Sales Agent George B. Foster and Harry Byrne. No exhibit was made, but the entertainment and hospitality were of the best and a credit to the company. Expensive and beautiful badges of unique design were also lavished on convention members by the Allis-Chalmers and Bullock staffs.

Of course the Standard Underground Cable Company put in its usual handsome appearance, and Western Manager J. R. Wiley and E. J. Pietzcker as usual did the eminently proper thing. Mr. Pietzcker made his visit to Milwaukee the occasion of an announcement to his host of friends that he had only just been honored by his company with the appointment of managership of the company's southwestern office, with headquarters in St. Louis. Mr. Pietzcker is a gentleman thoroughly liked by western electrical people, and his appointment was a matter of great congratulation. He will have charge of the business in Missouri, Kansas, southern half of Illinois, western half of Tennessee and Kentucky, Mississippi, Texas, New Mexico, Oklahoma and Indian Territory and Arkansas.

The Stanley Electric Manufacturing Company made no attempt at an exhibit, but was ably represented by Western Manager Edw. L. Barr, A. A. Morton, head of the Stanley transformer department, and Locke Etheridge, western salesman for the Stanley company. Rumor had it that although these gentlemen made no display of apparatus, nevertheless several important deals were pushed along with that energy for which the Stanley staff is noted. Incidentally it may be mentioned that under Mr. Barr's management the Stanley company's western business has progressed at an astonishing rate. Mr. Morton has only been working in the West temporarily and expects shortly to return to his former headquarters at Pittsfield, Mass. His many new friends in the West will regret his not having been made a permanent fixture in the western country.

Fairbanks, Morse & Co., Chicago, came to the front in the person of its energetic representative, James H. Harden. Mr. Harden works more particularly for the company in its railway motor car and gasoline-engine departments. Incidentally it may be stated, however, that Fairbanks, Morse & Co. are now most energetically pushing the electric-motor branch of its business. The company's large works at Three Rivers, Mich., about a year ago was operating with 600 men, and as an illustration of the growth of the company's general business, inclusive of the electric-motor branch, it may now be stated that the Three Rivers works gives employment to as many as 1,200 hands. It is stated on good authority that Fairbanks, Morse & Co. are now prepared to make a special "drive" for electric-motor business throughout the United States, and with this company's equipment of machinery and staff it is fair to presume that it will command a goodly share of the motor business of the United States.

As the convention was held in the home town of the National Electric Company, that company made special arrangements for the reception and entertainment of its friends. Bromide enlargements on exhibition gave an excellent idea of some of the larger electrical machinery made by this firm. Of particular interest was the photograph of the 1,000-kilowatt rotary converters recently supplied to the Milwaukee Electric Railway and Light Company and that of two 1,000-kilowatt units comprising a motor-generator set supplied to the Union Electric Light and Power Company of St. Louis. Of special interest to the visitors was the new Lundell Universal motor. A publication entitled the "National Electrical Catechism" was presented to each visitor as illustrating the latest advertising device of this company. The trade-mark adopted by the National Electric Company has attracted a considerable amount of attention, consisting of two half sections of generators placed one above the other. The lower part represents the alternating-current machinery and the upper the direct-current, the two parts being joined by a scroll bearing the word "National." As a souvenir of the convention a very handsome watch fob was given away, bearing as a charm a bas-relief representation of the company's trade-mark. Invitations, which included a pass over the street-railway system, were given to the members of the association to visit the works of the National Electric Company. The following-named members of the staff of the company were present: S. W. Watkins, president; B. T. Becker, assistant general manager; Robert Lundell; C. G. Burton, sales agent; W. L. Waters, chief engineer; W. J. Richards, assistant engineer; A. P. Peck, sales agent; J. H. Denton, general superintendent; R. P. Tell, secretary and treasurer; Robert T. Lozier, general manager electric sales; Harry M. Klingenfeld, advertising manager.

The Electric Water and Telephone Company has been granted a telephone franchise at Tomahawk, Wis.

## Chicago Street-railway Situation.

[illegible] municipality in that regard are approximately [illegible]

[illegible] speaker a means of solution of the difficulties that [illegible] the present traction difficulty Mr. Belmont suggested that all litigation and controversy over the street-railway franchises in Chicago be suspended and the companies be permitted to develop and rehabilitate their properties so as to meet the public need; that if the operation was not up to the prescribed standard the city have the right to take the properties at a figure fixed by arbitration, and after the payment of the money be permitted to enter upon the operation itself or to select a new private occupant. If this "compromise" did not work out favorable results Mr. Belmont said Chicago would be free to undertake the venture of municipal ownership with its financial and civic responsibilities.

Action on the franchise extension ordinance for the Chicago City Railway Company was deferred at this week's meeting of the Chicago City Council. The ordinance with several amendments was sent back to the committee on local transportation. The understanding is that the document together with a similar one treating with the Union Traction system is to be reported back to the council in time for a full discussion both by the aldermen and public before the spring election. This will permit of the two ordinances being considered at once and, if passed, allow of a referendum at the spring election.

## Dinner to Allis-Chalmers-Bullock Salesmen in Canada.

The directors of the Allis-Chalmers-Bullock Company of Canada celebrated their first semi-annual meeting with their representatives from all parts of the country, by tendering them and the office staff a dinner at the Canada Club in Montreal on January 18th.

The table was beautifully decorated with flowers and the chair was occupied by Mr. George Bullock of Cincinnati, president of the company. Mr. Edgar Macdougall of Montreal, vice-president of the company, was vice-chairman. There were over 50 present, all directly interested in the company. Among them were Messrs. B. H. Warren, president; W. J. Chalmers, treasurer, and W. H. Whiteside, general manager of sales of the Allis-Chalmers Company of New York, Chicago and Milwaukee; J. S. Neave, vice-president of the Bullock Electric Manufacturing Company, Cincinnati; R. W. Chapin, second vice-president and general manager; Colonel Henshaw, H. J. Fuller, J. W. Pyke, Alex. Pringle, Phelps Johnson, W. C. McIntyre, all of whom are directors; W. C. Brown, Lieut.-col. J. B. Maclean, H. Markland Molson, E. Kirke Greene, C. E. Gudewill and others financially interested.

Mr. Bullock, as toastmaster, made a very pleasing talk, in which he spoke of the success of the company and gave much credit for this condition to the salesmen. He had just returned from the Northwest and British Columbia and was convinced that the success of the company was assured from that territory.

Concluding his remarks, Mr. Bullock proposed a number of toasts to which responses came from Mr. Alfred Collyer, Mr. B. H. Warren, Mr. W. J. Chalmers, Mr. W. H. Whiteside and Mr. J. S. Neave. Songs and music filled in the rest of a most enjoyable evening.

## Electric Locomotives for Port Huron Tunnel.

The Grand Trunk Railway Company has at last placed an order for six electric locomotives with the Westinghouse company for handling trains through the tunnel at Port Huron, Mich. The third-rail system will be used, the rail being placed on the side of the tunnel, so as to offer less danger to men at work upon the track. The plans also call for a brilliant illumination of the tunnel, which will be whitened and advertised as an attraction to tourists.

## Change in New York Address of Western Electrician.

Owing to the fact that the new building of the New York Times is located at Broadway and Forty-second Street, New York city, the address of the New York office of the Western Electrician as "193 Times Building" is no longer distinctive. The address should now be given as 41 Park Row, New York city.

## The Rating of Street Lights.[1]

By George D. Shepardson.

The purpose of this paper is to call attention to the unsatisfactory methods in use at present for rating lamps for street lighting and to propose that steps be taken toward establishing a more rational basis for their rating and testing. A consulting engineer not infrequently receives a letter reading about as follows:

Dear Sir:—We are looking for an unbiased engineer to test our street lights. We believe that they are not as strong as the contract specifies, although the company claims that they are stronger than required.

Our contract reads: "Now, therefore, it is agreed by the second party that it will furnish to the said first party for the term of five years from the first day of April, 1904, 275 incandescent lamps, of not less than 25-candlepower each, and 35 arc lamps, of not less than 1,200-candlepower each, and such other and additional lamps either incandescent or arc, as the City Council may at any time during the continuance of this contract require from said party of the second part, and said incandescent lamps and said arc lamps are to be operated and kept burning and lighted every night and all night for the term of this contract."

The committee on lights wishes you to name a date at your earliest convenience when you can meet them and make a practical test of the lights while burning. Yours truly,

John Doe,
Chairman Committee on Lights.

N. B.—Do not let anyone know that you are coming, nor when.

The engineer is in a trilemma. He may save himself from an uncomfortable situation by explaining how very busy he is with important construction work that demands his close and continuous attention. He may make a sort of test, show that the lamps are not within gunshot of giving 1,200 candlepower and earn the enmity of the company and of the fraternity. He may decide upon an educational policy which will probably satisfy both parties and will reduce the liability to further friction between them. He replies as follows:

Mr. John Doe,
Chairman Committee on Lights.
Suburbanville.

Dear Sir:—Acknowledging receipt of your esteemed favor of even date, I beg to say that I should be pleased to make the tests you desire at such time as may suit your convenience. Before completing arrangements, however, I think it proper that the committee should be familiar with my customary position in connection with such tests.

The rating of incandescent and arc lamps for street lighting is not on as definite a basis as might be desired. As a consequence difficulty frequently arises in deciding upon the fair interpretation of a contract based upon the candlepower.

Incandescent lamps are rated according to the candlepower they develop when supplied with the proper current and voltage, and when new. The light developed gradually falls off, becoming less and less the longer the lamp is in operation. In many cases the lamp is allowed to remain in circuit until it breaks, or until its light becomes so feeble that complaint is made. According to the contracts leaves considerable uncertainty as to whether the specified candlepower refers to the initial candlepower or to the minimum. It is practicable to measure the amount of light actually developed by an incandescent lamp, by the use of a portable photometer, and if you so desire I will make a number of measurements of the light actually given out by the incandescent lamps in regular service.

The rating of arc lamps is a matter of greater difficulty. It is possible to make tolerably reliable measurements of the light actually given out. The results of such a test are generally unsatisfactory, however, for engineers usually recognize that a so-called "2,000-candlepower arc light' does not give 2,000 candlepower in any direction under ordinary conditions of service. Likewise a so-called "1,200-candlepower arc light" does not give 1,200 candlepower. Some years ago engineers agreed upon a standard for "2,000 candlepower arc lamps," according to which they should require 450 watts at the arc or about 480 watts for the whole lamp. No standard was adopted for the "1,200-candlepower" lamp. The general practice at the time was to use from nine to 10 amperes for "2,000 candlepower" or "full" arcs and to use six to seven amperes for "1,200 candlepower" or "half" arcs, the voltage in each case averaging 43 volts at the arc. In recent years, however, the old-style open arcs are going out of use, being replaced by inclosed arcs, which take smaller currents and operate at higher voltages. No standards seem to have been adopted by the engineering associations, and the practice of the manufacturers seems to be about the only basis of classification at present.

As the company which has your lighting contract is using modern enclosed arc lights, and as there seems to be no generally accepted standard for such, the only just test which can be made is to determine whether they are operating the lamps according to the published instructions of the manufacturing company. Such a test I can make, if you so desire.

I would suggest that in the next contract for street lighting, you include a definite agreement as to the requirements to be met by the lights, and as to the methods of making tests. I should be pleased to meet with your committee when such contract is to be considered.

Hoping the above explanation of my attitude and practice will be clear and satisfactory to you, I am truly yours,

E. N. Silvereye.

P. S.—I prefer to have a member or employe of the company present at tests, especially those of arc lamps.

It is a difficult matter to word a contract for street lighting so as to be fair to the city and to the company, so that each party knows exactly what is both the intended and the actual meaning of the terms, and so that either party can determine fairly whether the contract is being properly carried out. The city wishes to obtain illumination of the streets and landscape, together with a certain amount of what is sometimes called illumination appearance. Where simply illumination is desired the people are satisfied with any sources of light that will illumine the roadway so that one can see to walk or drive with a fairly good vision of the path. In addition to this there is a general desire to have the streets appear to be lighted—in other words, to have the sources of light conspicuous. For the latter purpose, nothing can compare with the open arc with its intense brilliancy and its deep shadows, although a Nernst lamp with clear globe approximates it. The modern enclosed arc light loses much of the illumination appearance characteristic of the older open arc and also gives out less total light, but it has less pronounced shadows and it throws nearly as much light to distant points.

Since light is what is desired, or rather illumination, it would seem that the most rational basis for a contract for street lighting would be an illumination of the street surface which should have certain average values on main streets, certain lower averages on others, and whose minimum values should not fall below certain specified values according to the importance of the streets. To avoid uncertainties in measuring care should be taken to specify whether the illumination is to be measured on the horizontal or vertical plane, the latter favoring widely scattered light sources, such as arc lights.

Lighting contracts based upon the illumination produced would put all sorts of light upon nearly the same basis and would render it comparatively easy for city or company employes to make fairly reliable tests whenever desirable.

In cases where companies do not care to sell illumination as such it would be some improvement over present contracts based upon nominal candlepower to charge by the kilowatt-hour. Contracts for lighting streets by gas are frequently based upon a fixed charge per thousand cubic feet, estimated from hours of burning, and periodical tests of consumption by various burners taken at random and tested under working pressure. In this case the city requires periodical cleaning of the globes and assumes that the street illumination is satisfactory. Such tests are difficult in the case of mantle burners, and unless provision is made for renewal of mantles when broken and after a definite period of service there is apt to be much poor illumination.

It would not be difficult to provide for similar sort of testing for electric lights. The circuits might be run into testing stations established in fire-department houses or police stations, where instruments could be plugged in at will to measure the current. Occasional tests on the line with voltmeters would check the adjustment of individual lamps with sufficient accuracy. In the case of alternating-current lamps an occasional wattmeter test is not a difficult matter.

One of the most satisfactory methods would be to have integrating wattmeters at the power house so as to measure the entire energy delivered to the street circuits for both arc and incandescent lighting. While this method would measure the energy lost on the line and in translating devices other than the lamps, suitable allowance could be made in the contract.

The main objection to contracting for street lights on the basis of energy consumption is that there is no definite relation between kilowatts and candlepower. In the case of incandescent lamps, the size, initial candlepower, age and method of manufacture all enter into the amount of light per watt, and the street fixture exerts an influence more or less. In the case of the arc lamp the light is affected by the globes and coatings, by the size and quality of the carbons, by the length of the arc and perhaps by the power factor.

That the old method of naming and rating arc lamps by nominal candlepower is not satisfactory few question. In the good old days of the open arc, a "2,000-candlepower arc" was one that absorbed 450 watts at the arc. (Some claim that it gave 500 candlepower up and down each street, making 500×4 =2,000 candlepower in all.) A "1,200 candlepower arc" was something less, with current varying from five to 6.8 amperes and with voltage from 42 to 60. There was also the four-ampere circuit for "800-candlepower arcs," and some even provided for a "1,500-candlepower" light. In these modern days of enclosed arcs operated on direct or on alternating-current circuits there is an equally wide range. The manufacturers list direct-current series lamps for 6.5 or 6.6 amperes, taking about 75 volts at the arc, about 495 watts at the arc and about 508 watts for the lamp. The increase in energy over that used by the open arcs tends to offset the lower efficiency of the enclosed arc. For alternating-current series circuits, lamps are made for 6.6 or 7.5 amperes, taking 430 or 490 watts, with 72 volts at the arc. An alternating-current street arc lamp for multiple circuits is made for 6.5 amperes, taking 418 watts at 75 volts. Arc lamps for indoor use on multiple circuits take from 3.25 to five amperes with direct current and from four to 7.5 amperes with alternating current. With this array of modern arc lights it is "up to" the electric-lighting men to define what they mean by 2,000 or 1,200-candlepower arc lights, or to find some more accurate method of description when making contracts.

Discussion (in Abstract).

R. N. Kimball, Kenosha: We have a 2,000-candlepower so-called contract, and we are using what we call a 450-watt lamp. Recently where we got in trouble with the City Council we put in wattmeters on the board and are able to show them at any time our daily readings. There is no controversy as to whether they are getting the light or not, and that is a very satisfactory way to close up a discussion that any enemy wants to open.

T. F. Grover, Fond du Lac, Wis.: Are there any others in the room who use wattmeters for measuring the current that they give the city?

H. Almert, Oak Park, Ill.: We first started to use wattmeters for that purpose, for our own protection, in trying to determine the amount of current lost or stolen, and we found the plan satisfactory and we adopted it also when we wanted to check up our street-lighting system to see what we actually did get on a kilowatt-hour basis for our current.

In making one contract with one municipality recently the local waterworks engineer was the engineer for the council, and he conceived the idea of having a voltmeter installed in the city clerk's office so that he could check up the street-lighting system at any time. I don't know exactly how he was going to do it, and it was to be a nominal 2,000-candlepower proposition. But I finally convinced the waterworks engineer that the only equitable way would be to specify 450 watts at the arc, and the city attorney in addressing the council finally said that the contract had been changed in one particular, that he did not know exactly how many "warts" there were in the lamp they were getting now, or how many the new contract expected to give them, but that the engineer would be satisfied to withdraw the voltmeter and insert 450 "warts" if they would give them one year's use of an extra lamp.

C. H. Williams, Madison, Wis.: Our contract with the city does not say anything about candlepower; it simply states the wattage consumption at the station per lamp, and we report to the city the watts consumed, and they take readings also and witness the test of the wattmeter, and we give them the number of lamps on the line. They check those data themselves.

Mr. Putnam: I would like to ask these gentlemen who have wattmeters on their city street-lighting system if they could give us the prices paid by the city for their arcs and also the net price they receive per kilowatt.

Mr. Kimball: As far as Kenosha is concerned, we are running on moonlight schedule, and in the longer hours the price per kilowatt is less, and I have not got the exact figures as to what we get out of it. On the year basis we get $78 per lamp, but have quite a little bit of dead-head lighting. There were no restrictions put on as to how much they should use on this dead-head lighting, when the contract was first made, and we run on a 24-hour service now, and find that the dead-head system is a bad thing for us. They have 16 lamps, for instance, in the city hall, and they can run them 24 hours a day if they want to. In checking up individual lamps it was reported to us that the city had an expert there, and had let down one of our lamps and had checked the individual lamp with a voltmeter and an ammeter, and we found it to be a fact in checking it ourselves that the average voltage on different lamps varied quite a little bit, so that the results obtained at any one time were misleading, and when they came at us that way we could not tell anything about it; but on checking the average result with the wattmeter they did not object.

## Another Electrical Building for Chicago.

The Electric Appliance Company, having outgrown its present quarters, is building for itself a six-story-and-basement building on the corner of Jackson Boulevard and Desplaines Street, one block north and one block west of the present location. The building, which is nearing completion and which President W. W. Low and Secretary Thomas I. Stacey of the Appliance company, with their staff of assistants, expect to occupy in April, fronts 100 feet on the boulevard and is about square. It contains over twice the floor space of the old building. The change indicates that the notable success which has marked the Appliance company from its birth continues unabated.

The five-story building to be vacated by the Appliance company, which is at 92 and 94 West Van Buren Street, will be occupied by the Arthur Frantzen Company, electrical contractor and manufacturer, which has leased it for a term of 10 years, beginning May 1, 1905. This enterprising company, whose business is rapidly growing, contemplates giving up its present quarters in the Fisher Building (Dearborn and Van Buren Streets) and its factory at 161 South Canal Street, uniting office and factory under one roof.

## Gasoline Engines Impracticable in Competition with Electric Cars.

The Indiana correspondent of the Western Electrician writes: "The officials of the Lake Erie and Western railroad have announced that they have found gasoline engines to be impracticable in competition with electric cars, and that they have decided to install an electric system of their own on most of their lines in Indiana as soon as spring opens. It is said that orders have already been sent in for the construction of electric cars and that an extensive system will be installed. The first line to be equipped will be its road from Indianapolis to Lafayette, via Tipton. It is on this division the interurban competition is the heaviest."

1. Paper read before the Northwestern Electrical Association in Milwaukee on January 18, 1905. Mr Shepardson is professor of electrical engineering at the University of Minnesota.

## An Invention of Dr. Weston Upheld by the Court.

An interesting decision in relation to measuring instrument patent litigation was handed down by Judge Kohlsaat of Chicago on January 24th, in the suit brought by the Weston Electrical Instrument Company of Newark, N. J., against the Jewell Electrical Instrument Company of Chicago and others, brought in the United States Circuit Court for the Northern District of Illinois. The following extracts from Judge Kohlsaat's clearly written opinion will explain the case and the decision:

This matter comes before the court on a motion for a temporary injunction, restraining defendants from infringing claims 8, 12 and 13 of patent No. 302,387, for an electrical measuring apparatus, issued to E. Weston, November 6, 1888. Patentee declares the principle of his design to be the organization and construction of a device wherein the current to be measured, passing through a coil in the circuit, which is supported so as to act freely in a uniform magnetic field, shall cause said coil to move in response to the resultant effect thereupon of the current and the field of the magnet with which it is placed in relation; also to oppose said movement of the coil by a uniform resilient resistance so graduated as to cause the movement of the coil to be practically proportionate to the strength of the actuating current, or, in case of an independent electrical resistance, proportionate to the electromotive force of the current; also to indicate such movement and the corresponding electromotive force upon a scale; to prevent oscillation by combining a mass of diamagnetic matter with the coil and placing the same in such relation to the field of force of the magnet as to steady the movement of the coil. The magnet used is a permanent magnet, and its field of force is entirely independent of the electric current which passes through the coil, thus giving the motive function and the damping function different sources of influence.

It is insisted by defendants that the patent covers a mere aggregation of elements. While it is true that the parts do not, strictly speaking, co-act directly upon each other, yet there is a co-action to a specific result in such a manner as to make it apparent that the device is the product of all the elements. * * * * The defense attacks the validity of the patent and denies the infringement. * * * *

The defendants' device differs materially in appearance from that of the devices of the defendant involved in any of former suits, so far as the same have been called to the attention of the court. They insist that their device, when construed with reference to the prior art, does not infringe the claims in suit. * * * *

It can hardly be claimed that the absence of a core is of importance. The core of the patent in suit serves no further purpose than to intensify the field of force and provide the two arc-shaped air gaps in which the arms of the coil move. The main point to be attained in the use of the magnet is a permanent and intense field of force. If it shall be held to be an essential element of complainant's claims under consideration, that there must be two air gaps and that both arms or sides of the coil shall move continuously within the field of force, then, of course, some arrangement of the space intervening the pole faces of the magnet must be made whereby a core might become a vital feature. In my judgment it is not, independent of the prior art, an important matter whether one or both arms of the coil move continuously within the influence of the permanent magnet. One is the fair equivalent of the other. The coil in either case moves within the field of force. Much consideration is given by defendants' counsel to the fact that the patent in suit calls for a pivotal mounting of the coil upon two pivots, while defendants' coil is mounted upon a shaft. It is not claimed that there is other difference between the two methods than that in the claims in suit the coil is located between the pivots, so that the coil can be mounted concentrically with the axial line of the pivots, while in defendants' device the coil is mounted eccentrically by means of the continuous shaft with its pivot ends. In this manner defendants are able to dispense with one of the air gaps. Unless, however, the two air gaps are necessary members of complainant's combination, these two arrangements are clearly equivalents. They are mere details of construction. It must, therefore, be held that unless the claims in suit are narrowed by the prior art, they are infringed by defendants. * * * *

An examination of the former Weston patent No. 334,145 shows that * * * * the former combination does not anticipate the combination of the patent in suit. The one difference of the permanent magnet, as opposed to the electromagnet, would differentiate the two devices. In the former patent the same current actuates the magnet and the coil, and a steady or uniform field of force could not be maintained between the poles of an electromagnet, since it must vary with the force and volume of the electric current passing through it. Add to this the manner of supporting the coil, and the difference is plain—a difference that seems to constitute patentable novelty.

The British patent to Siemens, No. 1,919, is for a relay device, to make and break the contact of a circuit. * * * * Even were it not in a substantially different art, this patent would not anticipate the patent in suit in any material respects. It resembles clearly the former patent of Weston, but would have to undergo [illegible] could be applied to the [illegible] motive base. I do not deem the [illegible] ent in suit narrowed thereby.

The device described by Deprez in La Lumière Electrique [illegible] consists of a coil [illegible] and a short one below, drawn over [illegible] act as a spring opposition and for the entry and exit of the current. It contains no damping frame or action. It has the core of complainant, centered with the faces of the concave pole pieces. It lacks a number of the active elements of each of the claims in suit. It was designed for the measurement of currents employed for industrial uses, such as electric lighting, etc., and describes how it can be made sensitive for finer work. It calls for a permanent magnet, a coil without a damping frame. It does not seem to me that any one of claims 8, 12 and 13 is at all narrowed by the Deprez descriptions.

The Finlaison Article of 1843 describes a method adopted by one Bain in operating electric clocks and telegraph instruments. The article is vague as to details. For instance, the coil is said to be freely suspended; the drawings seem to indicate some sort of a support other than suspension. I am unable to determine what the method was, and cannot consider it therefore as a makeweight upon this hearing. The device calls for a compound permanent magnet within the coil (probably equivalent to the core of the patent in suit) interposed between the pole pieces of a permanent magnet; spiral springs lead in the current and serve to return the coil on the withdrawal of the current. The coil moves back and forth between fixed stops as the current is turned on or off. No damping frame is employed, this being unnecessary, because of the use of stops. The main result sought to be attained is instantaneous action. I fail to see anything in this description which serves to modify the force of any one of said three claims in suit.

The Varley British patent No. 3,059 of 1856 covers an electric telegraph. It calls for a permanent magnet and a movable coil in the field of force. The wire coil is connected with the line wire by hair springs, or by the pivots, formed by dividing the axle in half and insulating them. There is no resisting spring action. There is no damping frame or function. What Varley claimed over Bain is that by his device he obtains greater deflection of the coil, due to intensifying the field of force, and makes it, therefore, available for relays and indicators. He also claims the application of moving coils to telegraphic instruments. In this device there are wanting a number of the elements of each of the claims in suit.

The foregoing summary, in my judgment, fairly sets out the prior art, so far as it materially affects the matters before the court. It must be conceded that Weston has not used one new element. Some of the older devices seem almost to embrace his combination. The galvanometer was in the minds of inventors as an important line of development. Some had almost conceived the idea of Weston. But it remained for Weston to devise and produce a commercial indicator. Defendants have followed Weston on substantially the same lines. It is the soul of invention of this nature to make a complete and commercial article. What was designed for telegraphic instruments and the running of clocks seems not to have led to the comprehension of an effective method for the measuring of electric currents, as they are required in manufacture and commerce. While each of the claims emphasizes a different feature of the complainant's device, it also calls for a complete apparatus in accordance with the drawings and specifications. Each of these is new in its arrangement, and that novelty amounts to invention.

Undoubtedly defendants, on the record here shown, infringe. Complainant is entitled to an injunction, and it may be issued.

## Electric Supplies Wanted in China.

From Hangchau, China, under recent date, United States Consul G. E. Anderson writes: "Several of the larger mission schools in Hangchau and vicinity are considering the equipment of their schools with small electric-light and power plants in connection with gasoline-engine power. They are doing this both for the sake of the light and for the means such plants would afford for instruction. The president of one of the academies has asked me to obtain catalogues for such plants, and I will be glad to use any sent me both with him and with others. Fifty-light or 60-light plants will probably be about the size needed. The equipment of one or two schools with such plants will lead to the equipment of others as a matter of course, but the chief importance of the matter is in the fact that these small plants will be object lessons for Chinese business men and officials of what can easily be done in the cities in commercial light plants.

"Several American electric-light people are considering schemes for the establishment of light plants in cities of this province, but so far, among other hindrances, they have lacked the cordial co-operation of Chinese business men. With a few object lessons at hand this backwardness may be overcome. The development of trade in electrical supplies and machinery in this part of China will prob- [illegible] business men."

## Nebraska Telephone Association.

[illegible] which had been appointed to investigate this proposition reported favorably and its report was adopted by the association. The committee was composed of J. C. Kellogg of [illegible] coln, G. T. Everett of Columbus, W. E. Bell of York, and T. H. Pollock of Plattsmouth. This committee, in co-operation with the executive board, will perfect a plan for a clearing house by which all the toll lines of the Independent companies may secure a just division of long-distance tolls. A report is to be made on this some time in March, to be carried to every board of directors in the Independent telephone business, with recommendations for adoption. All who join, according to present plans, must sign a contract to belong for two years.

The subject of standardization was enthusiastically discussed. The committee appointed to report on this matter, however, asked for further time. This committee is composed of F. E. Ebersole of Lincoln, O. M. Thorpe of Wahoo, W. E. Bell of York, A. N. Munn of Nebraska City, and T. H. Pollock of Plattsmouth. On the recommendation of the chairman, the report will be submitted to the executive board with full power to approve or reject the report. The desire is to set in motion a plan to establish eventual uniformity among the systems of the various Independent companies.

The matter of affiliation with the national organization of Independent telephone companies was discussed and largely favored. The constitution of the Pennsylvania state association, by which it maintains its loyalty to the national organization, was read and referred to a committee to report, with recommendations as to changes that would benefit the Nebraska order.

The election of officers for the ensuing year resulted as follows:

President—W. E. Bell of York.

Vice-president—C. J. Garlow of Columbus.

Secretary and treasurer—G. T. Everett of Columbus.

During the week of the convention the office and exchange of the Lincoln Telephone Company were thrown open to visitors. Many of the delegates inspected the fine automatic system of this company.

## Bell Telephone Output.

The year 1904 was the heaviest instrument-output year in the history of the American Telephone and Telegraph Company, the net result being a gain of 701,047 instruments outstanding, according to the report. It is estimated by the company that the annual gross earnings of the entire system, central and subsidiary companies included, are now close to $100,000,000. The statement of the output of instruments for December and the year from January 1st to December 31st, with comparisons, follows:

| | [illegible] | [illegible] | [illegible] | [illegible] |
|---|---|---|---|---|
| December | [illegible] | [illegible] | [illegible] | [illegible] |
| Gross output | 122,285 | 88,167 | [illegible] | [illegible] |
| Returned | 43,858 | [illegible] | [illegible] | [illegible] |
| Net output | [illegible] | [illegible] | [illegible] | [illegible] |
| January 1st to December 31st | | | | |
| Gross output | [illegible] | [illegible] | [illegible] | [illegible] |
| Returned | [illegible] | [illegible] | [illegible] | [illegible] |
| Net output | 701,047 | 624,137 | 623,734 | [illegible] |
| Outstanding Dec. 31st | 4,180,864 | 3,479,817 | [illegible] | [illegible] |

# COMMUNICATION.

## Another Opponent of "Hello."

To the Editor of the Western Electrician.

Referring to your issue of the 21st instant, page 56, and the communication on the subject of "Hello." we beg to send herewith a copy of this company's operating rules, inviting your attention to page 22, paragraph 58, on this subject. We agree heartily with what Mr. A. S. Hibbard has to say in the article that you published from him on this subject.

LELAND HUME.

Nashville, Tenn., January 23, 1905.

[Mr. Hume is the assistant general manager of the Cumberland Telephone and Telegraph Company. The paragraph to which he refers reads as follows: "'Hello' Prohibited.—Operators will answer all calls of toll lines by giving the name of the exchange instead of saying 'Hello.' Will answer all calls from local subscribers by saying: 'Number' or 'Number, please,' instead of 'Hello.' When testing connections that are up, or have rung off, operator will call in the line and say: 'Waiting?' The idea being to discontinue the nonsensical use of 'hello' in the operations of switchboard service."]

## Annual Report of Chicago Telephone Company.

President Arthur D. Wheeler's annual report of the business of the Chicago Telephone Company for 1904, dated January 18, 1905, is given herewith:

The comparative showing as to revenue and expenditure is as follows:

| | 1903. | 1904. | Increase. |
|---|---|---|---|
| Gross revenue | $5,514,590.19 | $6,373,116.10 | $858,525.91 |
| Gross expenses (operation, taxes, maintenance and reserve for deferred maintenance) | 4,113,246.10 | 4,809,500.02 | 696,253.92 |
| Net earnings | $1,421,344.00 | $1,563,616.08 | $142,271.99 |
| Dividends | 1,274,835.00 | 1,400,000.00 | 125,165.00 |
| Surplus for year | $ 146,509.00 | $ 163,616.08 | $ 17,106.99 |

The comparative balance sheets as of December 31st are as follows:

RESOURCES.

| | 1903. | 1904. |
|---|---|---|
| Invested in plant | $12,635,532.79 | $13,208,689.17 |
| Invested in real estate and buildings | 1,273,733.59 | 1,346,560.20 |
| Other investments | 125,036.75 | 114,650.07 |
| Balance of bills and accounts payable and receivable | 300,331.59 | 395,546.11 |
| Material on hand | 369,057.63 | 163,638.67 |
| Cash | 547,640.00 | 511,312.69 |
| Total | $15,251,334.35 | $15,740,396.91 |

LIABILITIES.

| | 1903. | 1904. |
|---|---|---|
| Capital stock | $14,000,000.00 | $14,000,000.00 |
| Reserve for taxes | 90,377.07 | 157,290.02 |
| Reserve for deferred maintenance (to provide for renewal of switchboards and apparatus and for continually accruing depreciation of cables and plant) | 646,551.32 | 913,825.83 |
| Reserve for unearned rentals | 46,336.56 | 39,891.13 |
| Reserve for outstanding toll tickets and car tickets | 3,302.20 | 1,006.65 |
| Surplus | 464,767.20 | 628,383.28 |
| Total | $15,251,334.35 | $15,740,396.91 |

The increase in the number of subscribers' telephone stations has been satisfactory. The growth is more nearly normal than during the two preceding years, when the construction and operating forces of the company were taxed to the utmost to supply the phenomenal demands. At the close of 1900 there were 36,414 subscribers' stations. In the succeeding four years the number has increased to 117,893, an average of over 20,000 stations a year, distributed as follows: 1901, 17,097; 1902, 25,532; 1903, 22,144; 1904, 16,706.

The traffic of the Chicago exchange system demonstrates that the value of telephone service to the subscriber is in proportion to the number of stations in the exchange. A subscriber who five years ago paid $60 a year for service in his residence was given facilities for communication with 353 other telephone stations for each dollar paid; today for each dollar paid his circle has enlarged to 1,445 stations. There are now nearly 6,000 more telephone stations in private residences in Chicago than there were in the entire Chicago exchange for both business and residence purposes five years ago. There is a greater number of telephones in private residences in the Chicago exchange system than in any other telephone exchange in the world. During the year a reduction of $5 per annum was made in the rate for a large class of residence extension telephones. In an increasing number of homes telephone facilities, accessible from different parts of the house are being provided.

The order department for the Chicago exchange system alone issued during the year 79,631 orders in compliance with the wishes of our subscribers for installations, removals, moving or other changes affecting service or equipment, the performance of each order involving the services of from half a dozen up to 50 or more employes. In addition to this, the suburban department, with its 986 employes, covering the 110 exchanges outside of the Chicago exchange system, is carrying on its volume of construction and operation in the suburban and rural districts in which there was a net increase of 5,860 stations. The payments to employes for services during the year amounted to $2,260,947.08.

From every point of view from which the question has been studied it is clear that the operating efficiency throughout the plant has never been greater. In previous years reference has been made to answering tests conducted by expert observers. Over 50,000 such tests during the year have shown that an answer was received from the operator on an average of 4.5 seconds, and that 95.7 per cent. of all the calls were answered in six seconds or less. The extent to which the subscribers in the Chicago exchange system made use of the free police, fire-alarm and time service is indicated by the fact that during the year 30,085 police calls and 4,890 fire calls were transmitted under the supervision of Chicago operators. An actual count disclosed that upon one day 28,877 requests for the "correct time" were received and answered. United States Weather Bureau predictions are given daily upon request from subscribers in the suburban and rural exchanges. The distribution of presidential election returns, November 8th, to the homes, clubs and other meeting places of the people was greatly appreciated. Three thousand five hundred subscribers were as quickly and fully informed in their farm houses as if they had resided in a city.

The exchange-building operations of the company during the year have included extensive additions to the Lake View, West, Wentworth and West Pullman exchange buildings, and the erection of a fine building in Waukegan, in which complete new central-station installation will be made early in 1905. The erection of a building for an extension of the Central exchange in the Chicago exchange system has been commenced and should be completed to a height of four or five stories in 1905. The construction is of a character to admit of the addition of other stories. The erection of a building for an exchange to be known as Humboldt exchange, in the northwestern portion of Chicago, has been commenced. Building sites have been purchased in Wilmette, Blue Island and at two locations in Chicago, in each of which places buildings will be required in the future. Plans are being considered for the occupation of a new building in Highland Park.

No additional shares of capital stock have been issued and sold during the year, as it has been the policy of the company to accept first the new business offered accessible from the plant erected during the very considerable extensions within the last few years. At the close of the year there were on hand over 3,600 unfilled requests for installations, and any necessary new plant to meet such requests must be provided during the coming year. A portion of the proceeds of the last issue of stock paid for by the stockholders is still available for plant extension.

No large items of necessary plant displacement immediately confront us to make a draft upon the reserve for deferred maintenance, but a new toll switchboard and a new building to accommodate it must be provided for within the next year or two. In the report to the stockholders for the year 1900 the meeting of a loss to the company from switchboard displacement, of $274,999.60, by charge to reserve for deferred maintenance, was explained. Through this account and the charges against revenue, for depreciation beyond the reach of current maintenance, the effects of invention, use and age upon plant have been recognized and met in the company's accounting. The company was singularly free in 1904 from extraordinary items of maintenance caused by weather. One wind and sleet storm cost nearly $5,000, but this was a fortunate outcome as compared with the injuries to plant, amounting to $50,000, which have been inflicted by single storms in the company's history. The underground plant suffers its own peculiar injuries, especially in Chicago. Over 20 miles of poles was removed from the streets of the city of Chicago, facilities having been provided by underground construction. Similar pole removals, with the substitution of underground facilities, have been made in the suburban exchanges where conditions justified it. The subjoined table makes a statistical showing of the company's plant history during the last 10 years:

TABLE SHOWING GROWTH OF CHICAGO TELEPHONE COMPANY.

| | 1895. | 1896. | 1897. | 1898. | 1899. | 1900. | 1901. | 1902. | 1903. | 1904. | Increase 1904. | Per Cent. Increase. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Number exchanges | 22 | 31 | 42 | 58 | 70 | 84 | 95 | 112 | 114 | †111 | | |
| Toll stations | 72 | 68 | 82 | 86 | 101 | 101 | 97 | 93 | 82 | 80 | | |
| Number of exchange telephones | 13,804 | 15,384 | 16,900 | 21,188 | 27,663 | 36,414 | 53,511 | 79,043 | 101,187 | 117,893 | 16,706 | 16.5 |
| Underground conduit miles | 42 | 54 | 58 | 61 | 104 | 121 | 136 | 197 | 235 | 254 | 19 | 8 |
| Underground duct miles | 171 | 185 | 234 | 267 | 527 | 874 | 1,019 | 1,192 | 1,272 | 1,468 | 96 | 7 |
| Miles of wire underground | 10,050 | 20,548 | 24,324 | 30,259 | 41,737 | 68,593 | 87,685 | 123,708 | 149,234 | 161,202 | 11,968 | 8 |
| Miles of wire aerial cables | 6,091 | 7,189 | 7,864 | 11,225 | 14,415 | 19,194 | 25,976 | 32,570 | 40,480 | 46,697 | 6,217 | 15.3 |
| Miles of wire on poles | 12,127 | 12,713 | 13,932 | 15,629 | 18,692 | 22,818 | 32,124 | 38,742 | 41,484 | 45,189 | 3,705 | 8.9 |
| Total miles of wire | 38,168 | 40,450 | 46,120 | 57,113 | 74,894 | 110,605 | 145,785 | 195,020 | 231,198 | 253,088 | 21,890 | 9.5 |
| Capital stock | $ 1,726,200 | $ 4,336,500 | $ 4,336,500 | $ 4,336,500 | $ 5,030,000 | $ 7,000,000 | $ 9,000,000 | $11,903,400 | $14,000,000 | $14,000,000 | | |

* The exchanges (now 14) in Chicago exchange system are counted as one.
† Decrease from union for operation.

It has been considered of first importance that the service should be maintained at the highest point of efficiency. There is an increasing appreciation on the part of our subscribers of the intricacy and delicacy of a telephone system and of the service benefits of intelligent co-operation on their part.

Jules Siegfried, ex-minister of commerce of France, is president of an organization which has completed plans for the establishing of a hotel for telephone girls in Paris. Extensive grounds have already been purchased. The hotel will have 100 apartments, a co-operative restaurant, and a library.

## Consolidation of National and Interstate Telephone Associations Assured.

Two committees having full authority to act and representing, respectively, the National Independent Telephone Association and the Interstate Independent Telephone Association of America met at the Claypole Hotel, Indianapolis, on Saturday evening, January 21st, for the purpose of effecting a consolidation of the two associations. There was such unanimity as to easily pass a resolution to effect a reorganization into one association to be known as the National Interstate Telephone Association. After a friendly but earnest discussion of plans and purposes a constitution was adopted which provides for the early organization of the various states and districts served by the lines operated by the consolidating associations on a delegate basis, allowing one delegate for every 10,000 units represented in their local associations.

Those composing the committees present and taking a part in the meeting were James B. Hoge and Ed. L. Barber of Ohio, W. D. Barnard and J. C. Splain of Pennsylvania and Col. J. D. Powers of Kentucky, for and representing the National association, and Theodore Gary of Missouri, L. L. C. Brooks of Minnesota, C. E. Hull of Illinois, E. M. Coleman of Kentucky and Henry A. Barnhart of Indiana for the Interstate association. These committees were combined as the executive committee of the new organization, but the selection of officers was deferred until the next convention, which, it was agreed, should be held in Chicago on June 14th and 15th. James B. Hoge and Theodore Gary, presidents of the respective associations, were given full authority in the matter of details relating to the new organization and the preparation for the Chicago convention. The members of the joint committee expressed themselves as being highly pleased with the bright outlook for the new association and the Independent telephone business in general.

S.

## Telephone Extension in Western Canada.

The Bell Telephone Company of Canada is contemplating an extensive invasion of Western Canada during the coming summer. In addition to the company's present plant, it will erect from 10 to 15 main exchanges and from 20 to 25 branch exchanges. The plant will be so distributed as to give good telephonic connection all over Manitoba and the more settled sections of the Canadian Northwest Territory. Connection will also be made with the American Northwestern Telephone Exchange of Minneapolis at various points on the international boundary, so as to give a good service with Minneapolis and other places on the American branch telephone lines. Mr. L. P. McFarlane, general superintendent of the Bell company, says that the great growth of business has necessitated this extension, which will involve a large expenditure by the company. He states that the Bell policy is to follow the rapid development of the Canadian West with as complete a long-distance service as circumstances will permit.

## Independent Telephone Difficulties in Cincinnati.

The Circuit Court at Cincinnati on January 21st decided that the Queen City Telephone Company (Independent), organized to enter the Cincinnati field, has not yet obtained the right to appeal to the court for a franchise or the enforcement of a legislative charter because of its failure to comply with municipal requirements. Four Independent companies were originally interested, but the test was made in this case by the Queen City Company, largely composed of Indiana men, which contended that, having a charter from the state Legislature, it held franchise rights to use the streets and alleys of the city in conformity to corporate regulations. For the city it was contended that the legislative body of the city had sole jurisdiction. After entrance was refused by the city officials the company under the state law appealed to the Probate Court, which decided that the company had a right to occupy the streets and alleys, but on appeal to the Common Pleas Court this ruling was reversed, and now the Circuit Court approves that reversal. The case will now be appealed to the Supreme Court.

## TELEPHONE MEN.

C. F. Speed has resigned as manager of the Washtenaw (Mich.) Home Telephone Company. C. D. King of Chicago succeeds him, and will put in a new plant at Ypsilanti.

H. E. Stimpson of Minneapolis will hereafter be local manager for the Consolidated Telephone Company at Grantsburg, Wis., with charge of the exchanges at Cambridge, Grantsburg, Frederic and Luck.

## Indiana Telephone Items.

The Roanoke Telephone Company has increased its capital stock to $10,000, the additional capital being necessary to make improvements and extensions, in order to take care of the growing business. E. M. Wasmuth is president and E. E. Richardson, secretary.

James B. Adams of the Branch Coal Company asks $5,000 of the Indianapolis Telephone Company for injuries he claims to have received last October, when he accidentally touched his chin on the transmitter and received a shock which temporarily paralyzed his limbs. The trial is likely to bring out some expert testimony.

Thomas Taggart, proprietor of the Grand Hotel, has decided to install telephones in all the rooms of the hotel.

The Temert Telephone Company at Walkerton has just issued a new directory, which shows quite an increase in the list of subscribers.

The Daleville Telephone Company is in the market for wire and telephones. F. E. Barber, general manager, is preparing to greatly increase the extent and capacity of the plant in the spring. The company recently declared a semi-annual four per cent. dividend.

The Central Energy Telephone Company of Frankfort has issued a manifesto, declaring the plant to have been thoroughly modernized, a new switchboard of 3,200 capacity installed, and that the 1,200 subscribers may talk with towns and cities over toll-line connections. The company has recently completed 6,500 feet of underground cable and repaired the central building, which it owns.

Indiana telephone men, as well as insurance men, are greatly interested in the recent decision of the Wisconsin Supreme Court in the case of the Wausa Telephone Company against the German-American and other insurance companies. The company has an indorsement on its policies to the effect that it would not be liable in case of loss from electric currents coming in from the outside. This is the usual electric clause attached to telephone exchanges, but the Wisconsin court holds that the indorsement is in violation of the Wisconsin standard-policy law, and says that insurance companies cannot be permitted to refuse to pay losses caused from electric currents of this kind. Underwriters predict that this decision, if followed by other state courts, will result in companies refusing to write telephone exchanges, claiming that many losses occur from outside electric currents. S.

## Ohio Telephone Notes.

The capital stock of the City and Suburban Telephone Company of Cincinnati will probably be increased to $500,000 at the annual meeting on February 15th in order to provide funds for laying conduits for the lines that run out to the suburbs on the hills. Engineers are now at work on estimates for this work.

The Northern Ohio Telephone Company of Maumee has been incorporated to build a system of lines in Lucas, Wood, Fulton and Henry counties, which include the section about Toledo. Grafton B. Moneau, Henry N. Perrin, David C. Creps and John M. Ormond are the incorporators. The capital stock is placed at $100,000.

Officers of the Akron Peoples' Telephone Company were elected at the annual meeting a few days ago, with Will Christy as president. The reports of the officers show that the company had a prosperous year.

An increase of capital stock from $20,000 to $40,000 has been made by the Upper Sandusky Telephone Company of Upper Sandusky.

The Farmers' Telephone Company of West Jefferson, Madison County, has been incorporated with a capital stock of $10,000 by Hiram Ingalls, James Huggett, F. B. Biggert and others.

A. J. Parsons, who has been manager of the American Telephone and Telegraph Company's office at Maumee for some time, has been made manager of the Central Union at South Bend, Ind., and John Russell, wire chief, will succeed him at Maumee.

A list of Independent and Bell telephones in Lorain County, just published, shows 4,302 of the former and 710 of the latter company. C.

## Michigan Telephone Matters.

The Co-operative Telephone Company of Detroit is endeavoring to increase its sphere of action. It is understood that local capitalists have become further interested and that experts will be brought from out of town to develop the property. C. M. Burton is the president of this company, which has been in existence for two or three years, and which has been carrying on a long-distance service independent of the Bell interests. At present the Co-operative company is the only medium of communication the Independent lines throughout the state have with Detroit merchants.

The subscribers of the Michigan Telephone Company of Mount Clemens have been advised that rates will be raised, beginning April 1st, to $30 for business telephones and $24 for residences. The present rates are $24 and $18. The Business Men's Association will meet and take action in regard to the matter.

W. A. Young of the Benzie County telephone system has recently made a visit to the offices of the Citizens' Telephone Company at Grand Rapids, and it is understood that he is [illegible] arrangement for interchange of business.

The Northern Michigan Asylum at Traverse City, wishes to obtain consent from the state for the installation of a new and improved telephone system in the place of the one [illegible] and various cottages with the main building.

The annual report of the Valley Telephone Company at Saginaw shows very favorably, as there is an increase in net receipts over last year of $12,000, and over $16,000 dividends paid. The city has 4,471 instruments in use, which is an increase of [illegible] last year. W.

## Telephone News from the Northwest.

George W. Hart has sold the telephone systems at Flandreau and Eagan, S. D., to C. and J. W. Miller. Several new rural lines are being planned.

The Cook House in Rochester, Minn., has installed an interior telephone exchange, connecting 50 rooms.

The Nicollet County Telephone Company will build a block at New Sweden, Minn., for an exchange.

The Northwestern Telephone Exchange Company took over the system of the Minnetonka Telephone Company at Excelsior, Minn., January 20th.

The Odin (Minn.) Farmers' Telephone Company has been incorporated with $5,000 capital stock.

The Storla (S. D.) Telephone Company is considering the extension of its wires.

F. B. Rowe of Chamberlin, S. D., seeks a franchise at White Lake, S. D., for a local exchange, which will probably be granted.

A local exchange for Clara City, Minn., is projected, and a temporary organization has been formed to secure information upon the subject.

Work has been begun installing a local exchange for Echo, Minn. The franchise granted by the city of Faribault, Minn., to K. D. Chase and others for an Independent exchange is said to be unsatisfactory to the projectors of the enterprise, and they may not accept it.

The Chamber of Commerce in Minneapolis has arranged for a switchboard upon the trading floor, to centralize the numerous wires through the building. The Northwestern Telephone Exchange Company has installed a long-distance board, and both it and the Twin City Telephone companies will set up switchboards on the floor, to operate the 39 open telephones now on the exchange, and the numerous private lines.

The Interstate Telephone Company of Modalie, Iowa, has increased its capital to $50,000.

The Iowa Telephone Company is planning to construct eight toll lines out of Des Moines to Sioux City, Omaha, Davenport, Clinton, Dubuque, Kansas City and the Twin Cities.

The Dayton (Iowa) Telephone Company has increased its capital to $25,000. R.

## NEW COMPANIES.

The Nashville Mutual Telephone Company of Nashville, Mo., has organized with J. J. Randall as president and will construct a telephone system to be operated on the co-operative plan.

O. M. Hale, E. R. Boggs and T. J. Williams have incorporated as the Kirksville Mutual Telephone Company at Kirksville, Ill. The company is capitalized at $2,400 and proposes to operate a local telephone system.

The Summers and Mercer Mutual Telephone Company, with headquarters at Junta, W. Va., has been incorporated, having a capital of $10,000. Charles A. Baker and William A. Smith of Junta head the list of incorporators.

## MANUFACTURERS AND DEALERS.

The Vought-Berger Company of La Crosse, Wis., says that it has been absolutely deluged by requests for the souvenir celluloid ruler advertised recently in the Western Electrician. It will be glad to send out these rulers to everyone who has sent in the desired information, but is forced to delay the distribution until about February 10th, owing to the fact that the celluloid factory making the rulers has been put to an unlooked-for delay and will be unable to furnish the souvenirs until about that time.

Switching stations for small or isolated telephone exchanges and auxiliary cord equipments form the subject matter of Bulletin No. 26, issued recently by the North Electric Company of Cleveland, Ohio. The standard-size units are for five, 10 and 20 lines, though a further increase may be readily had by using two or more units in conjunction. Standard tubular drops of the magneto or relay types are used, which are illustrated in the bulletin. The bulletin besides containing illustrations and descriptions of all of the various parts of the apparatus also gives complete instructions for installing and the method of operation, together with circuit diagrams.

The Iowa Telephone Association will hold its annual meeting at Des Moines on March 13th and 14th. It is probable that the association will make arrangements for a clearing house through which all toll-line money will pass.

## Texas Independents Organize.

[illegible]

The chairman briefly outlined the purpose of the meeting [illegible] pendent telephone exchanges throughout the state within the last two years gave evidence of the fact that in almost all towns and cities there are Independent systems [illegible] subscribers and farmer lines are firmly established. Many individual owners of Independent exchanges are not aware of the developments in territory outside of that covered by their local exchanges. The benefits derived from state organizations in northern states and the need of a combined effort to oppose the Bell, were considered sufficient reasons for organizing. Upon motion, it was decided to organize such an association of the Independent telephone interests.

J. F. Strickland of Waxahachie, president of the Southwestern Electrical and Gas Association, extended an invitation to the delegates to consolidate with his organization. The fact that the Bell company is entitled to membership in this organization was considered sufficient reason for the Independent people to maintain a separate association. Committees on credentials, constitution and by-laws and permanent organization were appointed by the chair. The committees retired and, while preparing reports, an interesting address was given by W. J. Maroney. The reports of committees were then read and adopted. The association then took up general business, and an enthusiastic meeting resulted. It was found that there was represented at the meeting over 14,000 miles of toll lines and more than 12,000 Independent telephones.

The executive committee was authorized by the association to prepare a map of the Independent lines throughout the state and secure data as to the number of telephones in operation. Those present were greatly encouraged at the prospects of united effort for mutual benefit, and many predicted for the Texas organization one of the strongest of the state associations. The meeting adjourned, after having passed a motion to hold the next meeting at Fort Worth within 60 days, the exact date to be fixed by the executive committee of the association.

After adjournment of the meeting the members were entertained by representatives of manufacturers located at Dallas. Following a dinner at the Oriental Hotel, the members in a body attended the opera house, and later on, through the courtesy of C. W. Hobson, of the Duncan-Hobson Electric Company, were entertained at the Elks' Club.

## GENERAL TELEPHONE NEWS.

C. O. Wood has submitted an offer to the city of Chanute, Kan., to sell the local telephone plant to the city for $60,000.

A telephone bill which will be introduced at Albany, N. Y., and which is intended to give relief to York city, has been prepared. The bill provides for a uniform rate between the various boroughs—that is, that the rate for one borough shall be the rate for all. It is said that the telephone interests are inclined to accept a measure of this kind as a compromise.

The Independent Telephone Company, which has applied for a franchise at Winnipeg, Man., proposed to put in a system capable of supplying 10,000 telephones. All its wires will be placed underground. Charles Webster of Minneapolis, T. A. Potter of Britt, Iowa, C. A. Cosgrove of Minneapolis, A. T. Averin of Cedar Falls, Iowa, and W. Hastings and F. A. Hubbard are the promoters.

A mailing card from the Inter-Ocean Telephone and Telegraph Company of Buffalo, N. Y., contains a map showing the territory covered by its lines in New York. The card bears the statement that the company is serving over 75,000 subscribers in Western New York and that over 60.000 subscribers not connected with the Bell company can be reached in Western New York by Independent lines. Eastern connections are nearing completion.

The West Orange (N. J.) Town Council has passed on first reading an ordinance, the life of which will be 50 years, granting a franchise to operate in the town to the New York and New Jersey Telephone Company. The town and company have been unable to agree on the question of a limited franchise, and the affair has dragged on for more than three years. It is believed that the ordinance will go through now without further hitch.

# CORRESPONDENCE.

## Great Britain.

London, January 14.—The two events of the week have been the arrangement come to by the postoffice with the Marconi Wireless Telegraph Company for the acceptance of space-telegraph messages at any postoffice to ships at sea, and a rumor that a settlement had been come to with the National Telephone Company as to the sale of the latter's undertaking. The details of the former are as follows: The postmaster-general in an official announcement states that he has made provisional arrangements with the Marconi International Marine Communication Company for the acceptance at telegraph offices in the United Kingdom of prepaid messages for transmission from wireless stations on the coast to ships at sea. The charge is 6½d per word, the minimum charge to be 6s. 6d. It appears that a certain number of Atlantic steamers fitted with Marconi apparatus have been brought into the arrangement by the Marconi company and a list of these for each month is available at all postoffices. A schedule of tunes has also been prepared when these ships pass various wireless stations on the coast along their route, but inasmuch as telegrams are accepted at all times the risk of their delivery rests with the sender. This arrangement is no doubt the important agreement which, it was announced at the last annual meeting of the Marconi company, was almost completed between the postoffice and the company. On all hands here the action of the postoffice is favorably criticised. Mr. Marconi is reported to have stated that 30 words per minute can now be transmitted by his system and also that his company will shortly declare a dividend.

Concerning the purchase of the undertaking of the National Telephone Company, it may be remembered that it has been repeatedly pointed out in these notes that the postmaster-general has pledged himself not to enter into any binding agreement before submitting the matter to Parliament. However, on Friday a rumor became current on the Stock Exchange that a sale had been virtually arrived at, with the natural result upon the shares of the company. The deferred stock, which is entitled to the surplus earnings of the company after fixed rates of interest or dividends have been paid upon prior securities, are regarded as the speculative mediums of the company's stock, and these rose 11 points. There was no confirmation of the rumor, and the following day half the rise had disappeared. The postmaster-general immediately afterward issued an official denial to the purchase rumor. But that it was no mere supposition may possibly be gathered from the following extract from the official denial: "The negotiations between the government and the company are not yet concluded, and in any case no announcement on the subject will be made until Parliament meets." The question that the general public has to consider is, in view of the fact that as the government lost the right of compulsory purchase by not giving the company notice six months ago, Will a sale by agreement or upon arbitration terms tend to enhance the value of the undertaking?

As was anticipated at the time notices were given of intention to promote private bills in Parliament in the coming session, the numerous proposals by companies to seek power to supply electricity all over London have called forth spirited and prompt action on the part of the borough councils. This is not surprising when it is stated that with but very few exceptions all the London borough councils have electricity works of their own. There are no less than eight proposals by big companies to supply electrical energy in London either in bulk or else to distribute it to individual consumers. Most of the schemes take in portions only of London, but one comprises absolutely the whole county of London—a huge area—and pieces of neighboring counties. Thus, if all the bills were sanctioned—an impossible thing—there would be several companies in competition over districts already served by municipal works. The effect of this upon these undertakings may well be imagined, even if only a few of the proposals are sanctioned, and a conference has been called by the borough councils to determine a common course of action against all bills. An executive committee is to be appointed to conduct a joint opposition, and in this way much expense will be saved.

Another important matter which is to be discussed at the conference is the advisability of formulating a municipal scheme for a large generating station in the most favorable position in London for supplying electricity in bulk to existing electricity undertakings. This is interesting, in view of a proposal made by the London County Council a few years ago to seek similar powers, a proposal which was abandoned on the advice of the Board of Trade that a general improvement in the electrical legislation of the country was about to take place. Now that two abortive efforts have been made to bring about this promised improvement, it remains to be seen whether the London County Council or any other body will ask for special powers of this sort in connection with the purchase of the London electric-supply companies' undertakings. The conference above referred to may prepare the ground for such action.

The lighthouse at St. Katherine's Point, at the Needles, Isle of Wight, has just been fitted with an electric beacon of 15,000,000 candlepower, five times as powerful as the one displaced. It is stated that in clear atmosphere the light is visible from the French coast, nearly 50 miles away. The revolving portion of the arrangement floats in mercury, of which there are 816 pounds, the rotation being maintained by a clockwork mechanism. A point of interest is that no addition has been made to the generating plant, which was put in 17 years ago, and consequently quite out of date compared with present-day types. The new light was erected by a Birmingham firm.

The Underground Electric Railways Company of London has just closed a contract with the Hiram Maxim Electrical and Engineering Company for arc lamps for its various stations. They are to be 500-volt direct-current traction-circuit lamps, burning five in series, but so fitted that any lamp may be examined or trimmed without switching off the current from the other four. The full length of the lamps is to be only 28 inches.

At last an absolutely final decision has been come to by the Dublin corporation with regard to its electricity works. It will be remembered that in consequence of certain unflattering criticisms passed upon the new three-phase works at the Pigeon House Fort, the consulting engineer made a sporting offer to acquire the works and run them upon a certain basis, which would have relieved the corporation of all responsibility. That happened as far back as August, 1904. It has now been definitely decided to retain the undertaking in the hands of the council. This was the unanimous opinion of a special committee, which was ratified by the corporation. G.

## New York.

New York, January 21.—Nothing really new has developed as to the city-lighting problem. The evidence given last week by Mr. Ellicott of Chicago has occasioned much newspaper comment and amateurs and professionals have alike written much to prove or disprove both sides of the case. Controller Grout still hopes to force the Edison company to reveal details of the cost of supplying the public lamps, and Mayor McClellan has gone over a little farther in favor of a municipal plant, with a suggestion that gas lighting should be done away with entirely. This is regarded as an answer to the allegations in the Hearst newspapers that the mayor is interested in the local gas corporations. It is found also that in a bill now up at Albany regarding water supply a clause is inserted which might be construed to mean that the city can sell electric current to private consumers from energy generated by waterpower.

Subway trains commenced to run between Brooklyn Bridge and Fulton Street at midnight last Sunday. The authorities have taken a firm stand with regard to advertisements in the new section of the subway, and on Thursday used force to remove certain slot machines which the Interborough company had allowed to be placed at Fulton Street.

The Pennsylvania railroad is making rapid progress on its tunnel and terminal construction. The main power house for the undertaking will be in Long Island City, and there is to be a large substation on Thirty-first Street, Manhattan, just south of the terminal.

It is announced that the board of directors of the Hudson Companies, which concern has acquired the Hudson River tunnel franchises, now includes William Barclay Parsons. Five of the directors are also directors of the Interborough Rapid Transit Company.

Current for 440 incandescent lamps and for motors aggregating 60 horsepower is to be supplied to the new Christ Church, now building on West Thirty-sixth Street.

The Wilson Line of steamships has decided to abandon its private lighting plant at its piers on the North River and to take current from the local Edison mains.

George F. Hammond's private yacht, Aztec, has been kept in commission during the winter in the East River. The lighting circuits have been temporarily switched off from the ship's engines, and connected with the mains of the Edison company.

M. K. Macdonald and associates have incorporated the Brooklyn Telegraph and Messenger Company with a capital of $100,000.

The town of Hempstead, L. I., has spent nearly $3,000 in regard to injunctions, to restrain the Queens Borough Electric Company from erecting poles and wires in its borders.

The January bulletin of the New York Edison Company contains a portrait of George Simon Ohm, with a brief biography.

The State River Improvement Commission is considering the possibility of utilizing water energy, equivalent to 240,000 horsepower, now going to waste in the Adirondacks. D. W. W.

## New England.

Boston, January 21.—One of the big deals which the New York, New Haven and Hartford Railroad Company occasionally brings about in the electric-railway field was concluded at New Haven, Conn., last Wednesday. The Consolidated Street Railway Company, which is controlled by the steam-railroad corporation, absorbed the Berkshire Street Railway Company, as far as acquiring control of it is concerned. The Berkshire operates between Great Barrington and Cheshire, a distance of 30 miles.

The Randolph and Stoughton Street Railway Company suffered loss by fire on January 12th of its car barn and rolling stock valued at $8,000.

The new Nahant street-railway company, replacing the one in which Senator Lodge was named as one of the incorporators, has provisionally organized, with the following-named directors: Walter H. Southwick, Edward E. Strout, James A. Carahar, Charles Cabot Johnson, Eugene H. Brann, Nahant; Clifton Colburn, George E. Belonga, Lynn. The capital will be $50,000. B.

## Dominion of Canada.

Ottawa, Ont., January 21.—It is stated that Charles D. Haines of New York, who has undertaken the building of the Hamilton, Ancaster and Brantford electric railway, also intends to promote lines to Guelph and Galt, Ont. He has a route laid out that overcomes the heavy grades and reduces the cost of construction.

At the annual meeting of the Toronto Electric Street Railway Company all the old directors and officers were re-elected. The financial statement of the company gave the total receipts for the year as $2,444,534, an increase of $272,000. The expenditure on capital account was $218,779. Net earnings were $1,020,354, out of which four quarterly dividends of 1¾ per cent. were paid. The surplus for the year amounts to over $218,000.

The Canada Middlesex railway of Ontario, which is applying to the Dominion Parliament for a charter, is to be an electric road, and it has several strong financial men back of the enterprise. The four principal cities on the route are St. Catherines, Brantford, Woodstock and London.

The Canadian Pacific Railway Company has decided on the establishment of its own power plant to supply all the power and electric lighting in all its new shops. Its electrical experts have reported that the power could be obtained at less cost than if purchased from any local power concern. On the other hand, the Grand Trunk experts found that power could be got cheaper from such concerns.

R. J. Fleming, the new general manager of the Toronto street railway, will visit the important street-railway centers of the United States, with a view to getting ideas regarding the latest and most improved types of street cars, brakes, fenders and other street-railway appliances. These, so far as practicable, will be incorporated into the new cars to be constructed for use in Toronto, and also on the Winnipeg street railway.

Reginald Aubrey Fessenden, a distinguished Canadian electrical engineer, who has won considerable success in the United States and who is at present residing in Washington, D. C., has been appointed to the municipal power commission of the province of Ontario. He takes the place of Mr. Ross of Montreal, who has retired in consequence of his firm having been given the contract to report on the scheme. Messrs. Ross and Holgate of Montreal have been entrusted with the detailed engineering inquiry.

The Montreal Light, Heat and Power Company, which has just closed with the towns of Verdun and Outremont new contracts for the supply of electric energy, now has exclusive franchises for at least 20 years with all the towns using gas and electricity for lighting purposes on or around the island of Montreal, with the exception of Westmount. It is largely the result, it is said, of these exclusive franchises that the company looks to securing a new franchise from the city of Montreal. The basis for nearly all the contracts is the same, allowing the towns to take electric light at $75 per lamp per year upon their agreeing to take the same kind of lamp as now used in Montreal. The company, it is announced, has also closed a long-term contract with the Grand Trunk railway to supply all the power and light required in that railway company's different shops and buildings. W.

## Southeastern States.

Charlotte, N. C., January 21.—Construction on an electric freight railway will soon be begun from Asheville, N. C., into the mining districts of Yancey and Madison counties by the George D. Mills Company. The road will be 50 miles in length and will serve as an outlet to a number of mines in the mountains of the western section of the state.

W. T. Thompkins of the American De Forest Wireless Telegraph Company visited Charleston, S. C., recently, with a view to establishing a plant in that city.

The Consolidated Railway, Light and Power Company of Wilmington, N. C., will soon install a new steam turbine to take care of its rapidly increasing business.

The Atlanta-Marietta (Ga.) electric railway, which has been under process of construction for a year, is now nearing completion.

The Citizens' Rapid Transit Company of Richmond, Va., has deposited the required $5,000 in bonds as security to guarantee the construction of its electric lines within a year.

Holders of certificates to the amount of $200,000 have asked for the appointment of receivers for the Bay Shore railroad of Norfolk, Va., which is now in charge of a special master. The application was

made by Messrs. Wright, Snyder and associates of Philadelphia.

A conference was held recently at Washington, D. C., upon the question of the manner in which electric lighting wires shall be carried into houses and about the making of open cuts in certain months. The conference was attended by the commissioners and representatives of several lighting companies in the city. The meeting reached no definite conclusion and the matter may be tested in the courts.

O. H. Sheffield of Atlanta is in charge of the erection of the power plant on the Savannah River near Elberton, Ga., and has already contracted to furnish power to a number of manufacturing plants in Elberton.

It is said that the Savannah Lumber Company will enter the field and offer electric light and power in the city of Savannah, Ga. The company will erect a plant, but will not for the present at least enter into competition for the municipal lighting. Lawrence McNeill, J. J. Cummings and others are said to be behind the enterprise.

The Charleston-Summerville (S. C.) Electric Railway Company is getting into shape to begin work. The company has already been given a franchise to run through certain streets of Charleston.

It is stated that the R. B. Fentress Company, which has been endeavoring to secure a franchise in Norfolk, Va., to erect a lighting and heating plant, will not give up the fight to secure the desired rights, but will likely make the attempt again along other lines. L.

## Ohio.

Cleveland, January 21.—As a result of the placing of the Appleyard lines in the hands of a receiver it is said that the Elkins-Widener syndicate of Philadelphia is formulating plans to take over the entire system and with them complete through lines between Cleveland and Cincinnati and Toledo and Cincinnati. The lease of the Cincinnati, Dayton and Toledo and possession of the Appleyard roads would give the big syndicate lines from Cincinnati to Columbus and Urbana. The Tucker-Anthony syndicate owns the roads from Columbus to Zanesville and has worked in harmony with the Appleyard people, so it is reasonable to suppose a working arrangement could be made to use this line as a part of the system. Between Zanesville and New Philadelphia there is a gap to be filled. The Tucker-Anthony line between New Philadelphia and Navarre connects with the Canton-Akron line, also owned by them. This would give an entrance to Akron and from there the Northern Ohio runs into Cleveland. On the other side of the state the Cincinnati, Dayton and Toledo, Dayton and Troy, Western Ohio and Toledo, Bowling Green and Southern, with a gap to be filled between Lima and Findlay tells the story. The receivership of the syndicate roads was extended this week to cover the Columbus, Grove City and Southwestern with the same men for receivers.

President W. Kelsey Schoepf of the Cincinnati Traction Company, in reply to complaints of a delegation of the Central Labor Council to the mayor, said that the company is running 50 per cent. more cars than the old roads, although travel had increased but 18 per cent.; that $3,000,000 had been spent in improvements, whereas the lease required but $2,000,000. He further said the generating stations are all being enlarged and that 50 more large cars are almost ready for delivery. In fact a few of them have now been put in service. Mr. Schoepf did not agree with the committee that a central power station would be more economical than the improved generating stations that will be ready for use unless such a station could be located on the river front, where coal and water could be secured at less expense.

Mayor Finch of Toledo, in his annual message to the City Council, recommended that no street-railway franchise be passed without being submitted to a vote of the people and that the lighting contract be made for a short term with a view to the establishment of a municipal plant.

The Lima, Findlay and Toledo Railway Company of Lima has been incorporated with a capital stock of $700,000 for the purpose of constructing an electric line from Lima to Findlay, a distance of 31 miles. Frank Butler, E. Sanburn, J. H. Griswold, C. L. Stocker and N. S. Harris are the incorporators.

There is considerable speculation regarding the Cleveland, Wooster, Mt. Vernon and Columbus Railway Company, which was incorporated for the purpose of building a road from Wooster to Columbus, a distance of 105 miles. At Wooster it will connect with the Cleveland and Southwestern. A branch 12 miles long will connect with Mansfield. F. W. Jones is president.

John Kumler and associates have incorporated the Ottawa Park Street Railway Company at Toledo, with a capital stock of $10,000, to build an electric line from the city limits to Ottawa Park. The commissioners granted a franchise for this road a week ago.

The Gillen Electric Company of Cleveland has been incorporated with a capital stock of $10,000 by E. J. Gillen, S. H. Gillen and others.

Henry A. Everett has been chosen as a member of the board of directors of the Lake Shore Electric Railway Company. This is the only change made in the directorate.

The Hamilton Gas and Electric Company of Hamilton has given a mortgage to the Union Savings Bank and Trust Company of Cincinnati for $[illegible],000, to secure an issue of bonds. Preceding this transaction the Hamilton Otto Cooke Company mortgaged its plant to the Hamilton Gas and Electric Company for $[illegible],000.

It is reported that the bond issue of $[illegible],000 of the Cincinnati, Columbus and Toledo Traction Company has all been subscribed.

Three-cent-fare cars were put on the Cleveland lines Monday morning, labeled "3-cent fare, No Transfer" on both ends in large letters. There were 13 or 14 of them, but the patronage was not what has been predicted by Mayor Johnson. If the patronage is not greater it is not probable that the cars will be kept on any great length of time, as they are quite an additional expense.

The Barberton, Wadsworth and Western Traction Company of Barberton has been incorporated to build an electric line from Barberton to Creston. Byron M. Clendenning of Cincinnati and George H. Heffner of Celina are promoting the enterprise. The distance is 18 miles and the road will connect the Northern Ohio and the Cleveland and Southwestern at Seville.

The lease of the Toledo, Bowling Green and Southern property to the Toledo Urban and Interurban Railway Company has been filed for record at Toledo.

W. G. Hanford and W. H. Halloway of Springfield are planning an electric road from Springfield to Lima, by way of Marysville and Kenton.

J. H. Fannegan, who has an invention for operating cars by means of magnets, was in Columbus a few days ago, endeavoring to interest business men in the proposition to develop it. He is a resident of Chicago.

Henry A. Everett denies that the Everett-Moore syndicate is in any way interested in the plan to build a road from Toledo to Cincinnati, which is now being projected by the Toledo, Columbus and Cincinnati Traction Company.

Net earnings of the Toledo Railways and Light Company for 1904 were $329,749.93, in comparison with $319,067.47 the year before. The operating expenses increased, while a good sum was spent for improvements.

The Electric Supply Company of Massillon has been incorporated with a capital stock of $10,000 by F. F. Flickinger, R. S. Hardgrove and others.

The Western Ohio, with its connections, together with the Indianapolis and Eastern, has established a through service between Dayton and Indianapolis, running three trains a day each way. A Holland sleeper was also put into service. The distance is 108 miles and the schedule has been fixed at four hours and 50 minutes. O. M. C.

## Indiana.

Indianapolis, January 21.—At the annual meeting of the stockholders of the Indianapolis and Northwestern Traction Company on January 18th directors were elected who subsequently elected the following-named officers: President, George Townsend; vice-president, Philip Saltzonstall; secretary-treasurer, Chauncy Eldridge.

A new traction line is projected to be built between Greentown and Hobbs by way of Windfall, connecting the lines of the Union Traction Company at Hobbs and the Kokomo and Marion lines at Greentown.

In consideration of right-of-way, etc., the Indianapolis, Greenwood and Columbus agreed to stop its cars at designated crossings in the country, but in order to make better time cut out many of its stops. The farmers sued to have the contracts enforced and the state Supreme Court holds that the contracts must be carried out.

The steam railroads are opposing the enactment of a railroad commission law in Indiana by the present Legislature. They object to the provision that steam roads shall interchange traffic with electric lines. They claim that the time is not ripe for such agreements between steam and electric lines.

Two bills have been introduced on the subject of gratuitous transportation. One bill makes it unlawful for public officials to accept of railroad passes on steam or interurban roads and the other makes it unlawful for railroad officials to offer or to give passes to an official.

A. E. Wiest, general manager of the Huntington and Columbia City traction line, is asking for a subsidy of $17,000 from Turkey Creek and Syracuse townships in Kosciusko County in aid of the line which it is proposed to build through those townships to Wawasee.

The old power plant of the Terre Haute Traction and Power Company was wrecked by fire yesterday, entailing a loss of nearly $100,000. The street cars and many industries depending on it for power were stopped and a portion of the city is in darkness. Horse cars were put on but proved poor substitutes. The fire originated in the boiler room and the dynamos and engines were badly damaged. A new power plant is nearly completed, designed more particularly for the interurban service. Through this the company will light the city, but it will be some days before it can be put in operation. The heavy loss was almost entirely due to the use of five-inch flooring under the switchboard and generators, for when this flooring caught fire the flames quickly enveloped the costly apparatus. Added to the loss

[illegible]

The injunction suit against the Jeffersonville Belt

[illegible]

some time.

[illegible]

and Wabash Valley Traction Company to light the city with electricity. The company proposes to light the city cheaper than is now being done by the municipal plant.

Five bills relating to the regulation of automobiles have already been "smothered" by the legislative committee on roads. One bill, however, remains and will probably be reported on favorably. This bill is a medium between some of the now drastic measures introduced and the milder ones and provides against accidents and offensive management. S. S.

## Michigan.

Detroit, January 21.—The American Carbolite Company has begun operations at Constantine, the power being furnished by the Constantine Electric Company, which company has secured an option for a dam in the St. Joseph River at Mortville.

The L. E. Myers Company of Chicago has been awarded the contract for building the new electric line from Lansing to Pine Lake. The road must be completed before January 1, 1906. Contracts for grading have been let and work is expected to commence February 1st. After the line leaves the Agricultural College, it will be constructed on private right-of-way. The line may later be extended to Park Lake and Bath.

The Detroit United Railways is increasing the size of its power house to accommodate a 2,000-horsepower unit, including a generator, engines, boilers, condensers, etc., which it has contracted for, to take care of the heavy business at the rush hours of traffic. The company has also purchased 50 new double-truck cars, 25 of which will be built by the Brill company and 25 by the St. Louis Car Company. It is estimated that the total improvements now being made on power house and cars will amount to about $400,000.

The city of Flint is agitating the question of discontinuing lighting the streets by arches suspending incandescent lamps over the streets, and of adopting the tower system.

The Detroit, Monroe and Toledo Short Line electric road has put on a new time card from Detroit to Toledo, which will cut down the running time 30 minutes. Heretofore the time was three hours. The new time of two hours and a half will equal that of the steam roads.

The M. B. Wheeler Company of Grand Rapids has asked for a 30-year franchise to supply that town with electricity. Underground conduits and a low charge for lights are promised. This company expects to dam the White River in Blue Lake Township, 14 miles north of Muskegon, and build a power house which will furnish all nearby towns with power.

Last week the southern portion of this state was visited by a very severe sleet and ice storm which played havoc with electric wires of all kinds. At Ionia a number of wires in front of the opera house became entangled with ice, and the high-voltage current produced a brilliant illumination, nearly causing a panic in the opera house, in which a play was in progress. C. G. W.

## Northwestern States.

Minneapolis, January 21.—D. L. Aiken and others propose to organize another electric-lighting company at La Crosse, Wis., to furnish lighting for North La Crosse and Onalaska. The company has applied for a franchise at Onalaska.

The new paper mill at Kimberly, Wis., will be provided with an electric plant that will cost nearly $100,000. Three-phase alternating current will be used and the plant will be installed by H. N. Nold of Philadelphia, who will be in permanent charge. Forty motors of from 7½ to 300 horsepower will be used, the waterpower to be supplemented by Diesel engines.

The St. Paul City Railway Company has refused to pay a five-per cent. gross-earnings tax or to tunnel the Selby Avenue hill, both of which demands had been made by the City Council. It has, however, agreed to make numerous extensions of its lines, including a third interurban line to Minneapolis.

The Light, Heat and Power Company of St. Cloud, Minn., has amended its articles of incorporation, changing the name to the Public Service Company and fixing the capital at $300,000.

The Des Moines (Iowa) City Railway Company has under consideration plans for the building of a second power plant with a capacity sufficient to operate practically its entire system. Its lines will also be considerably extended during the year.

The Minnesota Power and Trolley Company has

announced that it will advertise for bids shortly for the construction of a power dam across the Mississippi River at Elk River, Minn.

The deal has been consummated whereby the Deadwood and Lead (S. D.) electric-light companies are to be consolidated. J. J. Henry of Denver, Colo., is the principal promoter.

The Vinton-Belle Plaine Interurban Railway Company has been voted a franchise at Vinton, Iowa.

H. W. Spaulding and others are talking of forming an electric-railway company to construct several trolley lines out of Grinnell, Iowa. R.

## Pacific Slope.

San Francisco, January 20.—The United Railroads Company, which is at work transforming the steam railroad to the Cliff House into an electric line, is considering the advisability of changing the Sutter Street line from a cable to an electric line, and an underground trolley system is talked of.

The well-known railroad contractors, Erickson & Peterson, have gone to Portland, Ore., to supervise the construction of an electric road from Hillsboro to Portland. The road will be of standard gauge and equipped with modern trolley cars and apparatus.

H. H. Noble and E. V. D. Johnson of the Northern California Power Company have taken an option on the holdings of the Anderson Water Company at Anderson, Cal. If the property is purchased a large electric pumping plant will be installed.

The Seattle-Tacoma Power Company, formerly the Snoqualmie Light and Power Company, has applied to the board of public works of Seattle, Wash., for permission to erect poles and string wires in First Hill district. It is understood that the increase of the stock of the company to $500,000 is to be used in the extension of the light and power system in Seattle.

The Oregon Railway and Navigation Company is to expend more than $100,000 in the installation of block signals in the immediate future on the line from Portland to Bonneville and from La Grande to Cayuse, Ore. It is reported that all the Harriman lines are to install the block system as fast as possible.

The farmers in the vicinity of Pomona, Cal., have appointed a committee consisting of J. E. Adamson, H. J. Nichols, W. A. Lewis and G. P. Robinson to investigate the feasibility of establishing a big central electric power plant to furnish current for the many small pumping plants in the vicinity. If the plan goes through the power will be used for other purposes also.

The Sutter Street Improvement Club of San Francisco has passed a resolution favoring the changing of the cable railway on Sutter Street into an underground electric road.

A new corporation organized under the laws of New Jersey and known as the Interurban Railway Company is to equip and operate an electric railway to run east from State Street in Santa Barbara, Cal.; thence to Summerland, Carpenteria, Ventura and eventually to reach Los Angeles. The capital is $250,000. John B. Miller, F. E. Miller and A. L. Selig are the incorporators.

The Pacific Electric Railway Company of Los Angeles, Cal., has begun the construction of an air line from Los Angeles to Alamitos Bay by way of the Willows. A double track of heavy rails is to be built direct to the bay.

The trustees of Suisun, Cal., have passed an ordinance granting a franchise to Leonard Prior to construct, operate and maintain an electric-light and power system in Suisun.

Green & O'Brien of San Francisco contemplate building an electric railway in Eureka, Cal., and suburban roads to Arcata and Ferndale. A petition is to be presented to the council of Eureka on February 17th.

Thomas H. Day's Sons are preparing to install a complete system of electric wiring in the building being constructed for Christian Froelich at First and Natoma Streets, San Francisco.

The Von Emon Electric Elevator Company has just finished the installation of a number of electric freight elevators for Getz Bros. & Co. at Sacramento and Davis Streets, San Francisco.

The Siskiyou Electric Power Company has absorbed the interests of the Keplar Electric Light Company at Etna, Cal., and is now supplying power from the Fall Creek power house. A.

## PERSONAL.

William R. King of New York city is now associated with Sanderson & Porter of the same place, who carry on a general practice as consulting engineers and contractors.

J. H. Sanders, president of the Central Construction Company of Oshkosh, Wis., was elected president of the Wisconsin Electrical Contractors' Association at the convention held in Milwaukee last week.

Mr. H. C. Abell, a business associate of Mr. Henry L. Doherty, has accepted the appointment of "Wrinkle" editor for the Denver-Colorado Springs convention of the National Electric Light Association. Mr. Abell has discovered a great many wrinkles in connection with central-station operation, and knows where to learn of a great many more. It is hoped that all hands will lend their aid to make the "Wrinkle" department the greatest possible success.

Mr. Max Loewenthal, secretary of the Prometheus Electric Company, New York, was awarded a medal from the International Jury of Awards of the St. Louis Exposition for his personal contribution to the art of electric heating.

Mrs. A. McElroy Brett, general manager and contractor, and George B. Ellison, general superintendent and chief engineer, of the Southern Independent Telephone Company of El Paso, Texas, are in Chicago on business for their company. They look for a great future for the telephone industry in El Paso.

Edward Van Winkle of New York city announces that he will continue the engineering business of Pratt & Van Winkle, but in new offices in the Flatiron Building. Charles R. Pratt, Mr. Van Winkle's former partner, has retired from active engineering practice and will devote all his energies to the interests of the elevator safety company which bears his name.

The Philadelphia employes of the Western Union Telegraph Company, aided by the executive department, recently presented Col. Joseph Greene a handsome gold-headed cane, the occasion being Mr. Greene's seventy-second birthday. Mr. Greene is employed by the Western Union and is said to be one of the oldest telegraph operators in the country. He was private operator for General Grant during the Civil War.

The death of Robert E. Winn, assistant superintendent of the Western Union Telegraph Company for the New England district, occurred at Dallas, Texas, on December 13th. Mr. Winn came to Boston from St. Louis, where he had served 12 years as chief clerk in the office of the superintendent of the Western Union company for the Missouri district. He was a great favorite with the members of his profession, and the news of his death cast a gloom over the telegraph fraternity of New England.

A surgical operation was performed on Thomas A. Edison on Monday last for a mastoid abscess behind the ear. The operation, which is reported to have been completely successful, was performed at the inventor's home in Llewellyn Park. While Mr. Edison's general health has been good, the growth did not yield to treatment, and for a week before the operation caused the distinguished inventor much suffering. Everything points to a speedy recovery of the patient. He is reported to be in good spirits and in no pain, and his greatest worry seem to be that he is not permitted to read the papers about the situation in Russia.

C. A. Moreno has tendered his resignation as engineer in chief of the United Railways Company of St. Louis, to take effect on February 1st. Mr. Moreno has taken a half interest in the Bambrick-Bates Construction Company. It is said that Richard McCulloch, assistant general manager of the United Railways, will assume the duties of chief engineer, at least for the time being. In connection with the management of the United Railways Company, as reported in a St. Louis daily newspaper, it is claimed by intimate friends of Capt. Robert McCulloch, general manager, that the latter intends soon to resign from that position. Captain McCulloch assumed the management of the United Railways Company, then the St. Louis Transit Company, about the first of April, 1904, and immediately proceeded to reorganize the service for the World's Fair period.

## ELECTRIC LIGHTING.

The Bronson Light and Telephone Company has engaged in business at Bronson, Kan.

J. I. Linter will establish an electric-light plant in Waynesboro, Ga., where he has received the contract for lighting the city.

The Board of Aldermen of Sturgeon, Mo., has ordered a special election to be held February 6th, to vote on bonding the city for installing an electric-light plant.

Officials of Chestertown, Md., are said to have awarded a 40-year franchise to D. S. Pindell of Sault Ste. Marie, Mich., to erect and operate an electric-light plant in the town.

An ordinance has been applied for by F. W. Potter to erect, maintain and operate an electric-light and power plant in the city of Fort Worth, Texas. The matter has been referred to the street and alley committee.

All of the property of the General Gas, Electric and Power Company of Connersville, Ind., consisting of real estate, buildings and equipments of coal gas, electric plant, central station, hot-water heating plant, franchise, etc., will be offered for public sale by the receiver on March 9th.

A neat little folder from the office of the Edison Electric Illuminating Company of Brooklyn calls attention to the fact that the retail rates for electric lighting were reduced on January 1st. Incidentally, the folder presents some strong facts in favor of electric lighting and electric advertising, intended to convince merchants.

R. H. Berry of Lincoln, Mo., is reported as organizing a company to establish an electric-light plant at Prior Creek, I. T.

The city of Anadarko, Okla., will receive bids for an electric-light plant, to be according to plans and specifications now on file in the city clerk's office. Bids are to be opened in open council on January 30th.

Rochester, N. Y., is the headquarters of the newly incorporated Eastern Monroe Electric Light and Gas Company, which has a capital of a quarter of a million dollars. The incorporators are Henry C. Brewster, Rochester; Andrew H. Brown, Penfield, and Walter A. Parce, Fairport.

The Compañía Eléctrica de Santiago, recently organized in Santiago, Cuba, with a capital stock of $300,000 and an authorized bond issue of $300,000 additional, expects to build immediately a plant to supply light and power to private consumers and later to construct a city and suburban electric railway. The plant will have three Babcock & Wilcox boilers of 500 horsepower, two 235-horsepower Buckeye engines, and General Electric generators. José Marimon is president, and Eduardo J. Chibas, vice-president and managing director. The company operates under a concession given by the president and secretary of government of the Republic and a charter given by the municipality of Santiago.

## ELECTRIC RAILWAYS.

The promoters of the Freeport-Dixon electric line have asked the City Council of Freeport, Ill., for a 20-year franchise to construct and maintain an electric railway for the transportation of freight, mail and express within the city of Freeport.

The South Side Elevated Railroad Company of Chicago has purchased from the St. Francis Xavier Female Academy the vacant property at the northeast corner of State and Twenty-ninth Streets. The purchaser will cut the property in two, using the rear part for additional track purposes.

The electric railway from Milwaukee to Racine and Kenosha, Wis., will be rebuilt next spring from South Milwaukee to Kenosha, it is said. The time of interurban cars from Milwaukee to Kenosha, 35 miles, is two hours, and this will be reduced a fourth, as the new survey will cut out nearly all curves.

The stockholders of the Douglas Street Railway Company, at a meeting recently held in Bisbee, Ariz., considered the matter of installing an electric street railway, covering all the principal thoroughfares of the Smelter City, and equipping it with modern electric cars. The contemplated improvements will cost $40,000.

The Philadelphia Rapid Transit Company has awarded the contract for the foundations for the West Philadelphia elevated line of its system, between the Schuylkill River and Forty-second Street. McGraw & Gray, who secured the contract, had previously been awarded a similar one for work between Forty-second and Sixty-third Streets, and from Sixty-third Street about a half-mile west to the terminus. Work on the previous contract has been under way for some time.

The Railway and Marine News of Seattle, Wash., says that the Seattle Electric Company has been prosperous during the last year, and that the company gives the public excellent car service. General Manager Grant's report shows that in 1904 the company carried 33,542,267 passengers, and the car mileage was 6,414,501. The revenue from passengers per car-mile is given at about 25 cents. During the year the company extended several of its lines and expended a large sum in improvements. Five new double-truck passenger cars, 12 freight cars and one coal car were added to the rolling stock.

Bids have been invited by the New Haven railroad for the construction of the four new tracks in the improvement of the line from New Rochelle to the Harlem River, New York. The improvement includes the electrification and the six-tracking of this line, the elimination of all grade crossings and the erection of roller lift bridges over the Bronx and Pelham rivers. This work is expected to be finished in about two years, six months or a year before the Pennsylvania tunnel through New York, with which it will connect. When both improvements are completed the necessity of transporting freight and passenger trains by water around New York will be in large measure removed.

The United States Circuit Court at St. Louis has decided that the Southern Electric Railway Company of St. Louis had a right to sell its property to the United Railways Company. The Southern Electric Company, the old Sixth Street line, extending to Carondelet, was absorbed by the United Railways Company under an act which became operative on July 19, 1899, the latter company absorbing numerous other lines about the same time. The suit to prevent the merger was filed in the Circuit Court July 12, 1900, and alleged that, as the consent of all the stockholders had not been obtained, the company had no right to sell. The matter has been in the courts ever since.

## POWER TRANSMISSION.

The United Railways and Electric Company of Baltimore, Md., is about to erect a power house in Highlandtown, a suburb. The building will be one story and basement, with two galleries, 29 by 124 feet. Construction will be of reinforced concrete throughout. Plans and specifications are by P. O. Keilholtz of Baltimore.

A bill has been introduced in Congress to grant to Charles H. Cornell the authority to construct, for power purposes, a dam across the Niobrara River on the Fort Niobrara Military Reservation, the property of the United States. The bill further grants him the authority and right to construct and operate a trolley or electric railroad with necessary side tracks; also telegraph and telephone lines upon the reservation.

## PUBLICATIONS.

The Technic, the organ of the Engineering Society of the University of Michigan, which has heretofore been issued as an annual, will this year consist of two numbers. The first will be published early in March and the second at commencement time in June.

Two price lists, No. 81 and No. 82, have been published by Pass & Seymour, Solvay, N. Y. The former covers tubes, cleats, ceiling buttons, etc., and the latter attachment plugs, sockets, shade holders, cut-outs, fuses, receptacles, rosettes, etc. Price lists Nos. 70 and 80 are withdrawn.

A folder from the Standard Vitrified Conduit Company of New York city illustrates some of the company's conduit and also a picture showing the process of installing it at the power house of the Niagara Falls Power Company. There is also shown the Manhattan third-rail insulator which is in use on many large third-rail systems.

The Central Construction Company of Oshkosh, Wis., is an extensive manufacturer of electrical signs and it has just issued a catalogue (No. 2) devoted to this class of apparatus. The signs are of the trough-letter type and the catalogue shows a few of the many styles manufactured. Twenty-one pictures of signs are shown, together with tables of sizes and prices.

W. N. Matthews & Brother of 603 Carleton Building, St. Louis, announce that they are working on a new 32-page catalogue devoted entirely to the Stombaugh guy anchor. It is to be the most attractive piece of literature that this enterprising firm has sent out. The firm expects to have it ready for distribution about March 1st. It should prove of much interest to those who have poles to anchor. It will be sent on request.

W. H. Anderson & Sons of Detroit, Mich., have issued a catalogue of their various construction implements, chief among which is an adjustable boom or derrick, mounted on a wagon, for lifting telephone and telegraph poles into place. The team may be attached to the rear of the wagon, the steering being done by one of the crew. Other articles listed in the catalogue are cable hangers, cable reels, cross-arms, pole steps, etc.

W. H. Schott, an engineer of Chicago, who is paying especial attention to the development of central-station heating plants, is sending out an appropriate calendar for 1905. The picture upon this calendar represents the interior of a model hot-water heating plant and is a view of an installation in Terre Haute, Ind. A two-column table is given also, one column being outside temperatures and the other the temperatures at which the circulating water should be kept for the corresponding outside temperatures.

Queen & Co. of Philadelphia have just issued a new circular, in which they describe the various instruments they make for resistance measurements; from the elaborate and complete Wheatstone bridges and rheostats of the Anthony and Kelvin type, to the small individual unmounted resistance coils. It is one of the most complete catalogues which have been issued on resistance measuring instruments. It also describes in detail the company's well-known Acme and Decade sets, and a considerable space is devoted to the description of the Queen portable cable-testing set. The catalogue is fully illustrated. It will be sent on request.

## SOCIETIES AND SCHOOLS.

The Illinois Society of Engineers and Surveyors held a three-day convention in the Sherman House, Chicago, beginning January 18th. Several papers were read, and Mr. S. S. Greeley, one of the old-time surveyors of Chicago, gave the opening address of welcome. The president was J. W. Alvord of Chicago. While in the city the engineers visited the system of the Illinois Tunnel Company and the plant of the Illinois Steel Company.

The membership committee of the National Electric Light Association is requesting superintendents of city schools to send in a list of educators in their districts, with a view to increasing the individual membership of the association from among the staff of professors of engineering, chemistry and physics.

The Armour Institute of Technology has recently established a four-year course in telephone engineering. The first class in this course started with the opening of the present winter term and consists of several third-year men. The telephone laboratory is completely equipped with telephone apparatus, many of the large manufacturing concerns having contributed a full line of apparatus for experimental uses. The course in telephony is also being given in the night school. This course is given mainly to the employes of the various telephone interests of the city. Lectures and laboratory work are given on alternate evenings, the course extending over a period of 10 weeks.

The annual dinner of the American Institute of Electrical Engineers promises to be a great success. President Lieb has appointed, as the committee of arrangements, T. C. Martin, chairman; W. C. Gotshall, L. B. Stillwell, H. G. Stott, Calvin W. Rice, F. C. Bates, H. W. Blake, P. G. Gossler, E. B. Katté, C. W. Price, W. A. Pearson and W. L. Conwell. Frank J. Sprague and Leo Daft are to speak for the Institute pioneers in the great field of electric traction. The banquet will be held in the grand ballroom of the Waldorf-Astoria, on February 8th, and it is expected that between 400 and 500 will be present, including many ladies. Tickets are $5 each, exclusive of wine. There will be exhibited, for the first time, the beautiful oil painting just presented by the British Institution of Electrical Engineers to the Institute, representing Dr. Gilbert making magnetic experiments before Queen Elizabeth. The bust of Professor Ferraris, also presented to the Institute last year, will be exhibited in the Astor Gallery reception room.

## TRADE NEWS.

The Century Electric Company of St. Louis will move on February 1st to 404 North Fourth Street, where it has secured larger and better quarters, made necessary by its increasing trade.

The branch office of the Columbia Incandescent Lamp Company at Memphis, Tenn., has been moved to new quarters, suite 362 Scimitar Building, and is in charge of Mr. George R. Newcomer, who is equipped to take the best care of the company's trade throughout the South.

Under the "chemical-exhaust" patents for incandescent-lamp manufacture the General Electric Company has secured injunctions against the Standard Incandescent Lamp Company. The Talmont Electric Engineering Company has made a license arrangement with the General Electric Company.

Patrick, Carter & Wilkins, manufacturers of annunciators, bells and other specialties in house-good supplies, will remove about January 15th to the northeast corner of Twenty-second and Wood Streets, Philadelphia. In the new factory the company will have nearly double the present floor space and better facilities for meeting its growing trade.

The annual meeting of the Prometheus Electric Company was held in New York city recently. The following officers were elected: President, D. T. Davis; vice-president, Dr. S. S. Wheeler; secretary, Max Loewenthal; treasurer, William B. Symmes, Jr. The directors elected to serve for one year are David T. Davis, Dr. S. S. Wheeler, William B. Symmes, Jr., F. S. Blackall and Max Loewenthal.

The American Electric Fuse Company of Chicago, which has factories at Chicago, Milwaukee and Adrian, Mich., will consolidate these plants at Muskegon, Mich., where three large buildings will be erected, and the company will continue its manufacture of electrical supplies and telephone apparatus. The decision to go to Muskegon was reached through negotiations with the Chamber of Commerce of that city, whereby the company receives a bonus of $25,000 upon the fulfilment of an agreement to occupy 5,000 feet of floor space and employ 400 men. The new factory will be occupied about July 1st.

The published statement of last year's business operations of the General Electrical Company of Berlin shows a marked improvement. The gross profits were $2,484,482, against $1,662,192 in the preceding year. The number of employes was 27,487. The company declared a dividend of nine per cent. and carried large amounts over to reserve funds and to payments to directors and to benevolent endowment funds for employes. The company has a turbine-manufacturing department which works on American designs and has also established a de-

[illegible] ger and freight traffic.

[illegible]

Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until February 3d for the electric [illegible] and clock wiring, etc., at the postoffice building, Atlantic City, N. J., in accordance with the drawings and specifications, copies of which may be had at the above address or at the office of the superintendent, Atlantic City.

The Wesco Supply Company of St. Louis has established a branch office and warehouse at Fort Worth, Texas, in order to meet the urgent demand of its southwestern trade for a nearer supply depot. This branch will be in charge of Mr. V. E. Raggio, heretofore sales manager for the company and formerly its traveling representative in Texas. The warehouse is located on the Texas and Pacific tracks at 319-321 West Fifteenth Street, directly opposite the Texas and Pacific freight house and in close proximity to the Union station, which central location will facilitate the prompt shipment of orders. It is the intention of the Wesco Supply Company to carry in stock at Fort Worth everything in the way of electrical equipment and supplies, including the products of its telephone factory in St. Louis.

The Stanley Electric Manufacturing Company of Pittsfield, Mass., and the General Incandescent Arc Light Company of New York have consolidated, and the business, after February 1st, will be carried on under the firm name of the Stanley G. I. Electric Manufacturing Company. The new concern will take over the manufacture and sales of the products of the two concerns, doing all the work in the Pittsfield shops. It is probable that W. Murray Crane will remain president of the new company, and the vice-presidents will be: First, C. C. Chesney; second, M. D. Barr; third, M. J. Insull. Messrs. Chesney and Barr were vice-presidents of the Stanley company, and Mr. Insull was an officer of the Arc-light company. R. S. Murray will be treasurer of the consolidated company. At present he is assistant treasurer of the Stanley company.

## BUSINESS.

Rossiter, MacGovern & Co. of New York have for sale three compound and four simple second-hand engines. These engines are guaranteed to be in the best of operating condition and are ready for immediate shipment. Full particulars will be furnished upon application to the company.

Mathias Klein & Sons of Chicago make the announcement that for the protection of their customers all the small tools, climbers, etc., which they manufacture are stamped with the firm name, M. Klein & Sons. Those desiring to buy the tools manufactured by this company should make sure that "M. Klein & Sons" is stamped thereon.

The Haller Machine Company, Chicago, maker of high-grade electric signs, announces that it is now prepared to handle all inquiries direct from its Chicago office. It has made several important changes in its sign construction, and its dimmers have been much improved, thus affording a substitute for flashers and similar devices intended to draw attention toward the signs.

The friends of E. J. Meisenheimer, who has been well known through his connection with the Allis-Chalmer Company's advertising department, will be interested to learn that Mr. Meisenheimer has severed his connection with that company to go into the printing business under the name of the Meisenheimer Printing Company, Milwuakee. Mr. Meisenheimer will doubtless command an excellent business, as not only has he expert knowledge as a printer but his extensive advertising experience will make his services in this direction doubly valuable.

The friends of Secretary L. T. Nolker of the Commercial Electrical Supply Company, St. Louis, will be interested to know that Mr. Nolker, who has been also for some time vice-president of the St. Louis Credit Agency Company (successor to the Engel & Foote Mercantile Agency Company), was recently elected to the presidency of that institution to succeed Mr. L. W. Engel, retiring. This agency, it is understood, has succeeded remarkably during the last year, and without doubt under Mr. Nolker's guidance as president will do even a better business.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued (United States Patent Office) January 17, 1905.*

780,024. Circuit Making and Breaking Relay. Frank Conrad, Edgewood Park, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed December 20, 1902.

An alternating-current circuit making and breaking relay comprises an electromagnet having an unsymmetrically located closed coil and a metal plate, the upper end of which is pivotally supported and the lower end of which projects into the field of the magnet. One edge of the

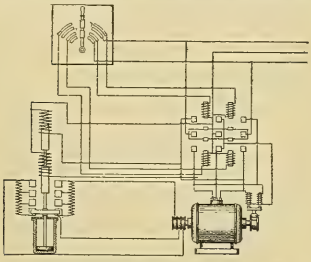
plate is provided with a contact piece, a stationary contact terminal located in the path of movement of the contact piece and an adjustable counterweight that serves to normally hold the plate and its contact piece in open-circuit position.

780,045. Single-phase Alternating-current Motor. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed May 3, 1904.

Means for equalizing the potential between commutator brushes of like polarity comprising inductive windings connected between the brushes, and leads from the middle points, which serve as the terminals of the armature winding, are the essential features of the invention.

780,046. Armature Winding for Electric Motors. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed May 3, 1904.

Leads connect the armature winding with the commutator bars and have such resistance that under normal running conditions of the motor the average of the currents induced in the short-circuited portions of the armature winding may be approximately 25 per cent. greater than the average of the currents supplied to the portions.



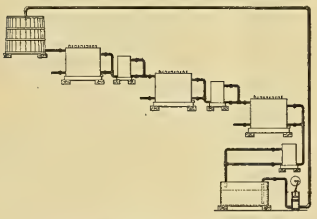
NO. 780,104.—CONTROLLER FOR ELEVATORS.

780,047. Electric Motor. Benjamin G. Lamme, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed June 30, 1904.

The motor possesses an armature, a commutator and resistance leads, which connect the several commutator bars to the corresponding armature coils, the leads being located in the armature slots and folded on themselves a sufficient number of times to obtain a definite resistance.

780,048. Single-phase Alternating-current System of Distribution. Paul M. Lincoln, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed May 3, 1904.

Combined with one or more translating devices and a source of alternating-current energy of higher voltage than that supplied to the devices, are a transformer winding having one terminal and an intermediate point connected to the source and having its other terminal and another intermediate point respectively connected to the terminals of the translating devices and means for regulating the voltage supplied to the translating devices.



NO. 780,191.—ELECTROCHEMICAL SEPARATOR.

780,055. Electrical Controlling Apparatus. Frank C. Newell, Wilkinsburg, Pa., assignor to the Westinghouse Air Brake Company, Pittsburg, Pa. Application filed May 5, 1902.

Several current collectors co-operating with a common collector rail have each an armature connection and means for varying the position of the collectors relative to the collector rail to shift connections and determine the direction of rotation of the armatures.

780,058. Controller for Electric Motors. Thomas S. Perkins, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed June 24, 1902.

A controller for electric motors comprises a main switch and a reversing switch, the main switch having its trolley finger located at an intermediate point between two sets of resistance fingers.

780,065. Electric Lamp. Elijah R. Roberts, Bellevue, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed December 15, 1900.

Combined with a glower and a heater of a lamp are means for cutting out a portion of the heater and leaving the remainder in series with the glower to serve as a ballast when the glower becomes conductive.

780,085. Dynamo-electric Machine. Bernard A. Behrend and William D. Pomeroy, Norwood, Ohio, assignors to the Bullock Electric Manufacturing Company. Application filed May 14, 1904.

In the revolving element of a dynamoelectric machine, which comprises a core and windings, are means for supporting the end turns or connections comprising an outside cover and clamping means within the end turns for holding them in fixed position against the outside cover.

780,087. Incandescent Electric-light Bulb. Martin C. Burt, Chicago, Ill. Application filed March 4, 1904.

A double incandescent electric-light bulb having a pair of vacuum chambers and independent filaments therein is described, the bulb having a continuous ventilating passage extending through both the chambers.

780,093. Telephone System. Alfred Ekström, Stockholm, Sweden, assignor to Aktiebolaget L. M. Ericsson & Co., Stockholm, Sweden. Application filed December 17, 1902.

Means connect the pole of the central battery not connected with the earth with a relay. When a plug is inserted in the jack, one branch or both branches of the line are connected during conversation through the relay with the pole of the battery. When in reposing position the telephone receiver hangs upon its switch hook, having a branch of the line connected with the earth. When the conversation is finished, the telephone receiver is placed upon its hook and the relay, which controls a signal system, becomes active.

780,104. Electric Controlling Apparatus. John D. Ihlder, Yonkers, N. Y., assignor to the Otis Elevator Company, East Orange, N. J. Application filed July 31, 1903.

In an electrical controlling system are controlling switches and apparatus, alternating-current magnets, each having a number of windings arranged to operate the switches and apparatus and means for supplying alternating current of different phase to each winding of the magnets. (See cut.)

780,117. Register. John O. Morris, Richmond, Va., assignor to the Every Fare Register Company, Richmond, Va. Application filed December 9, 1903.

An electric alarm circuit is periodically broken at stated intervals in the action of the register mechanism.

780,120. Electric-railway Signal. Elwood W. McGuire, Richmond, Ind. Application filed February 6, 1904.

The system comprises a subdivision of the rails into insulated blocks and a pair of insulated contact rails alined parallel to the track in each block. The contact rails of a given block are respectively connected to the opposing main rails of an adjacent block, the main rails of the given block being connected to respectively the pair of insulated contact rails of an adjacent block. The main rails of each block are connected in partial circuit with a source of electric supply which open circuit is adapted to be closed by the wheels of the locomotive.

780,142. Screening Mechanism. Robert H. Thorpe, Montclair, N. J. Application filed January 16, 1904.

A solenoid and plunger are arranged so as to move the screen in one direction, the return being accomplished by a spring.

780,164. Switch Mechanism. John W. Eskholme, Westfield, N. J., assignor to the C. & C. Electric Company. Application filed December 2, 1901.

An electromagnet is provided with an armature connected to the switch adapted to throw the switch and to be restored to a position ready to be again operated on by the magnet. Means automatically open the energizing circuit before the switch has completed its throw.

780,187. Combined Starting and Breaking Device for Electric Motors. Arthur Hultqvist, Gothenburg, Sweden. Application filed June 9, 1904.

In combination with an electric motor are a starting device, means for locking the movable member of the starting device in operative position and means for automatically returning the movable member into zero position. Switches in the motor circuit are adapted to be operated by the movable member so as to change the motor connections. Other means connect the starting resistance in the motor circuit simultaneously with the changing of the motor connections.

780,191. Electrochemical Separation of Metals. Woolsey M. Johnson, Hartford, Conn. Application filed June 23, 1902.

Electrical separation of metals includes the immersing of an electrode in an acid solution of ferrous ammonium chloride, subjecting it to electrolytic action and depositing upon another electrode. The electrolytic solution is from time to time subjected to a cementation process. (See cut.)

780,194. Sheath for Trolley Wheels. Santos Jurado, New York, N. Y., assignor to William Fechtenburg & Co., New York, N. Y. Application filed March 25, 1904.

Details are described.

780,221. Electric Igniter. James W. Packard, Warren, Ohio, assignor to the Packard Motor Car Company, Detroit, Mich. Application filed January 10, 1903.

An electric igniter for explosive engines embodies a generator, a spiral cam having a transversely adjustable extension at its rear end, the extension having one end inclined to the axis of the cam, and a spring-pressed member bearing upon the cam and operatively connected to the movable member of the generator.

780,222. Electric-lighting System. Granville E. Palmer, Boston, Mass. Application filed June 1, 1903.

Several lamp circuits in multiple branches have an independent switch in each circuit for opening and closing the circuit. Electromagnetic mechanisms controlled at a point remote from the switches operate them, there being an electromagnetic mechanism for each switch. A controlling circuit independent of the lamp circuits is in series with all of the electromagnetic mechanisms, the controlling circuit having selective means in series for energizing and actuating the electromagnetic mechanisms singly.

780,228. Electric Stove. Earl H. Richardson, Ontario, Cal., assignor to the Pacific Electric Heating Company, Ontario, Cal. Application filed January 25, 1904.

Heat-insulating material disposed in cup form contains a heat block. The face of the heat block is so curved as to present at least two points of contact.

780,316. Third-rail Insulator. Paul Winsor, Weston, Mass. Application filed June 10, 1904.

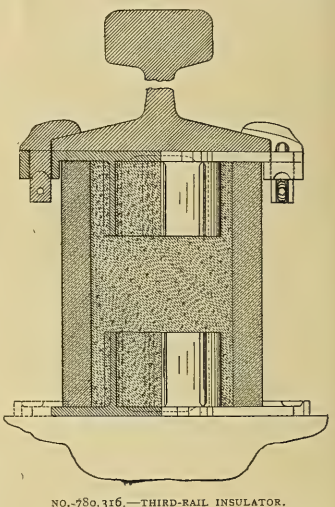
A metallic base is provided with an upwardly extended projection. A metallic cap is provided with a depending projection. An interposed composite body of insulating material, composed of a center portion of cementitious material embraces the projections and firmly joins the cap and base. A shell of non-metallic materials surrounds the center portion. (See cut.)

780,322. Electric Dental-instrument Holder. Monroe N. Callender, San Francisco, Cal., assignor to J. W. Rooch, San Francisco, Cal. Application filed November 3, 1904.

A board for holding a dental instrument is provided with electric wires leading to the instrument. A drum around which the wires are wound, a spring for winding up the drum, a pawl for holding the drum against the spring, terminals on the drum respectively connected with the ends of the wires, and connections from the terminals to a source of electricity are the remaining features.

780,365. Storage Battery. Joseph Melzer, Cleveland, Ohio, assignor to the Osborn-Morgan Company, Cleveland, Ohio. Application filed April 2, 1904.

An electrode divides the cell into independent compartments. An electrode of a similar metal is placed in one



NO. 780,316.—THIRD-RAIL INSULATOR.

of the compartments, an aluminum electrode in the other compartment and an electrolyte in each compartment.

780,386. Electromagnetic Traction Device. George W. Thompson, Melrose, Mass. Application filed July 26, 1904.

Several revoluble gear members are made of ferruginous material and engage each other. A magnetic member has substantially the form of a semi-ring and partially incloses one of the gear members, the concave side of the magnetic member being toward the point of contact of the gear members.

780,388. Trolley. Gutie H. Tuttle, Shorter, Ala. Application filed October 26, 1904.

Two sections of the trolley are separated transversely of the axis, and a support is provided for the sections whereby the sections may move into parallelism and also into oblique relation with each other.

780,439. Electric Circuit-closer. John K. Norstrom and Henry M. Graif, Chicago, Ill., assignors to the Automatic Telephone Company, Chicago, Ill. Application filed June 18, 1903.

A series of independently movable actuating devices adapted to be set for sending predetermined signals has means associated with each device for holding it in set position, means for moving the devices when the holding devices are released and means associated with each actuating device for releasing the holding means of some other actuating device in the series. One of the releasing means is arranged to be actuated by the setting of the actuating device with which it is associated.

## EXPIRING PATENTS.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on January 24, 1905:

376,730. Therapeutic Electric Belt. S. B. Brushfield, Denver, Colo.
376,818. Electrical Conductor. T. Egleston, New York, N. Y.
376,863. Electric Call. W. H. Citting, St. Louis, Mo.
376,886. Circuit-closer and Regulator for Electromagnetic Thermoscopes. H. J. Haight, New York, N. Y.
376,893. Underground Conduit for Electric Wires. E. C. Lindemenn, Baltimore, Md.
376,920. Watchman's Electric Controlling Apparatus. O. Skrivan and F. Dvorak, Vinohrady, Prague, Bohemia, Austria-Hungary.
376,976. Electrical Switch. S. Bergmann, New York, N. Y.
376,973. Mechanism for Electrical Connections. P. W. Wood and J. B. Wood, Montreal, Quebec, Canada.

# WESTERN ELECTRICIAN

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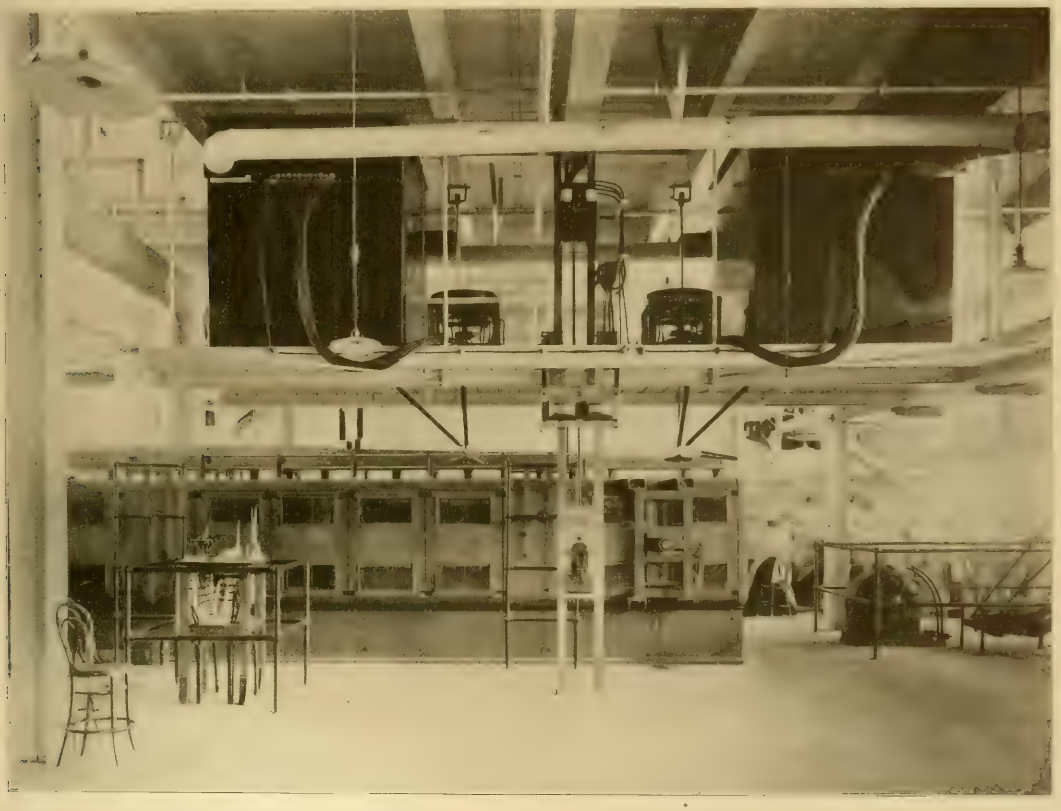
## Advantages of Electric Cooking.

By Day Allen Willey.

There is no more fascinating study in connection with the possibilities of electricity than its application for domestic purposes. Possibly so much attention has been given the various applications of electric light and power that the advance which has been made in the designing of systems for cooking has not been generally appreciated by the public. A brief article on the subject may therefore be of interest.

It may be said at the outset that doubt no longer exists as to the practicability of electric cooking. Practically every form of cooking, both in the household and restaurant, can be done on the electric range, as some are pleased to term it, and the only problem which remains to be solved is that of expense. The housewife or cook can roast, broil or fry the meats, stew the vegetables, bake the bread and biscuit, heat the dishes on which the viands are to be served and prepare the various beverages without needing a pound of liquid or solid fuel. Thus the economy of space is apparent, for the clumsy and bulky firebox which the stove utilizing solid fuel must contain is unnecessary and the room can be devoted to ovens or other receptacles. Consequently the necessary apparatus for a family can be condensed into a comparatively small room and the kitchen and pantry combined in one if desired. Even the refrigerator for perishable food can be kept in the same apartment, as the amount of heat which escapes in the air from the electric units is so small that the temperature around the apparatus is but little affected.

Foreign electricians have given much attention to electric cooking utensils, and in use in Great Britain and on the continent are a number of systems [illegible] possibly the Le Roy is the most [illegible] of the foreign method. It has a [illegible] which is wound a metallic conductor [illegible] special alloy. The two ends of each [illegible] port are provided with metallic caps forming current collectors and to which are attached the ends of the wire constituting the electric resistance. The metallic conductor wound around the porcelain is formed of several juxtaposed wires which permit of the use of a greater current than with a single wire, since the heat-radiating surface is greater than with one. The result is that, in order to form a given resistance, the length of the wires is necessarily [illegible] [illegible] is burned on the surface of the utensil, thoroughly insulating it from the metallic portions. The mica [illegible]



ELECTRIC OVENS IN A NIAGARA FALLS FACTORY SUPPLYING BREAD, PASTRY, ETC., FOR 500 PERSONS.

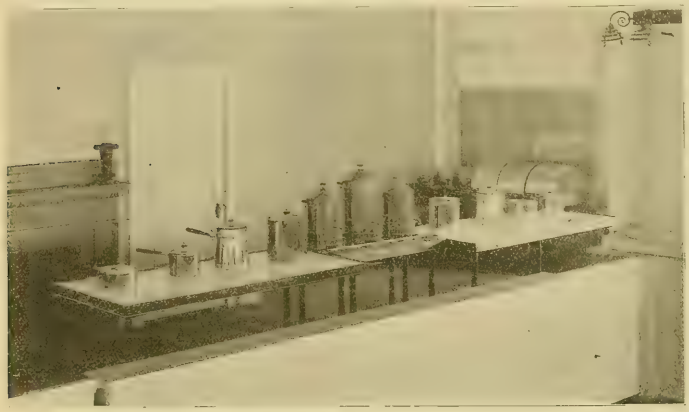
and there is a saving in the weight of metal. By the passage of the electric current the wires are raised to a red heat and the porcelain itself soon becomes incandescent, thus increasing to a large extent the surface of calorific emission. The screw-thread and the conductor have been so calculated that the elements may be used upon a 120-volt circuit. Mr. Le Roy has designed three models of elements, each of which is made in two types. These three models consist of small elements which have a length of 5.118 inches and a diameter of 0.787 of an inch and consume one or 1.8 amperes at 120 volts, or 120 and 215 watts; medium-sized elements which are 8.661 inches in length and 1.181 inches in diameter consume 2.5 amperes at 120 volts, or 7.5 amperes at 60 volts, and large-sized elements, which are 11.811 inches in length and 1.968 inches in diameter, consume at 120 volts seven or 8.5 amperes. The various heating elements are placed in a jacket consisting of a glass cylinder for stoves and fireplaces and a half-cylinder of asbestos for domestic apparatus.

The small elements are employed in stores, fireplaces and domestic apparatus. By combining the elements it is possible to reach consumptions of nine, of this material coated with a compound which includes sulphide of gold mixed with oil and nitro-benzine. After the coating has been applied to the mica the unit is exposed to a heat sufficient to literally burn the gold in the mica, expelling all of the organic matter. If the work has properly been done the unit will withstand a current of 220 volts without damage, although in common practice the voltage is considerably less.

The current is communicated to these units either by single circuit or a series of circuits, each being controlled, of course, by an individual switch. Where an unusual quantity of heat must be generated, as in serving large ovens, the multiple-circuit system, as it might be termed, is utilized, and when the temperature of the interior of the oven has been raised to the proper degree the surplus heat can be eliminated by merely cutting off as many circuits as may not be required and the contents of the oven treated to a uniform heat until the process is completed. It is perhaps unnecessary to say that for simple operations, such as boiling coffee, broiling a piece of steak, etc., one circuit is all that is required. In the majority of systems the application [illegible] the current is such that the ovens can be heated

to a required degree in at least 20 minutes, while the smaller utensils are ready to prepare the food in from five to 10 minutes.

When a comparison is made between the electric current for culinary purposes and coal, wood, petroleum or even gas the advantages in its favor are so many that unquestionably it will come into general service when the cost of production is lowered to a point where it can be utilized with a fair amount of economy. We have become so accustomed to the enormous percentage of waste which accompanies the use of solid fuel that it is a question if we realize how much of the heat generated in this way is of no value. The ordinary kitchen range requires nearly if not quite 20 times as much wood or coal to cook a meal as should be needed, since between 90 per cent. and 95 per cent. is not applied to the preparation of the viands. A very large proportion of the heat generated by gas is burned in the combustion caused by the application of air and is wasted, while even the most improved oil stove wastes a far greater percentage of heat units than the electric apparatus. It is an encouraging fact that methods have been devised which actually save from 80 to 90 per cent. of the electric-heat units, and in some instances but five per cent. has been wasted. Only the cost of generating the current has stood in the way of its general introduction. Here and there illustrations have been given of its many advantages. For example, at Niagara Falls a large manufacturing concern not only operates every wheel of its machinery by means of the current generated by the cataract but prepares food for its employes in a completely equipped electric kitchen, herewith illustrated, and some of its products are cooked before being sent to market while in the process of formation. In some of the larger cities, such as New York and Chicago, apartments can be found where families are utilizing the current; but as yet it may be admitted that the expense is such that it has prohibited the introduction of such utensils on an extensive scale.



ELECTRIC URNS AND STEW-PANS IN KITCHEN OF A NIAGARA FALLS FACTORY.

Broadly speaking, the cost to the ordinary consumer of electricity for cooking, ranges from eight cents to 15 cents per kilowatt-hour. At Niagara Falls, however, the current is generated so cheaply that it is supplied in some instances as low as four cents. It is not improbable that there are other places in this country where waterpower is available to operate generating units at such a low cost that current can be used in the vicinity for domestic purposes as well as for operating machinery and illumination. Consequently we may first expect to see it used extensively in communities which are adjacent to such sources of power, but with the development of the long-distance transmission lines it is not fantastic to expect that a few years hence the housewife will be cooking with the electric current in places possibly 100 miles from the source of its origin.

## A Great California Transmission System.

The California Gas and Electric Corporation of San Francisco has purchased two other large power companies—the South Yuba Water Company and the Central California Electric Company. By this move the two large electrical systems coming into Sacramento are brought under one control. The Central company has three generating stations, one at Newcastle, another at Auburn and a third at Sacramento. The California Gas and Electric Corporation is now one of the largest electric operating corporations in the world and operates in 21 counties of California. Its main pole lines are 992 miles in length, and the distributing lines aggregate 575 miles.

## Ohio Interurban Railway Association.

Dayton, Ohio, January 27.—Eminently successful was the first annual meeting and banquet of the Ohio Interurban Railway Association, which took place here yesterday. The list of members and guests showed a number of men prominent in the traction world as well as those in other lines of work. Those who were present from Indiana fully realized the scope and plan of the association and feel that it will encourage the establishment of similar associations among the various companies of other states to the end that the electric interurbans may be operated as vast systems instead of short lines as at present.

The business meeting was held in the morning, when a number of matters were discussed. The election of officers resulted as follows: President, Edward C. Spring of West Milton; vice-president, Warren F. Bicknell of Cleveland; Secretary, F. W. Coen of Cleveland; treasurer, R. B. DeWeese of Dayton; executive committee, F. J. J. Sloat of Hamilton, F. D. Carpenter of Lima, W. B. Tarkington of Toledo, J. R. Harrigan of Newark and F. J. Green of Springfield; finance committee, Edward C. Spring, J. H. Merrill of Lima and A. W. Anderson of Dayton.

The report of the retiring president, Harrie P. Clegg, consisted largely of a discussion of the traction business in Ohio, with references to the large interests in other portions of the country. The purposes for which the association was formed were outlined and this was followed by a description of what had been accomplished during the year. Mr. Clegg considers the work has been a benefit not only to the members but to the traveling public as well. With complete harmony among the various companies the service to the public may be immeasurably increased and at the same time the benefits will be felt by the companies themselves.

E. P. Roberts of Cleveland read a paper on "Steam Power," and this was discussed in the afternoon by many of the members. The talk led to a comparison of steam and electricity as a motive power for transportation purposes. The efficiency of steam for rapid transit was fully recognized, yet the consensus of opinion was that electricity will eventually take its place on the long as well as the short lines. At no distant date, it was argued, it will be possible to take an electric car or train in New York city and journey across the continent to San Francisco in as short a time as the steam roads now make the trips. Not only this, but the passenger will escape the smoke and dirt that always accompany the latter mode of travel. Again, it is possible to obtain more power with electrical generating machinery with the expenditure of the same amount of money than through the use of the modern steam locomotive. The work of inventive minds will so improve electrical devices within the next score of years that steam will be entirely superseded by electric power for transportation. These views seemed to coincide with those of Governor Herrick expressed at the banquet later in the day.

The interchangeable baggage system also received attention, but the members seem to have come no nearer arriving at a conclusion than at former meetings. It is probable that this problem will give the association more trouble than any other that will come up for some time. It is recognized that something must be done to reduce the interchange of baggage on long-distance business to a system, but just what, is the question that has not been solved.

Something like 25 new members were admitted. The February meeting of the association will be held at Lima on February 23d.

After a reception in the evening at the Algonquin Hotel, where the meetings were held, the 150 guests marched into the banquet hall promptly at seven o'clock, where an elegant dinner was served. The hotel was decorated from top to basement with hothouse plants, ferns and cut flowers. About the table of honor were gathered Governor Herrick, Dr. J. E. Lowes, Charles B. Clegg, Valentine Winters, Hon. Dennie Dwyer, Larry Reist, J. Spriggs McMahon, John Kirby, Jr., John F. Ohmer, Gen. W. P. Orr, A. F. Broomhall and J. B. Foraker, Jr.

Harrie P. Clegg, retiring president, acted as toastmaster. Mr. Clegg, always happy in his public utterances, was especially so on this occasion, and introduced each speaker with a witty remark as to his personality. His own good humor carried others with him and the result was a general good-fellowship meeting.

Edward C. Spring, the new president, was the first speaker, and he responded to "The Ohio Interurban Railway Association." Mr. Spring thanked the association for the honor conferred upon him and on behalf of the association presented Past President Clegg a beautiful loving cup as a token of esteem. Mr. Clegg made a suitable response and then introduced Governor Myron T. Herrick, who spoke in part as follows:

"Interurban electric railways are getting closer and closer every day to the status, the business and the characteristics of commercial steam railroads. In a number of recent cases the courts of Ohio have found it difficult to distinguish between these two classes of common carriers. In the early days of the horse cars and even later, when electricity as a motive power was first introduced, street railways were looked upon as conveniences for the cities alone. They were purely municipal institutions and no one thought of carrying their work beyond the public streets. But within recent years the business of street railways has been revolutionized. The urban has become the interurban. So far as the business of these companies is concerned, municipal boundary lines have become obliterated. There is scarcely a street-railway line in Ohio that does not run into two or more municipalities, and if today we should seriously consider municipal ownership, the first question that would be asked with respect to nine out of 10 of the street railways in Ohio would be, 'What municipality shall own them?' So fast indeed has this business grown and so active has been the genius and enterprise engaged in it that the very growth it has enjoyed has perhaps settled, for the present at least, the question of retarding it by appropriation—for the number of cities and villages now reached by the interurban roads is so great that municipal ownership would only serve the purpose of destroying the continuity of the lines.

"But the progress of the business has gone even further. It has not only obliterated the boundaries of municipal corporations but it has crossed with its network of tracks throughout the country the lines of counties and states. The interurban railroad has become the short-haul carrier for the people. Manifestly, therefore, we have lived past the day when these companies may be regarded as purely local conveniences and controlled solely by local authorities. The Legislature of Ohio in recent years has been recognizing with increasing assurance and conviction the ultimate sameness of all railroad companies, whether operated by steam or electricity, whether operated upon the highways or upon private rights-of-way, or whether called by one name or another. The General Assembly of 1902 granted to the interurban companies the power of eminent domain outside of municipalities, and the General Assembly of 1904 granted the street and interurban railways, under certain conditions, the right of eminent domain within municipalities, and the same Legislature last winter provided for the taxation of property of interurban electric-railway companies by a method identical with that in force with respect to the steam railroad companies. Thus the two kinds of railways are coming closer and closer to mean one and the same thing. Peering into the future it does not require mental field glasses to see the day when in fact as well as in law there will be one kind of railway in this country, and when electricity, which is now coming more and more into use, will be the only motive power for all.

"Now, what does all this mean? Certainly I am not one of those who believe in taking away from the municipalities of the state the inherent right of home rule; and certainly I would not advocate any plan that would destroy the principle of local government in so far as it is necessary to protect local interests. But in so far as interurban railways have ceased to be the concern of a single city or a single locality and have come to be the concern of the state at large, I believe the business in which they are engaged ought to be regulated and controlled by the state. As interstate commerce is the concern of the nation at large, so intrastate commerce is the concern of the state at large; and any agency which thus unites, by bands of steel, the interests of urban and rural communities and conducts a passenger, freight and mail traffic between different sections of the state should be directed and controlled by some authority which would see that equal justice is done between all patrons of the lines, whether they live in the city or the country. Nothing has seemed to me more obstructive of general progress than the spectacle of an interurban railway line being, on the one hand, retarded in its work by the caprice or cupidity of local authorities, or, on the

other, practicing discrimination in favor of the people of one community against those of another. I am not willing to take from the people of our municipalities the control of their streets, or deprive them of the just return which should be made by those who use the streets for any public-service business. But with respect to interurban railway lines which run through a number of municipalities as well as counties, I believe that for the protection of the people and for their safety and convenience as well as for the protection of investors in these enterprises some just and equitable method should be devised for their control which will avoid the confusion that conflicting interests always entail."

Judge Dennie Dwyer, a pioneer in the interurban business, next responded with a retrospective view of the business and a talk on the progress that had been made in recent years. Judge Dwyer is an enthusiast in traction matters. Gen. W. P. Orr of Piqua responded in a humorous manner, describing a road in which he was interested and finally sold to the Clegg-Winters syndicate. E. B. Grimes read a poem, in which almost every traction man in the state was alluded to in a witty manner.

Others who responded to toasts were John A. Ohmer, A. F. Broomhall, J. Sprigg McMahon, Dr. J. E. Lowes, Attorney Charles Bosler, E. W. Hanley, F. J. J. Sloat and Capt. George H. Wood.

## Modern Central-station Design as Exemplified in Boston.[1]

By I. A. Moultrop.

Within the last two years the Boston Edison Company has purchased the property of many local companies, and in most instances is changing the stations to modern alternating-current sub-stations, making a suburban business which extends in various directions from 12 to 30 miles outside of the city.

This large increase in suburban territory together with the rapidly growing city business called for an immediate enlargement of the alternating-current station which was already loaded to its full capacity. A new station was therefore planned with an ultimate capacity of 60,000 kilowatts, to be built on the L Street property alongside the existing station. The first installation of 10,000 kilowatts is just being completed. The position of the existing station on the property was fortunately such that it was no handicap in the location and arrangement of the new station. As a matter of fact, the old station naturally merges into and becomes a part of the new station, and had it not existed it is doubtful if any change would have been made in the design of the latter.

The turbine room will be [ultimately] 650 feet long, 68 feet wide, 56.5 feet high, and without a basement. It has no side windows. A liberal monitor with glass sides and roof gives a better distribution of daylight than do side windows and in connection with windows in the end walls provides good ventilation.

The boiler house will be 640 feet long, 149.5 feet wide and of same height as the turbine room. The arrangement of the boilers practically divides this building into seven fire rooms. The lighting and [illegible] from the [illegible] to the turbine room.

The switch house will be 605 feet long, 30 feet wide, and several stories high. The buildings for the installation of 60,000 kilowatts of machinery cover about 160,000 square feet, which is equivalent to about 2.67 square feet per kilowatt.

The turbine room has received all of the machinery in the station; even the boiler feed pumps, usually considered an adjunct of the boiler house, are treated as part of the turbine auxiliaries, and are placed in charge of the turbine operators. The boiler house contains only the boilers with the necessary piping, etc., so that the work in this room is to burn coal properly and maintain the steam pressure.

All of the electrical apparatus has been grouped together and installed in a separate building adjoining the turbine room, isolated from the noise and dirt of the latter and free from liability of damage by accidents to any of the turbine-room machinery.

The apparatus is installed on the unit system. In the turbine room all the auxiliaries required for a generating unit are grouped around that unit and are generally of sufficient capacity to serve that unit alone. The boilers necessary to supply the generating unit are in one row directly behind the turbine. In this way each generating unit is a small central station in itself. Practically no cross-connections are installed between the various units except that between each pair of units. The steam mains are joined by a small-sized tie so that a generating unit can be run temporarily from the boilers of its mate, should an emergency require. In this way a very simple piping system is sufficient, reducing the cost of installation and maintenance, and simplifying the manipulation of the station under emergencies when the engineer has to think quickly, and when he must be sure that the manipulations are made rapidly and correctly. The duplication of auxiliaries is eliminated, and should a generating unit be put out of commission by the failure of any one of its essential parts, it is intended that the entire unit will be shut down and another one started in its place.

Before determining upon the apparatus to be installed in the station, careful consideration was given to the respective merits of turbines and reciprocating engines as prime movers. The advantages of the turbine over the engine in first cost, the lesser amount of help required to operate, the ability to use condensed steam with safety for feed in the boilers, together with the fact that the apparatus takes very much less room decided the question in the favor of the turbine. These considerations were held to justify the decision without regard to the water consumption, and the decision will be considered wise even though the water consumption proves to be no better than that of a good engine, although it is expected to be better. Another important feature is the ability to start an idle unit quickly. The earlier turbines were open to improvement in this respect, but the later machines have been safely started and brought up to full load with remarkable speed.

The turbines used in the first installation are of the Curtis type with a rated capacity of 5,000 kilowatts on a conservative temperature rise in the generator. They are four-stage machines with surface condensers built in their bases and are equipped with mechanical brakes for bringing the machine to rest for an emergency stop. In these features they are the first machines of their kind to be installed. The base condenser was adopted [illegible] Its disadvantage is that it increases the height of [illegible] moment. Its first cost is somewhat more than an [illegible] cial arrangement for filling the condenser tubes with water when the turbine is to be non-condensing.

[illegible] because the turbine will run for some hours with no load and no field, while with the brake it is possible to bring the machine to rest in about five minutes. It also facilitates the overhauling of the step bearing by sustaining the weight of the rotating parts.

The generator is a three-phase alternator, Y-connected, 60-cycle machine, generating at 6,900 volts. This number of cycles was determined upon because the bulk of the alternating-current business is lighting, and also for the reason that the existing alternating-current apparatus has the same number of cycles.

The auxiliaries for each turbine consists of a circulating pump, a wet and a dry vacuum pump, a step pump, a hydraulic accumulator, and the boiler feed pump for the group of boilers connected to the turbine. All these machines are steam driven, with the exception of the wet vacuum pump, which is motor driven because its speed is too high to be conveniently handled by an engine. Careful consideration was given to the subject of steam versus electrically driven auxiliaries, and steam was determined upon because it gives better station economy. All the exhaust steam from the auxiliaries is carried to the feed-water heater and is condensed in heating the boiler feed. The condensation is then discharged to the sewer as it contains too much cylinder oil to warrant trying to purify it. As all the exhaust from the auxiliaries can be condensed in heating the feed water, the greatest possible use is made of the heat originally put into this water in the boilers, for practically all that is not taken up in the form of work in the engine cylinder is returned to the boiler in the feed. Moreover, the first cost of steam-driven auxiliaries is less than electric drives, and speed regulation over wide ranges is much more easily accomplished.

The circulating-water pump consists of a centrifugal pump driven by a simple high-speed engine with a throttle governor. The distinctive feature of the dry vacuum pump is that the air cylinder is placed at a right angle to the steam cylinder, thus giving a better turning moment on the crank, and it takes less room.

The step on the turbine is lubricated by water instead of oil, because the water is as good a lubricant for this purpose, is cheaper, and the lubricating system simpler.

The condensing apparatus is designed to condense 153,000 pounds of steam per hour and maintain a 28-inch vacuum in the condenser, with the cooling water at summer temperature of 70 degrees Fahrenheit.

The storage of coal is a very essential feature of a large central station, and is seldom adequately taken care of. Alongside of this station and adjacent to the water front an open-air storage of from 60,000 to 70,000 tons of coal is provided where the

FIG. 1. TYPICAL CONNECTIONS FOR GENERATORS AND LINES IN L STREET STATION, BOSTON.

1. Abstract of a paper presented at the meeting of the American Institute of Electrical Engineers in New York, January 27, 1905. Mr. Moultrop is the mechanical engineer of the Boston Edison Company. A general description of the system was given in the Western Electrician of May 21, 1904, and reference was made to it in the issue of January 7, 1905, under the heading "Electrical Progress in the United States in 1904." The present paper contains many details of interest.

coal is stored without any shelter and immediately on the ground. The winter's supply of coal can therefore be purchased while the freight rates are low during the summer time, and, including the loss from weathering coal, reduces the cost of fuel delivered in the fire room.

An inspection of the wiring diagram (Fig. 1) will show the general arrangement of the switching. There are of necessity three bus-bar pressures, the excitation, and the possibility of a fourth pressure being required later. The engine-driven alternators [of the old station] generate at 2,300 volts, and the turbine-driven alternators at 6,900 volts. This latter was fixed upon after careful consideration of the location of the present business with reference to the station and of its probable growth. There is also a certain amount of 4,600-volt business which crept into the system some time previous because a considerable amount of business developed at a distance too far away for the economical use of 2,300 volts, and the standard cables on the system would safely carry only 5,000 volts. Therefore, the simplest expedient at that time was to install two-to-one transformers and supply them from the old station bus bar. This business which started in a small way long before a turbine station was considered had grown to a considerable size at the time the turbine was installed, and the loss in the underground cables and other apparatus—which would have no commercial value in case this pressure was changed—prohibits making any change at the present time. The turbine pressure of 6,900 volts promises to be ample for the present needs of the company, but it can be easily foreseen, should the lines be extended beyond their present limits or should the business at the end of some of the transmission lines materially increase, that this pressure might be too

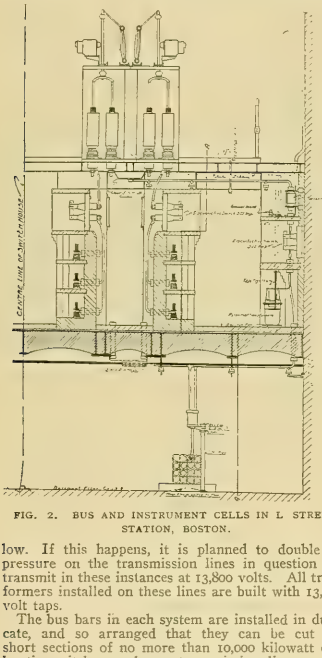


FIG. 2. BUS AND INSTRUMENT CELLS IN L STREET STATION, BOSTON.

low. If this happens, it is planned to double the pressure on the transmission lines in question and transmit in these instances at 13,800 volts. All transformers installed on these lines are built with 13,800-volt taps.

The bus bars in each system are installed in duplicate, and so arranged that they can be cut into short sections of no more than 10,000 kilowatt each by tie switches, and any transmission line or generator can be isolated if it is desired to do so. Transmission lines are grouped with the generators on a section of bus bar so that this bus bar does not have to carry much current any distance lengthwise. The generator is connected to the bus bars through one main switch and two selector switches. These switches are designed to open under the full station capacity, should emergency ever demand it. The transmission lines have selector switches but no main switches at present, space being reserved for the installation of selector switches should they prove desirable later.

The switches are all installed on the third floor of the switch house. The selector switches are in two rows. Each row consists of two switches (placed back to back) running through the center of the building and immediately over the bus bars, to which they connect. The main switches are installed in two single rows, one on each side of the switch house and against the side walls. On the floor below, the bus bar compartments are arranged similarly to the selector switches, two rows of two through the center of the room. In two single rows on each side wall immediately under the main switches are grouped the instrument transformers in special compartments.

The oil-switch cells, the bus-bar chambers, and the instrument transformer chambers are all built of a light-yellow brick with a fine cement joint, the brick being selected for its low absorption properties. The barriers in the bus-bar compartments and also in the instrument compartments are of reinforced concrete with a fine, close-grained finish. These are all made in molds and set in place similarly to slabs of alberene; they have as good insulating qualities as alberene with less absorption, are much cheaper, and furthermore are less liable to break. The bus-bar chambers are fully enclosed, small doors being left in the wall for access to the connections only. The instrument transformer cells are left open. [Fig. 2 is an elevation of bus and instrument cell with wall removed.] The front of each switch cell is enclosed with a wooden frame, filled with a pane of glass, which permits an inspection of the pot, while at the upper part of the frame there are a few slats for ventilation, and for vents in case of an explosion.

The transmission lines and also the turbine leads and transformer leads enter the basement of the switch house in duct lines which terminate in this room and at a point nearly underneath the selector switches they connect with the upper floor. The lead-sheathed cables terminate in end bells as close to the end of the ducts as possible, from which points cable with flame-proof braiding is carried on glass insulators and through porcelain tubes to the switches overhead. From the end of the ducts the cable is taken in air runs and they are so grouped throughout the basement that there is ample air space between all cables. Provision has been made for the installation of static-discharge apparatus in this basement, but at present none has been installed.

The electrical operating room is on the top floor of the switch house in about the center of the building and contains nothing but the operating apparatus. Convenient stairways leading down from this room through the switch house bring the operator in close touch with all the switching apparatus. A signal system similar to that used on board ship enables him quickly to communicate his orders to any of the generating rooms, doing this with a certainty that the order will not be misunderstood. This system also provides for an acknowledgment indicating when the order has been carried out.

All the switching apparatus, with the exception of the excitation system, is remote controlled. The controller panels with all the necessary instruments are grouped in the operating room in the form of a rectangle, facing inward so that the operator can see at a glance any panel in the room. The excitation switching is hand controlled. The bus bar for this is brought into the operating room and placed between the two groups of switches controlling the engine-driven alternators and the turbine-driven alternators. The panels for the ground detectors are installed alongside the excitation, but so that the operator has grouped at one end of the room all the apparatus which requires constant attention. The transmission-line panels, transformer panels and others are scattered along down the room in the order that is most convenient for their installation, without reference to the sequence of the switches themselves downstairs. The excitation is furnished by one small steam-driven set of sufficient capacity to start up an engine-driven alternator in case the entire station should be shut down, three small motor-driven alternators, located in the old engine room, having a capacity sufficient for all the engine-driven alternators, and three large motor-driven exciter sets, one in each of the individual turbine rooms, with sufficient capacity to supply the turbines. In addition to the motor generator sets there is a storage battery with capacity of 1,000 amperes for an hour, floating on the excitation bus bar. Besides the generator fields, there are fed, from the excitation bus bar, a few other pieces of apparatus which are particularly necessary to the operating of the station, such as the motors operating the oil switches, the relay pumps or the step bearings, and a few lights around the station which would be essential in case the general lighting system should give out.

Unfortunately no test or station-economy figures can be given at this time. The turbines are still in the builder's hands and while the first machine has been in commercial service for about three months, the conditions under which it has been operated make the station-economy figures of little value.

### Discussion in New York (in Abstract).

H. G. Stott, New York: The first point in reading this paper which occurred to me was in relation to the cost of a plant and its operating cost. Take the average lighting plant—probably, as our president said, 50 per cent. of the load does not last more than 300 hours per annum. An extra investmen of $12.50 per kilowatt would mean that the depreciation and taxes on that investment considered, the cost per kilowatt would increase a half a cent per kilowatt-hour. I think that, as engineers, we have neglected to think of the load factor sufficiently. Our plants are probably far too economical in the sense that they cost too much, and burn up interest, taxes and depreciation on investment more than outweigh the reduction in the cost of operating them. Some plants today cost $140 per kilowatt for investment. If we can reduce that cost to, say, $25, there is one cent a kilowatt saved in fixed charges. There is a point where we can balance the interest on the capital invested against the purely operating cost and maintenance, and get the minimum cost per kilo-

[Continued on page 92.]

## Electrical Destruction of Animal Life Harmful to Trees and Plants.

Electricity is coming more and more to the front as a useful agent in various branches of agriculture. Its adaptation to the freeing of the soil and the trees or plants themselves from the injurious effects of insects, caterpillars, worms, slugs, etc., is, however, a new application and of considerable interest. Sigismund Lokuciejewsky of Odessa, Russia, has taken out a patent for a method of this kind, which consists in subjecting the soil, trees or plants to an alternating current of high tension and frequency, by which the insects are destroyed and the

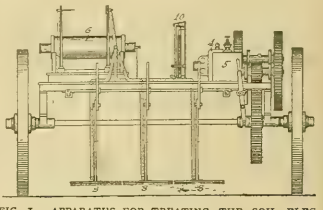


FIG. 1. APPARATUS FOR TREATING THE SOIL ELECTRICALLY.

soil at the same time charged with ozone, which is said to impart to it increased productivity.

A portable source of electric current is preferably employed. The source of current may be a storage battery or a generator capable of furnishing either a direct current or an alternating current. In the latter case the generator is mounted upon a wheeled frame (Fig. 1) in such a manner that the armature will be rapidly rotated.

The current, whether direct or alternating, furnished by the storage battery or the generator, is first led through an interrupter (5) of any suitable construction, and after passing the rheostat (10) enters the transformer or induction coil (6). Thence the current is directly led back to the opposite pole of the generator (4). Thus a current of high tension and frequency and low density is produced in the induction coil.

One pole of the high-tension current terminates in a tool or other implement of any suitable kind, which is arranged to either slide on the surface of the soil, tree or plant or to cut into the soil. As shown in Fig. 2, there is employed for this purpose a circular disk or wheel (7) carried by a rod adjustably attached to the frame of the car so that according to the adjustment of the rod the wheel will cut more or less into the soil. The second pole of the electric circuit terminates in brushes or similar tools (8) (Figs. 1 and 2). The brushes are fixed to the lower ends of rods or levers which can be brought in contact with the surface of the soil or tree.

The generated current flows from the transformer through the disk into the soil and through the latter to the other pole, passing in the form of strong sparks or radiating rays from the soil to the brushes and then back through corresponding conducting wires to the transformer. All the worms, larvæ,

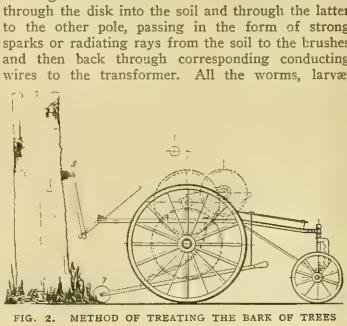


FIG. 2. METHOD OF TREATING THE BARK OF TREES ELECTRICALLY.

slugs, insects, caterpillars and other animals of any kind in and on the soil through which flows the alternating current of high tension and frequency are thus subjected to its action and destroyed. When the brushes are raised from the surface of the soil so that the sparking is prevented the soil becomes ozonified.

The animals on trees, plants and flowers are destroyed by the application of current as shown in Fig. 2. The one movable pole is moved by hand along the surface of the trunk or branch of the tree to be treated, and the other pole (7) is introduced into the soil near the tree, thereby subjecting the animals in the bark and on the surface of the tree and direct on the roots to the high-frequency current. Trials have also proved that the productivity

of the soil treated in this manner has been increased considerably.

The apparatus is intended to be so arranged as to give at a potential of 500,000 volts about 0.000005 of an ampere of current. These figures indicate the approximate relation of the volts to the amperes. It has been found that currents of such high potential and low current density do not injure plants, but do seriously act on insects, worms, larvae, etc.

## Edward H. Mullin.

Edward Hemphill Mullin, well known to electrical and newspaper men, died suddenly from an attack of heart disease on January 25th, at his home in Milburn, N. J. Mr. Mullin was born in Castlederg, County Tyrone, Ireland, on October 22, 1859. He was educated at the Methodist College Public School of Belfast and the Queen's College, Belfast, where he took his bachelor's degree with honors in physics and chemistry in 1881. Shortly afterward he came to New York and engaged in newspaper work. From 1887 to 1895 he was an editorial writer on the staff of the New York Sun. The two following years he spent on the staff of the New York Evening Sun. The two following years he spent on the staff of the New York Times, in charge of the technical reporting of that newspaper. Subsequently he became editor of the Bookbuyer and a prolific contributor to the magazine and technical press.

On February 1, 1898, he entered the service of the General Electric Company, at first as manager of its advertising department and latterly as a confidential representative of the company in many matters. He was the authorized representative of the company in all its relations with the press and the official host of the company whenever foreign engineers or capitalists desired to visit its works or become acquainted with its methods. He was a thirty-second-degree Mason and a member of the Engineers', Press, Lotus and Transportation clubs. He was vice-president of the New York Electrical Society and a manager of the American Institute of Electrical Engineers; also vice-president of the Association of American Advertisers. Mr. Mullin had

EDWARD H. MULLIN.

a large number of friends in New York and abroad and was known among them for his erudition and wide acquaintance with electrical and engineering subjects. He was a consistent student, and as a writer was distinguished for clarity of style and an Anglo-Saxon simplicity of diction which made his essays on mechanical and electrical matters very easy reading. He was buried on Saturday last, leaving a wife and a brother.

## Niagara Power Competition for Buffalo.

General Francis V. Green, Edmund Hayes, William H. Hotchkiss, George K. Birge, William H. Gratwick, R. K. Albright and Stephen M. Clement of Buffalo have organized the Iroquois Electric Company, with a capital of $1,000,000. They will manufacture electricity for light, heat and power purposes in Buffalo, Tonawanda, North Tonawanda, and villages and towns in Erie and Niagara counties. The new company is apparently allied with the Ontario Power Company of the Canadian side at Niagara, as the men named are interested in that project. The following authorized statement has been made:

"The main purpose of the organization of this company is to supply electricity for lighting, heat and power in the city of Buffalo. It will seek contracts with the municipality for the lighting of streets and public places, will offer its light and power to individuals and private corporations, and will, in short, become a competitor of the Buffalo General Electric Company and the allied Cataract Power and Conduit Company, all along the line. The company will, within a short time, be ready to furnish arc lights, and will also have a modern and fully equipped plant for furnishing incandescent lights. The power for the Iroquois company will be supplied by the [illegible] [illegible] lay conduits in the city of Buffalo will, it is expected, be made to the [illegible]

## Electric Lights in the Caverns of Luray.

About a mile from the town of L[illegible] entrance to the famous Caverns of Luray, perhaps not as well known as the Mammoth Cave of Kentucky, but still so vast in extent and containing so much of geological interest that they have been visited by scientists and others from all parts of the world. The caverns, which resemble nothing so much as a roofed-over valley, were discovered in 1878 by B. P. Stebbins, A. J. Campbell and William Campbell, Jr. Their existence had long been suspected, on account of the great number of sink holes and pools in different parts of the Luray Valley, and the discovery was not accidental, for the

Fig. 1. Means for Attaching Brackets and Hangers.

Fig. [illegible] Ceiling Hanger [illegible]

CONSTRUCTION DETAILS IN CAVERNS OF LURAY.

three men referred to gained an entrance only after considerable digging in various parts of the valley.

The extent of the caverns is estimated at from three to five miles, a considerable portion of which is not open to the public on account of the danger encountered in its exploration. The rock structure is dolomite or limestone, and the stalactite and stalagmite formations are very beautiful. Among the features of special interest are the Fish Market, so called from the fact that the rock formations resemble strings of black bass and silver perch; the Elfins' Ramble, a plateau 500 feet long by 300 feet wide; Pluto's Chasm, a great rift 500 feet long and 75 feet deep; Titania's Veil, and the Amphitheater or Ball Room, as it is sometimes called.

To furnish electric light in the caverns a plant is being installed at Luray by the Luray Electric Company, of which E. G. Hansberger is president. The plant consists of a General Electric 2,300-volt 60-cycle 60-kilowatt single-phase generator driven by a 300-horsepower Harris-Corliss slow-speed engine. The engine also runs a flourmill, the generator being thrown in by a clutch. The company has a five-year franchise for lighting the caverns and is required to furnish lights at any time, day or night, on three hours' notice.

A 300-light transformer is placed on a pole near the entrance to the cave and a three-wire circuit is run from the transformer to a main distributing box, located in the Fish Market. From there a two-wire system is used, and two sets of feeders, consisting of No. 0 wire, are carried out, one set going to Titania's Veil and the other to the Amphitheater. These two circuits also terminate in distributing boxes. From the three boxes all the branch circuits are run. Several sets of three and four-way switches are used to cut down the light bill, for when a party leaves one part of the cave the lights are turned off from that portion, as it may be an hour and a half before the party returns to the same point.

For supporting the wires on the walls and ceiling of the cave an ingenious device was resorted to. Holes four inches deep were first drilled into the rock. A strip of 1¼ by three-eighths-inch iron was then tapered at one end and the end split to receive a wedge. The wedge, which was about the size of the hole, was placed in the split end of the iron strip or hanger, which was then driven into the hole. The end of the hanger was thus spread against the sides of the hole so firmly that it could not be withdrawn. Fig. 1 illustrates the method in which this was done. Figs. 2 and 3 show a celing hanger and a side-wall bracket installed in the above manner. Pins of three-eighths-inch steel carry the insulators, there being no wood used whatever except in the cabinet boxes, which are of hard pine, painted with gas tar and put together while wet.

[illegible]

## Work on Chicago Freight Tunnels.

[illegible] district in Chicago. The company is, however, delivering building material and excavated material to and from structures in course of construction. Considerable work is being done on extending the tunnels, and work in connecting with the railroad freight terminal and dock property is also in progress. The telephone system is also being extended.

The House committee on postoffices and post roads at Washington has provided an appropriation of $172,600 for the purpose of covering the cost of conducting the transportation of mail in the tunnels during the year 1906. The postmaster-general is also authorized to contract for the underground service in Chicago at an annual rate not exceeding the sum of $172,600 for a period not exceeding four years. For this service the company is now making preparations.

Under its present plans, it is said, the company will be in a position by January 1, 1906, to handle 30,000 tons of freight per day by means of 75 electric locomotives and 3,000 tunnel cars. Working to this capacity President Wheeler estimates annual gross earnings of $5,400,000. Besides this he estimates a net income of $500,000 from the automatic telephone system. The power for trains, lights, pumps, elevators and conveyors will cost, it is estimated, $204,000 a year; wages and salaries will amount to $420,000; track maintenance, $30,000, and $271,000 is figured for repairs and depreciation of locomotives, cars, elevators and conveyors. After insurance, accidents, interest and payment for franchise privileges have been deducted there still remains a profit on operation of $3,755,000 if all goes as the company hopes. The figures as to revenue, however, are of course conjectural.

## Administration Bill to Regulate Space Telegraphy.

The bill recently drafted at the request of the Cabinet by the United States commissioner of navigation relative to government control of space telegraphy has been made public. It provides that no person or corporation shall use any apparatus for space telegraphy in this country or on any American vessel unless he is licensed by the secretary of commerce and labor. Persons exchanging messages or signals between points in the same state or on behalf of the American government are to be exempt from this requirement.

The president, in time of war or public peril, may close any wireless station or authorize its use by the government. No interference will be permitted between naval, military and private commercial stations. Each station must answer calls from any other licensed station and receive all messages offered. Operations of any apparatus on a foreign ship while in American waters shall be in accordance with the regulations. After further revision by the Cabinet the bill will go to Congress.

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## DATES AHEAD.

American Institute of Electrical Engineers (annual dinner), ballroom of the Waldorf-Astoria, New York city, February 8th.

Iowa Telephone Association (annual meeting), Des Moines, March 13th and 14th.

Ohio Independent Telephone Association (annual meeting), Columbus, March 30th.

Iowa Electrical Association (annual meeting), Hotel Julien, Dubuque, Iowa, April 19th and 20th.

National Electric Light Association (annual convention), Denver, June 6th, 7th and 8th, and Colorado Springs, June 9th and 10th.

Ohio Electric Light Association (annual convention), Hotel Victory, Put-in-Bay, August 16th to 18th.

American Electrotherapeutic Association (annual meeting), Academy of Medicine, New York city, September 19th, 20th and 21st.

IT IS pleasing to observe, with the official returns for December at hand, that the electrical exports of the United States for the calendar year 1904 were even larger than the total given in the New Years issue of the Western Electrician, when it was necessary to estimate the figures for the last month of the year. The official figures for the twelvemonth from the Bureau of Statistics of the Department of Commerce and Labor (which are, however, subject to revision) are $6,675,766 for electrical machinery and $4,363,992 for electrical appliances, the latter including telegraph and telephone instruments. The total is thus $11,039,758, which is, we believe, the highest figure recorded for the electrical exports of this country. The corresponding totals for 1903 and 1902 were $9,856,047 and $9,997,195. The increase of 1904 over 1903 is therefore $1,183,711, or 12 per cent.—quite a satisfactory rate of growth. However, it is to be observed that the exports of electrical appliances fell off a little in 1904, compared with 1903 (the figures being, respectively, $4,363,992 and $4,751,545), while the value of electrical machinery exported shows a substantial increase, the amounts being $6,675,766 for 1904 and $5,104,502 for 1903.

The government reports classify the electrical machinery exports according to destination. This list reveals some interesting facts. One is that the purchases of Great Britain of electrical machinery made in the United States are steadily decreasing. In 1902 Great Britain bought $2,924,989 worth of such machinery from us, $1,724,182 in 1903 and $1,220,600 in 1904. In other words, this customer took 49 per cent. of this class of exports in 1902, 34 per cent. in 1903 and only 18 per cent. in 1904. This is to be accounted for, no doubt, partly by the development of electrical manufacturing in England, to some extent under American auspices, and partly to the electrical trade depression in that country during the last year or two. On the other hand, British North America has steadily increased its purchases of electrical machinery in the United States, reaching $1,610,571 in 1904—the largest of any country or group of countries. The third largest customer in 1904 was Japan, which took $1,187,693 worth of American electrical machinery. The exports to the mikado's realm exhibit a remarkable jump from the $332,539 of 1903. Whether this is largely due to military requirements, or whether the demand is industrial and an emphatic demonstration of Japan's strength in the arts of peace, in spite of the war, is difficult to determine in the lack of detailed information. But in either case the fact is of quite unusual interest. Japan evidently needed a large amount of electrical machinery last year, and the United States supplied a great part of the demand. The fourth consumer, in point of size, was Mexico, another natural customer of the United States, which took American electrical machinery to the value of $646,398 in 1904. It is gratifying, too, to observe that the South American countries, taken together, are buying increasing quantities of this class of machinery in this country.

HOLDING that "the altered circumstances of these times call for a wider recognition of the importance of a fundamental industry like that of engineering and its subsidiary branches," the London Times announces the establishment of a weekly Engineering Supplement. Passing over the rather self-important implication that the appearance of the Times' supplement will give a distinct uplift to the engineering industries of Britain, it is to be remarked that this departure on the part of a great daily newspaper is of some significance. It shows that the press—or, rather, a powerful representative of the general secular press—realizes the present-day importance of engineering, whatever the attitude of engineering is now or may be toward the newspapers. The engineer is now generally recognized as an important factor in the development of an industrial community. His education, his ideas and his work are matters of national concern. The Times, which has published many important articles on the industrial characteristics of Great Britain, as well as on the corresponding achievements of other peoples, and the influence of these traits on the eager contest for place among the virile nations, sees this, and now takes a step in advance in accordance, as it thinks, with the spirit of the times. All daily newspapers of importance—in English-speaking countries at least, and probably in Germany also—realize in some degree the importance of specialized engineering and give more attention to scientific and technical matters than formerly. But the London Times is the first to go so far as to issue a weekly engineering supplement, and it at least deserves credit for its enterprise. There is no lack of high-grade technical journals in England; but perhaps the new venture may prove successful by interesting non-technical readers in engineering subjects. At any rate, the experiment will be watched with interest.

WHILE great progress has been made in the construction of refuse destructors, designed to raise steam by burning the street refuse of cities as fuel, electrical engineers are far from being convinced of the desirability of combined central-station and destructor works. It has been generally held by electrical men that the destructor may be all right viewed solely as a destructor, but as a steam-raising unit it is not considered a success. The material to be dealt with is unpromising, one-third, roughly, being incombustible solids and another third, perhaps, consisting of water. Nevertheless, the subject is attracting renewed attention, particularly in England, where Mr. W. P. Adams has presented a comprehensive paper dealing with this topic to the Institution of Electrical Engineers. It is a remarkable circumstance that the refuse richest in carbon comes from the poorest districts. Mr. Adams gives a table showing the wide variation in kilowatt-hours obtained per ton of refuse from various London districts, the amount varying from 17 to 86.5. It is advisable to store sufficient material to insure continuous working, for destructor plants should be charged steadily throughout the 24 hours. Storage batteries must be used in conjunction. Figures are presented to show that the cost of refuse disposal may be reduced by the sale of electricity, but all of the destructor stations are far from self-supporting. It is to be concluded that the primary function of a destructor plant is to provide for the disposal of refuse in a sanitary and unobjectionable manner.

THERE seems to be some doubt about the date of the National Interstate Telephone Association in Chicago in June. At the joint committee meeting in Indianapolis the date was set for June 14th and 15th, as stated in the last issue of the Western Electrician, but at the Wisconsin Independent telephone convention held in Milwaukee last week Mr. James B. Hoge, president of the National Independent Telephone Association, which, amalgamating with the Interstate Independent Telephone Association, is to merge into the new association, said that the date was June 7th and 8th. As we have pointed out, the Denver-Colorado Springs convention of the National Electric Light Association is to be begun on June 6th and held through the 10th. As there are a number of gentlemen who desire to attend both conventions, the conflict of dates should be remedied if possible. The time of holding the electric-light convention was set last December, and probably cannot now well be changed. But we hope the committee in charge of the telephone convention may see its way to change the date of that gathering so that it will be held neither in the week of the Denver-Colorado Springs convention nor in the week immediately following.

IN A letter written to Southey in 1817 Walter Scott said: "An individual always manages his own concerns better than those of the country can be managed." This observation is as true in 1905 as it was when it was penned; it expresses the fundamental objection to municipal operation of industrial enterprises. If public-service corporations disregard the rights of the people granting franchises, either in rates charged or service given, they should be checked and regulated. To attempt municipal operation of street railways, electric-light plants or telephone exchanges is not a sensible remedy for evils that may exist. If the roof of a man's house leaks, he does not tear down the house; he stops the leak, and the house does him very well. Even if the politics of American cities were ideal, the watchword, on economic grounds, still would be, "Private operation with municipal control."

## Institute Meetings in New York and Chicago.

The regular meeting of the American Institute of Electrical Engineers was held in Carnegie Hall, New York city, on the evening of January 27th. President Lieb was in the chair, and after calling the meeting to order said that it was his painful duty to announce the death of Mr. E. H. Mullin of New York, one of the managers of the Institute. He said the board of managers had sustained a severe loss and would draw up a memorial as well as attend the funeral in a body. Secretary Pope announced the death of Mr. C. M. Wilkes of Chicago. He said also that 53 associates had been elected at the meeting of the managers held in the afternoon.

Two papers were read and discussed. The first was on "Acyclic (Homopolar) Dynamos," by J. E. Noeggerath, an engineer of the General Electric Company at Schenectady. Prof. F. B. Crocker of New York opened the dicussion, in which the author, Prof. W. E. Goldsborough of New York, Dr. A. E. Kennelly of Harvard University, Crellin Cartwright of Schenectady, F. V. Henshaw of Ampere, N. J., E. P. Thompson of New York and others took part.

I. A. Moultrop of the Boston Edison Company read a paper on "Modern Central-station Design" as exemplified by the new L Street station of his company. H. G. Stott, P. A. Bates, Philip Torchio, Calvin W. Rice, C. O. Mailloux and W. F. White of New York discussed the paper, the author closing the discussion. An abstract of this paper and of the New York discussion is given elsewhere in this issue.

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A good meeting of the Chicago branch of the American Institute of Electrical Engineers was held on the evening of January 31st at the rooms of the Western Society of Engineers. The attendance was about 125 and overtaxed the seating capacity of the room, several gentlemen standing during the whole evening. Mr. Kempster B. Miller, the chairman, presided. Prof. John D. Nies of Lewis Institute read a paper, illustrated by diagrams, entitled "The Metering of Polyphase Circuits." The speaker detailed the results of an investigation to detect the errors that may enter into the measurement of polyphase currents by the use of induction meters. He recommended the use of three single-phase meters on a three-phase circuit. He used the illustration that if a farmer's boy knew of three woodchuck holes and had three dogs, he would better set a dog to watch each hole rather than tie the three dogs together. In this way he would not only secure the best results, but would know the exact efficiency of each dog in hunting woodchucks. F. P. Cox, a meter expert from Lynn, Mass., opened the discussion. He said that meters usually under-recorded the output of the station. He believed the advantage of the three meters to be considerable. Still it was to be considered that three meters cost more than one and that they take more room on the switchboard; nevertheless, their use is to be recommended. He noted that meters require constant attention and checking.

E. B. Clark of the Illinois Steel Company made an abstract of I. A. Moultrop's paper on the L Street station of the Boston Edison Company. He also opened the discussion, advocating roomy power houses and window lighting, rather than skylights where practicable. Peter Junkersfeld of the Chicago Edison Company spoke of the importance of power factor in central-station work. He believed in the unit system of central-station design where real-estate values do not make it prohibitive. This system goes far to insure continuity of service from the central station.

H. R. King of the Western Electric Company abstracted Mr. Noeggerath's paper on "Acyclic (Homopolar) Dynamos." This paper was discussed by H. H. Wait of the same company, who declared that the advent of the steam turbine has breathed new life into the unipolar dynamo. The machine described in the paper is of much promise, he thought.

Before adjournment it was announced that the next meeting of the Chicago branch will be held on February 28th. At that time John M. Humiston, a telephone engineer, will read a paper entitled "Some Notes on Maintenance of Underground Structures." E. B. Clark will present a paper on "The Use of Cement in Central-station Construction."

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The extension of electric railways, by conveying workingmen cheaply to suburban homes, is credited by some observers in England with the decrease in the sales of beer of recent years.

## Electrical Exports for December and the Year 1904.

Electrical exports from the United States for the month of December last amounted to a total value of $1,037,527, as compared with $852,598 for December, 1903, an increase of $184,929. Both classes of goods, electrical appliances and electrical machinery, the former including telegraph and telephone instruments—show a good increase, the figures in detail being: Electrical appliances—December, 1903, $403,677; December, 1904, $433,681. Electrical machinery—December, 1903, $448,921; December, 1904, $603,846.

The principal importers of electrical machinery only from the United States and the value of their purchases for December, 1904, are as follows: United Kingdom, $120,578; British North America, $111,091; Japan, $83,403; British Australasia, $67,557; Argentina, $54,045; Mexico, $40,807; Philippine Islands, $17,278; Cuba, $12,103; British Africa, $8,512; Germany, $8,386; Brazil, $4,869; France, $4,137; British East Indies, $2,582.

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The total value of electrical exports from the United States for the year 1904 amounted to $11,039,758, the largest on record. Previous to 1901 electrical appliances were included in "instruments and apparatus for scientific purposes" (as classified by the United States government); therefore comparisons for a long term of years cannot accurately be made, except for electrical machinery. The figures for the last three years, however, are as follows:

| | 1902. | 1903. | 1904. |
|---|---|---|---|
| Electrical appliances .... | $4,059,552 | $4,751,545 | $4,363,992 |
| Electrical machinery .... | 5,937,643 | 5,104,502 | 6,675,766 |
| Total .................... | $9,997,195 | $9,856,047 | $11,039,758 |

In a summary of the electrical exports for 1904 published in the last New Years issue of the Western Electrician the figures for December were estimated. With the official figures now available, it is seen that both electrical appliances and electrical machinery were slightly underestimated. The estimates were: Appliances, $413,000; machinery, $545,000. The official figures now at hand are $433,681 and $603,846, respectively.

In considering electrical machinery only, it is interesting to note that the United Kingdom, which has always been our largest buyer, no longer holds that position, having been surpassed in 1904 by British North America. The United Kingdom in 1902 imported from the United States $2,924,989 worth of electrical machinery. In 1903 the figure decreased to $1,724,182 and in 1904 still further to $1,220,600. British North America, on the other hand, has increased its purchases from $1,080,877 in 1902 to $1,380,198 in 1903, and $1,610,571 in 1904. Probably the most noteworthy fact revealed by the figures on electrical machinery exported in 1904 is the remarkable increase in the exports to Japan. Although Japan has been engaged in war with Russia, its imports of electrical machinery from this country were nearly four times as great as for any previous year. Classified according to destination, the following table shows the value of electrical machinery exported from the United States in 1903 and 1904:

| | 1903. | 1904. |
|---|---|---|
| United Kingdom .................... | $1,724,182 | $1,220,600 |
| France .................... | 49,623 | 126,546 |
| Germany .................... | 64,463 | 158,621 |
| Other European .................... | 284,737 | 227,145 |
| British North America.................... | 1,380,198 | 1,610,571 |
| Central American states and British Honduras .................... | 11,385 | 26,872 |
| Mexico .................... | 548,600 | 646,398 |
| Cuba .................... | 28,016 | 35,195 |
| Other West Indies and Bermuda..... | 17,505 | 5,538 |
| Argentina .................... | 30,313 | 103,614 |
| Brazil .................... | 170,153 | 122,871 |
| Colombia .................... | 6,726 | 8,767 |
| Other South America .................... | 51,461 | 238,982 |
| Chinese empire .................... | 7,268 | 28,911 |
| British East Indies .................... | 57,426 | 192,948 |
| Hongkong .................... | 15,408 | 20,695 |
| Japan .................... | 332,539 | 1,187,693 |
| British Australasia .................... | 220,276 | 389,537 |
| Philippine Islands .................... | 25,062 | 153,019 |
| Other Asia and Oceania .................... | 3,641 | 29,589 |
| British Africa .................... | 66,203 | 132,236 |
| All other Africa .................... | 8,400 | 9,418 |
| Total .................... | $5,104,502 | $6,675,766 |

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## The Iowa Convention.

The fifth annual convention of the Iowa Electrical Association will be held in the Hotel Julien at Dubuque, Iowa, on April 19th and 20th. The members of the executive and programme committees met recently and arranged the plans for the coming meeting. A number of valuable papers and committee reports will be presented. The present officers of the association are: President, W. L. Bowers of Davenport; vice-president, Austin Burt of Waterloo; secretary, W. S. Porter of Eldora; treasurer, Rufus Lee of Clarinda.

## Hydro-electric Development at Duluth.

Plans for [illegible] of hydro-electric development.

The Great Northern Power Company, controlled by business men of Duluth, is the corporation which [illegible] power initial output, and the company has prospects for the marketing of a larger amount later on, through long [illegible] important railway lines.

By systems of [illegible] water of St. Louis River [illegible] the heights above the city of Duluth. Measurements of flow during a [illegible] continual discharge of about 150,000 cubic feet per minute, which is about 36 per cent. of the rainfall over the drainage area. This area covers 3,700 square miles of tableland, almost entirely forest and swamp, and very little of it utilized for any purpose.

Three projects are included in the present plan—the Thomson, the Fond du Lac and the Duluth Heights. Work on the Thomson and Fond du Lac improvement will be undertaken first. The Thomson scheme consists of a dam flooding 480 acres with a canal 1½ miles long to the forebay. Another canal, 3½ miles long, will lead to a pipe line leading a mile to a power house on the river above Fond du Lac.

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## Miniature Lamps for Fancy Dress.

An advertising party is one which the guests attend in fancy costume, each endeavoring to represent some article, or the advertisements of some article which is being extensively advertised. The costumes are, of course, novel, and often amusing, and the wearers strive to obtain picturesque, artistic and beautiful effects. At two recent parties of this nature in Chicago electric lighting was personified, and made a decided hit. One young lady who used this idea was costumed in evening dress of black silk with black lace trimming and jet ornaments. Forming graceful and brilliant loops, which hung around her shoulders and over the bosom of the gown, were some miniature incandescent electric lamps, supplied from a small storage battery which was carried concealed in the dress. Two or three more lights appeared in her coiffure. The small wires leading from the battery to the lamps were carefully sewn in under the lace and other parts of the gown, so that they could not be seen.—The Electric City.

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## BOOK TABLE.

The Credit Man and His Work. By E. St. Elmo Lewis. Detroit: The Book-Keeper Publishing Company, Ltd. 1904. Pp. (5¾ by 7¾ inches), 360. Illustrated. Price, $2.

In convincing chapters, presented in logical sequence, the author gives his views of the true meaning of credit. His is not the unqualified definition of the dictionary, but one which may be expressed as follows: Credit is a transaction by which I give you of my goods today, and tomorrow take of yours; but it must be probable that you will have goods tomorrow, and the probability must be supported by evidence. As the evidence is strong so shall the credit be good, and conversely.

To the kind and value of the evidence, and particularly to the sources whence the evidence should be drawn, much of the work is devoted. It is in this that it should be valuable to the credit man. It should be of value to him, too, wherein it is pointed out that there are potential sources of corroborative evidence in many conditions and circumstances which even by acute and practical minds may be overlooked. Of the usual sources of credit—information and the collection and recording thereof—there is much useful matter.

Both sides of the question concerning credit-indemnity insurance are presented in a chapter treating upon this application of insurance principles to the accounts receivable item of commercial assets. Herein is involved the question of the credit man's control of such assets as, obviously, such control is insurance per se.

Whether the work of the credit man may be considered rightly an art or science, and as such entitled to academic notice on the part of the reader it may be said that the subject under Mr. Lewis' treatment doubtless will be of real interest to many of that class. This may be asserted in particular of the opening chapters, which have to do with the origin of credit, and the struggle of early civilization for a common standard of value.

The book is worth careful reading by those whose work gives them a special interest in the subject, and may lay claim to no little attention on the part of others.

## Hamacek's Series Arc Cut-out.

One serious difficulty in the operation of series arc lights is encountered in the breaking of loops leading to the lamps, which of course puts all the lamps in a series out of commission. A device for cutting out broken loops automatically without serious loss of current is now placed on the market by A. F. Hamacek of 2039 Kenmore Avenue, Chicago, and is illustrated herewith.

Fig. 1 is a diagram of the circuit. In this diagram (1) is the generator, (2) the series circuit, (0) any desirable number of lamps with the cut-outs in the

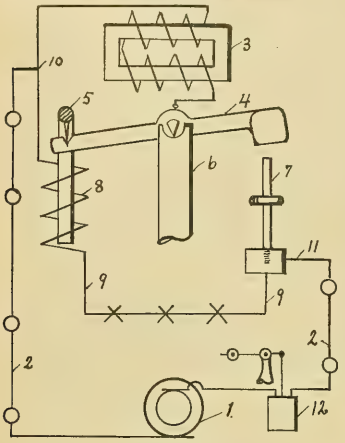



FIG. 1. DIAGRAM OF CONNECTIONS OF SERIES ARC CUT-OUT.

circuit, (3) (4) (5) (6) (7) (8) the component parts of the cut-out and (9) (x) (x) (x) the local circuit. The lamps are represented by (x), of which there may be one or more in the circuit to be controlled by the cut-out. In case any one of the lamps fails or the loops leading to it are parted the cut-out will automatically cut out the lamp and will again open when the circuit has been repaired.

The working of the cut-out is very simple, as shown in the sketch. The current enters at point (10) and divides, part going through the reactive coil (3) and part through the winding of the solenoid (8). When this has been done the solenoid pulls down the beam (4), which breaks the electrical contact between (4) and (7), or, respectively, between (10) and (11), thus putting the cut-out with the lamps directly into circuit. The dimensions of a cut-out with capacity to control one or two lamps are 5¼ by seven inches. The cap is removable from the base, it being merely slipped over the lower piece. The base screws on regular line pins, and when the cap is on, the whole presents the appearance of a good-sized insulator, as shown in Fig. 2, it being provided with the usual petticoats.

The next thing which may enter into consideration is the loss that may arise by the use of the cut-outs. On alternating current when lamps run in series with regulators of reactance type there is said to be no loss at all, and a small gain may even be made which may be explained in this way: Referring to Fig. 1, (3) and (8) are really small reactance devices similar to the regulator at the station (12), and therefore when the cut-outs

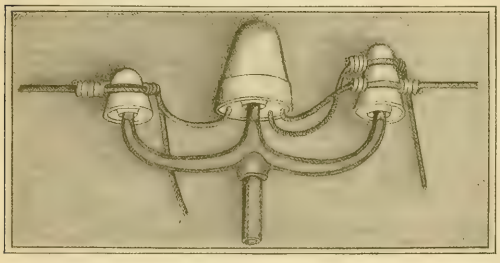


FIG. 2. CUT-OUT MOUNTED ON PIN.

are on the circuit they produce part of the necessary reactance. The regulator at the station is therefore to that degree relieved and the loss in the regulator is reduced to a value approaching the copper loss only.

In this cut-out the reactance coil (3) is out of the circuit when the lamp or lamps are in the circuit; but should the lamp be thrown out by means of open circuit, (3) is cut automatically into the circuit. In this latter event the reactance of (3) serves to compensate for the loss of resistance of the lamp and in that way relieves the stress on the regulator.

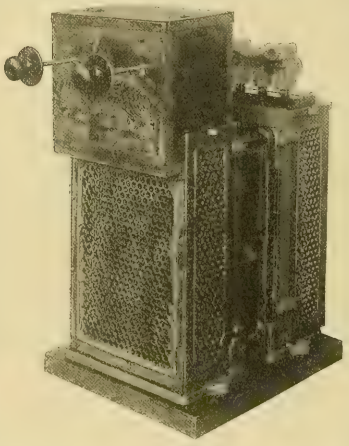
## Transformer Outfit for Thawing Ice in Pipes.

The manifest superiority of electricity as a thermal agent in thawing ice in pipes, and the field for this winter service in the northern states, has attracted considerable attention on the part of central-station managers, many of whom have improvised outfits for this purpose. There has arisen a demand for thawing outfits that shall have a range in capacity to cover all ordinary requirements; shall be portable, easy to connect and moderate in price, and to meet this demand the Westinghouse Electric and Manufacturing Company has designed the two transformers here described.

The larger of the two outfits (shown in the illustration) weighs complete with transformer, switchboard and base 750 pounds. It occupies a floor space two feet four inches by one foot 10 inches, and is one foot seven inches in height. A link in the top of the transformer case affords a means of lifting the outfit, and, if desired, truck wheels may be attached to the wooden base. It will be seen that it is of small size and comparatively light in weight.

The transformer may be operated satisfactorily on circuits varying from 1,800 to 2,500 volts. The low tension is arranged to deliver approximately 500 amperes for several hours at an electromotive force from 15 to 50 volts. By a simple change in connections, the windings may be arranged to deliver about 1,000 amperes at voltages from eight to 16, for thawing large mains, whose resistance is generally low. It is suitable for thawing anything from a one-half-inch pipe to a one-foot main.

The transformer is generously designed, and will deliver large overloads for short periods of time. The windings are air cooled. The insulation is not



TRANSFORMER OUTFIT FOR THAWING ICE IN WATER PIPES.

injured by rain, snow or ordinary abrasion. There are no moving parts to get out of order, and the entire outfit is contained in a single unit.

A light but substantial switchboard is mounted upon the high-tension end of the transformer. The switches are of the enclosed-plug type, such as are used upon high-tension arc-light circuits, and permit a variation of the low-tension voltage, and consequently the current supplied to the pipes. The switches are so arranged that it is impossible to make a wrong connection.

A second transformer outfit is smaller and is particularly adapted for thawing service piping about dwelling houses. It is light, of such proportions as to make it easy to handle, and is mounted in a wooden box provided with a handle and shoulder strap. It has a capacity of 200 amperes at potentials up to 25 volts for one hour. It is arranged for operation from a nominal 2,000-volt circuit, but can be supplied for any other primary voltage to as low as 200 volts. The voltage regulation and current control are obtained through plug switches in the high-tension circuit.

When desired, these outfits are furnished with a current-measuring device, so that the operator may know the amount of current that is being used.

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The project for an interurban railway from Marshalltown to Grundy Center, Iowa, has now reached a stage where the directors feel warranted in announcing that the road will be built within the present year. The annual meeting was held recently and A. G. Glick was elected president.

## Central-station Design in Boston.

[*Continued from page 88.*]

watt. It seems to me we need to look at the problem from a slightly different point of view than we have been doing. The great point in the past has been to obtain the most efficient apparatus and cut down the cost of coal, water and operation, whereas, in the average plant we will find that the interest and depreciation charges are at least equal, per kilowatt-hour, to the operation cost, and in some cases very much greater. The steam turbine, I think, is a move in the right direction, because there our investment is probably reduced 30 per cent. compared with reciprocating engine units of the same size.

In the arrangement of this plant I would like to criticize the statement that practically no cross-connections are installed between the various units. It seems to me that is a mistake from every point of view. We might have a 500-kilowatt unit shut down, because a 10-horsepower pump broke down. The other unit might be out of commission. In my opinion cross connections are very valuable in such cases. The same thing applies to the cross connection of steam mains, because if we shut down one unit suddenly and want to start up another one, we have to use six or eight boilers which are banked and have to use up coal for nothing, whereas, if we had sufficient steam connections we need not start up any more boilers.

In regard to the ability to start an idle unit quickly being in favor of the turbine, I do not believe, with the author, as I have seen engine units started up in two minutes. The point previously raised about the cost of the plant comes up in regard to condensers. A large condenser, with extremely high vacuum, will probably cost $8 per kilowatt. A barometric condenser, which will give equally high vacuum, can probably be had for $2. There is a difference of $6 in investment, and that $6 means, for 300 hours' use a year, a quarter of a cent per kilowatt-hour. The extra cost of water would be less than 0.01 part of a cent per kilowatt-hour, so that there seems to be a saving of 0.24 of a cent by putting in the cheaper condenser.

Philip Torchio, New York: As to surface condensers being put in the base of a machine of the Curtiss type, to economize space, it seems to me somewhat unwarranted as the turbine itself takes so little space there would be plenty of space available for the condenser outside and perhaps make the condenser more accessible and more roomy. Mr. Moultrop says that careful consideration was given to the subject of steam versus electrically driven auxiliaries, and steam was determined upon because it gives better station economy. I think in general this would be found correct in American practice, though eventually there may be the possibility, with the further development of the turbine, of using steam turbine driven auxiliaries.

C. O. Mailloux, New York: The discussion in reference to auxiliaries is one full of interest. Mr. Torchio spoke of steam turbine driven auxiliaries. While in Europe last summer I saw instances where steam turbines are used to drive feed-water pumps very successfully indeed and there is a great possibility ahead in that direction as soon as the pump shall have been sufficiently developed and made cheap enough, but we must not forget that there is danger of getting our steam auxiliaries too efficient in the use of steam. I find a decided tendency to leave out the economizer for reasons which are sufficiently stated in the paper. In the absence of an economizer you must have means of heating the feed water, and the most evident and ready means is to depend on the heat which we get from the exhaust of the auxiliaries, and when the auxiliaries have too small steam consumption there is a danger we would not get exhaust enough to properly and adequately heat the feed water, and I will anticipate a case where we might have to use live steam to heat the feed water to a point where it would be sufficiently warm to bring it into the boiler without producing troubles due to insufficient heat from contraction; so that I think it is just as well not to attempt too much in the way of undue economy in the steam-driven auxiliaries. I have had to deal with this problem in a practical way recently, and I am much more worried about not having steam enough from the auxiliaries than I am from having too much. I am afraid I will have to resort to some means other than the auxiliaries to heat the feed water sufficiently. I know of cases where the turbine manufacturer has stated that a connection may be made at the second or third stage of the Curtiss turbine so as to furnish some live steam, partially expanded, and which has done some work, for the purpose of supplementing the action of the feed water heating. I do not want to sit down before adding a word of high praise, not only for the excellence of the paper, but for the excellence of the Boston station itself. It was my pleasure to visit it in October, shortly after I had returned from a trip to Europe, where I examined several of the large stations there, supposed to be the best of their kind. I have no hesitation in saying that I consider the Boston station one of the finest and best designed that I have ever seen. It was especially gratifying to me to notice that they had spent some money in making things neat and attractive. I was so much pleased with the station that I sent my chief draughtsmen there to see it. As I approached the station, if I had not seen the chimney I might have suspected I was going into

an art gallery, which impression was strengthened when I saw the beautiful tiling on the walls. I talked the matter over with my draughtsman as to the effect of this refinement on the cost, and came to the conclusion it was a small percentage and was well spent. I believe if there were investors looking at that station they would be impressed more by the few cents per kilowatt added in ornamentation than they would by the other 98 per cent. of the cost.

W. E. White, New York: Mr. Stott based his argument on the jet condenser on the difference in cost and distributed that over a few hours in the year, 25 or 40 hours. Fifty per cent. of the station load will operate full time, 100 per cent. of the hours per year. For that portion which operates constantly, the surface condenser, due to its ability to utilize greater expansion and also to the benefits of higher vacuum, is undoubtedly preferable to the jet condenser. There is one phase of the question which has not been mentioned, and that is the effect on other parts of the plant of using a surface condenser or jet condenser. With the jet condenser you must use the outside feed water and take no benefit from the condensation. That not only affects the economy of the station in the cost of feed water, but also materially affects the cost of boiler repairs, reliability of boiler plant and the length of time during which boilers can be operated continuously without shutting down for repairs or cleaning. That is a very material point, because boiler repairs will not only be decreased, but the boiler life will be increased. The question of condenser also affects the question of whether or not an economizer is advisable. Therefore, it may materially affect the total cost of the station and reduce it as much as $5 or $10 per kilowatt.

Referring to Mr. Moultrop's paper, I think the absence of the economizer should be emphasized; also the arrangement of all the auxiliary apparatus under the immediate eye of the engineer on the engine room floor, cutting out the engine room basement and reducing the cost of building and other items making up total station cost. I also emphasize the fact that most large stations do not pay enough attention to having a large coal supply at the station. It is impossible to put what is ordinarily a sufficient reserve into a large coal bunker above the boiler rooms. The largest coal bunker practicable within reasonable limits will not give a sufficient reserve supply for large stations. If you are going to have a reserve supply outside the station, on the ground, as the Boston company has, then why have as large a coal bunker as most companies are adopting? A reserve supply outside of the station is undoubtedly desirable; therefore, the great investment in coal bunkers is unnecessary.

Mr. Stott: I take issue with the gentleman on the question of the ability of the barometric tube condenser to maintain vacuum. I can show such condensers which are operating with an average vacuum of 28 inches without any dry-air pump whatever. With a dry-air pump attached there is no difficulty in drawing 29¼ inches, which is within one inch of the barometer.

Mr. Moultrop: I agree with Mr. Stott in many of his comments. I think it is quite probable that many of the large plants have been built too good for the business they have to do. It certainly does not pay to put in the highest grade of apparatus to run it for a few hours each year. In our station the new apparatus we are putting in is the very best we can buy to carry the steady load on the system, putting it in as the steady load warrants, and holding the older apparatus for the peak and shorter running. That is about the cheapest way we know of. The old apparatus, be it ever so good, must be replaced and run a little while, cannot be sold at a reasonable figure.

There is one thing I want to call attention to and which was brought out in the paper, and that is that attention should be given to the matter of repairs, as well as the first cost of apparatus. In our case that has been given more weight in the purchase of apparatus than the first cost—that is, the ability of the apparatus to run continuously and under an overload, with very small amount of repairs. We believe we can economically increase the first cost considerably on this basis. I do not agree with Mr. Stott in regard to the cross-connecting matter. The Atlantic Avenue station was originally built with all sorts of cross connections, and in a little while we had an accumulation of stuff that no one knew exactly what it was for. Perhaps the chief engineer knew, but when it was wanted it was too complicated for us to understand its use. We took most of it out and we have possibly gone too far to the other extreme; but we have kept in mind that we were equipping a big station, that everything was big, and that we believed that simplicity was one of the prime things to be considered, and that is what we got. There are a few cross connections; but in a general way each piece of apparatus, each pipe connection and each wire connection is put in to do only one thing. In that way we reduce to a minimum the possibility of an operator doing the wrong thing, which, in a big station, with sub-stations, motor-generator sets, etc., might be a serious matter. We would rather sacrifice a little coal than upset a big station.

I believe the operating room should be separate—electrical operators are such, pure and simple, and have absolutely nothing to do with the running of the machinery. Their business is to maintain the pressure and distribute the current, and they do not require to know what is going on in the turbine room. The men in the turbine room generate the current and deliver it to the electrical operating room. The men in the operating room require a quiet room, with nothing to distract attention from their work, which is altogether brain work. In our case the switch house is so arranged that if the electrical men want to know what is going on in the engine rooms they can step through a doorway in the wall and see it.

I would state that when we purchased our auxiliaries we tried to buy turbines to run most of them. There was no turbine manufacturer at that time who would entertain the proposition and we dropped it. I have had a number of visitors ask me what the economy of the auxiliaries was. I told them I did not know exactly and furthermore did not care. The steam is absolutely all condensed and as long as I am doing that I am getting all that I can out of the steam.

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In a lecture before the Society of Arts in London on the electrification of railroads, Robert P. Porter said that London at present is expending more than $150,000,000 and projects are afoot to place London ahead of any city in the world in the amount of capital invested and in mileage. He predicted the gradual electrification of all suburban lines and ultimately of all trunk lines. He said the unification of the working of all systems in London must precede a really lasting and satisfactory solution of the difficult problem of affording facilities for the vast population of the metropolis.

## Officers and Salesmen of Allis-Chalmers Company.

taken recently at the Rel

16. H. A. Allen.
22. C. J. Printz.
25. G. C. Henry.

OFFICERS AND SALESMEN OF ALLIS-CHALMERS COMPANY.

28. H. Woodland, assistant treasurer.
29. Clemens Herschel, manager hydraulic turbine department.
30. C. A. Burns
31. H. L. Wells.
32. Franklin Wharton.
33. H. V. Croll.
34. G. L. Tiffe.
35. J. D. Millar.
36. W. C. Trout.
37. M. C. Miller.
38. W. A. Wood.
39. H. Schiffin.
40. J. A. Milne, comptroller.
41. H. S. Pell.
42. G. S. DeWein.
43. H. J. Holden.
44. M. J. Furlong.
45. George T. Thomas.
46. W. E. Dodds, superintendent of construction.
47. Richard Hoppin.
48. H. C. Helvey.
49. Albert Hoppin.
50. A. J. Gates, superintendent Chicago works No. 1.
51. George L. Fisher.
52. W. N. Tanner.
53. Richard Barnard.
54. F. W. Greenleaf.
55. H. S. Mallalieu.
56. H. I. Keen.
57. J. O. Watkins.
58. R. J. Glendenning.
59. G. F. Collins.
60. R. D. Tomlinson.
61. C. A. Derby.
62. G. A. Berg.
63. J. C. M. Lucas.
64. W. O. Everett.
65. H. A. Hammil.
66. D. T. Jones.

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The first system of electric tramways ever introduced into China has just been completed in Hongkong by the British firm of Dick, Kerr & Co., for the Hongkong Electric Tramways Company, which has its headquarters in London. It is said that an interesting fight for supremacy is taking place between the ricksha, drawn by coolies, and the new system of traction. The equipment is all of British make and of English standard practice.

## Kliegl Stamped Copper Terminal.

The terminal illustrated herewith is designed for ends of asbestos or rubber-covered wires wherever heat may be developed in electric wiring. It is made by the Universal Electric Stage Lighting Company (Kliegl Bros.) of 1303 Broadway, New York city. It may be attached easily, without solder, to any flexible or solid wire. The terminal, shown in Fig. 1, is so constructed that the bare copper wires are passed through a hole (illustrated in Fig. 2), then bent over between the wing clamps (shown in Fig. 3). The wing clamps are then tightened with pliers or hammer, which will make a solid protector over the asbestos or rubber insulation, and also secures the bare wire fast between an extra copper strip (shown in Fig. 2), which gives more than sufficient contact to the bare wire. The wing

Fig. 2.

Fig. 1. Fig. 3.

Fig. 4.

Fig. 5.

KLIEGL STAMPED COPPER TERMINAL.

clamps (shown in Fig. 3), clamping over the insulation, will prevent its working back, which often causes the wire to break off at the terminal. This new terminal is especially adapted for automobiles, telephone connections, arc lamps, or wherever there may be moving or jarring of the wire. Fig. 4 shows an old-style terminal with insulation stripped, in which the wires are soldered into the terminals. The stripped insulation causes the wires to break. Also the wire may drop out of the terminals on account of the solder melting through the excessive heat. Fig. 2 shows the Kliegl terminal in the first stage of operation, where the wire ends are shown through the hole between copper strips. Fig. 3 represents the second stage of operation. Wires are bent back with insulation between wing clamps. Fig. 5 shows the terminal complete, with insulation fastened between wing clamps, and the bare wires fastened underneath between copper strips. Fig. 1 shows the Kliegl patent stamped copper terminal for asbestos and rubber-covered wires from three-sixteenths to five-sixteenths-inch outside diameter of insulation and 25 amperes capacity.

## Magnetic-vane Switchboard Instruments.

The illustration presented herewith shows one of the switchboard instruments of the magnetic-vane type which has recently been placed on the market by the Reliance Instrument Company of 60-68 West Van Buren Street, Chicago. A growing demand has been manifested for a cheaper grade of switchboard instrument but one which will at the same time be sufficiently accurate for the purpose, and the company believes that the instrument here described will fill the requirements satisfactorily.

The instruments are neat appearing and reliable and can be used on either direct or alternating-cur-

MAGNETIC-VANE SWITCHBOARD VOLTMETER.

rent circuits. They are not gravity controlled, the pointer being held in position by two finely tempered springs. The moving parts are light and the coils are so arranged as to take the least possible current, the losses through the winding as well as friction being reduced to the lowest point. The amount of energy consumed in the voltmeters for a full deflection of the scale is unusually small, which means a considerable saving in the operation of a power plant or automobile charging boards, as a voltmeter is constantly in circuit and the energy consumed to indicate the voltage is a total loss to the plant.

The construction of the instruments is of the most substantial kind. The scale is five inches long and hand-drawn from recognized standards, the moving parts working on hardened steel pivots in jewel bearings. The standard finish is polished nickel face, with a black or dead-nickel background.

## Dr. Schneider's Lamp Flasher.

Publication in a recent issue of the Western Electrician of a description of the interesting "Firefly" lamp flasher of Dr. C. O. Schneider of Chicago has brought a letter from a correspondent in Mineral Bluff, Ga., who says that while the device may be original with Dr. Schneider, "unless it is of years' standing with him, it certainly cannot be his in priority. The same principle and arrangement have been used by Prof. J. M. Clement, Ph. D., of Mineral Bluff, Ga., for several years in his electric thermostat, one of the most successful thermostats made. This thermostat is used in a fire-alarm system and is capable of being set instantaneously for any degree of rise or fall of temperature, and shows at all times the current temperature."

To this Dr. Schneider answers: "The invention of the 'Firefly' flasher is certainly original with me, and, so far as I know, there is not another electrical instrument made that works on the same principle. It is inconceivable how anything could be similar to this simplest of all automatic electrical devices without being the same in both action and application. It is evidently impossible by the same principle and arrangement to obtain these results and also have the device act as a fire-alarm and temperature indicator. Thermostats for regulating the temperature and for fire-alarm systems are by no means new and must of necessity be acted upon by the rise and fall of the temperature in the surrounding atmosphere. This flasher obtains the heat from a coil, which also acts as a shunt and prevents sparking at the contacts. In the 'Firefly' flasher there is certainly a unique combination of many well-known physical phenomena that have not been brought together in this way before and the result is an instrument much in demand that performs its function perfectly."

## Small Cornwell Dynamo.

The R. M. Cornwell Company of Syracuse, N. Y., is putting on the market a line of direct-current dynamos and motors, ranging from the smallest made up to a one-kilowatt for commercial purposes. The accompanying illustration shows the "Wonder" dynamo, which has an output of about 12 watts and

SMALL CORNWELL DYNAMO.

is wound for a number of different voltages. In bringing out this machine, it was the aim to produce a small generator following in every detail the construction of the large commercial machines. Among the special features of the dynamo are its laminated armature, adjustable brushes, large and strong commutator and heavy interchangeable bearings. In its construction the endeavor has been to make the machine complete and efficient. It is to be used where a small amount of current or power is required and is especially desirable for use in connection with all experimental work. As a motor it will operate, running light, on about two watts of current, and with sufficient battery will do a surprising amount of work. It is also wound to run in series on a 110-volt lighting circuit. All parts are interchangeable and made of the best material.

The press of Gottenborg, Sweden reports an invention by G. Gröndal of Djursholm (patent registered in Sweden, November 14, 1903), of a process and apparatus for magnetic separation of finely crushed ore by which it will be possible to completely separate so-called "whole grain" from "half-grain" and dead ore, and at the same time to enrich the "half-grain."

## Stanley Rotated-jewel-bearing Wattmeter.

The Stanley Instrument Company, Great Barrington, Mass., has just placed upon the market a new recording wattmeter for alternating-current circuits, which contains many novel and remarkable features. The principal characteristic of the meter, in which it is a radical departure, is that the jewel bearing upon which the disk-shaft pivot rests and turns is itself turned or rotated by the train gearing, so that a new jewel surface is constantly automatically placed under the disk-shaft pivot whenever the disk moves. The meter derives its name of rotated-bearing wattmeter from this distinctive device, the details of which can be readily appreciated from the illustration on the opposite page.

The jewel-carrier shaft is connected with the train gearing by a bevel gear; whenever the train moves the jewel-bearing shaft must also move. The turning of the jewel bearing is a positive action, operated by the system of gears constituting the train-registering mechanism. At every movement, no matter how slight, of the train gearing a new spot or point of highly polished jewel surface is automatically brought under the disk-shaft pivot. Consequently during every portion of a revolution of the pivot a new jewel bearing is automatically supplied.

The gear in the train-registering mechanism which rotates the jewel-bearing shaft is so arranged that the disk-shaft pivot can be in contact with the same spot or point of the jewel surface only one time during approximately 1,800,000 revolutions of the disk-shaft pivot, the equivalent of 1,000-kilowatt-hours. For example, in a 10-ampere, 110-volt meter the disk will make 1,800,000 revolutions while the jewel bearing makes one revolution; and the train will register 1,000 kilowatt-hours. It is contended that if a stationary jewel-bearing meter will maintain its original highly polished surface, and will remain for any given period of time as accurate as it can be originally made, whether that period be a day, a week, a month, or a year, that same meter if arranged so as to be furnished continuously with 1,800,000 new highly polished jewel surfaces instead of one, must maintain its original degree of accuracy 1,800,000 times longer than the same meter could with the same spot or spots of jewel surface always in contact with the end of the disk shaft. If a meter having a stationary jewel bearing will register one kilowatt-hour without change of original accuracy, the same meter with a rotated jewel bearing will register approximately 1,800,000 kilowatt-hours without deviation from original accuracy, it is declared.

Under the continuous contact of rotation and hammering of meter pivot and upon the same spot the life of a polished jewel surface is limited and is variable, dependent upon the hardness of the jewel and the fineness of its polish, as well as on the design and construction of the meter; some meters lose accuracy because of jewel friction much more quickly than others; but it is a matter of some period, more or less extended, when the surface of a jewel in any stationary bearing meter must become roughened by the constant wear of the pivot end both from rotation and hammering.

In the rotating-bearing meter, no spot or point of the jewel surface can remain in contact with the pivot end long enough at any one time to be roughened in the slightest degree, because the pivot end is constantly moved from contact with any given spot on the jewel surface by every movement, no matter how slight, of the train gearing.

In the Stanley rotated-bearing wattmeter the jewel is so shaped that the disk shaft is maintained in exact perpendicular alignment when the meter is connected up in service; there is not possible any effect upon the disk shaft from side thrust. The jewel is cup-shaped and the jewel-supporting shaft is at an angle of about 45 degrees to the vertical disk shaft. This places the jewel in an oblique position under the pivot and the pivot is thereby brought in contact with the junction between the sides and bottom of the cup, this junction being shaped in the proper curve. The jewel carrier is a separate piece on the upper end of the rotatable-bearing shaft, and can be quickly and easily removed and replaced by anyone.

The new Stanley rotated-bearing wattmeter retains many of the characteristic features of the popular Stanley meters of previous manufacture. It is about the same size and of the same general appearance as the Stanley model "H" wattmeter, and retains the balanced-thrust principle, whereby is obviated the vibration of the disk by the alternating-current fluxes.

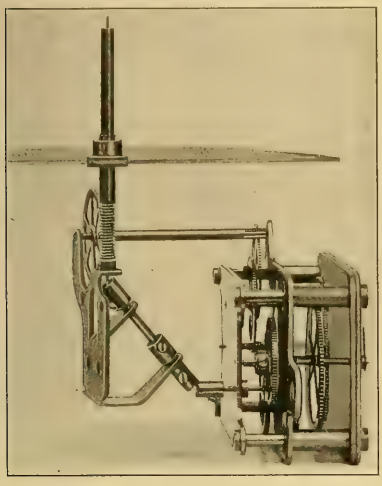
With vibration and hammer effect removed from the pivot end by the pivot-spring support supplementing the balanced-thrust construction, and with all possibility of friction wear on the jewel removed by the rotated bearing, it becomes permissible to use a heavier disk and thereby obtain a higher torque and its benefits without any of the disadvantages and injuries produced by high torque in other methods of construction. In the new Stanley rotated-bearing wattmeter the disk is 0.035 of an inch thick, five inches in diameter; the torque obtained is 50 millimeter grammes; the ratio of torque to weight is 10 to 7. It is, therefore, possible to obtain extreme accuracy on the smallest loads as well as with the heaviest loads.

It is suggested by the manufacturers that these

meters be tested by the purchasers for frictional conditions in the following severe method: Before beginning the special test ascertain the accuracy of the meter upon any desired load at stipulated rate of disk rotation, or determine the light load accuracy by comparing the full-load rate of disk rotation with the light load rate which will denote the mutual internal friction (if any) in the meters; then remove the brake magnet and let the disk spin round under full load for an hour, or a day, or a week; then replace the brake magnet, and without change of pivot end or jewel test the meter again in the same manner to ascertain the difference (if any) between rate of disk rotation at light load or at full load, or even 50 per cent. overload. No change in accuracy due to frictional conditions will be perceptible, it is asserted.

Another new and very valuable feature of the new Stanley rotated-bearing wattmeter is that it can be adjusted quickly and easily by any meterman for any frequency from 40 cycles to 133 cycles. This is accomplished by the magnetic shunt or bridge principle constituting an important part of the construction of all Stanley meters.

The new Stanley wattmeter is made with two



STANLEY ROTATED-JEWEL-BEARING WATTMETER.

terminals, one at bottom, the other at top, for connection through the meter of the two wires of a two-wire circuit, or of the two outside wires of a three-wire circuit, the shunt connection being provided within the meter.

Another characteristic and valuable feature of the new Stanley rotated-bearing wattmeter is the complete magnetic shield separating the shunt and current elements from the brake-magnet system. The excessively strong fields which necessarily result from short-circuits from lightning, or from abnormal voltage, or current overloads of any kind are confined within the iron box, and the brake magnet system is thus effectively shielded against the influence of these powerful fields and protected thereby from the injuries that must be sustained in the brake and moving system of meters which are not thus shielded.

The method of fastening cover to case is patented and consists of a sealing band or ring, which not only forms part of the means of connecting the case and cover, but also completely covers the joint between them.

The Stanley rotated-jewel wattmeter, the manufacturer asserts, has the following important features:

1. Jewel wear is entirely eliminated; the jewel actually becomes more perfect with age and use.

2. The same meter can be used on any commercial frequency from 40 cycles to 133 cycles.

3. Meters contain a magnetic shield, which effectively prevents injury to brake-magnet system from excessive voltage or current overloads.

4. The sealing of the meter is unique. It may have its case sealed entirely independent of the terminal boxes, if so desired, but the sealing of the terminal boxes permanently seals the entire meter.

5. Both current mains may be cut and passed through the terminal boxes, or one main may be put through the terminal and a shunt connection carried from the other terminal box to the meter.

6. All calibration, adjustments or any work about the meter are made without the use of special tools, and no skilled or expert labor is required. The calibration is particularly easy on account of using stationary brake magnets and adjusting their effect by screws which alter the air gap through which the disk revolves.

7. The meters have a very high torque, without the usual disadvantage of such design, and accuracy on light loads is consequently assured.

8. The shunt losses are only one watt in a 110-volt meter, considerably less than ever before successfully obtained. The shunt cores are worked at a low density, which greatly reduces the tendency to pound on the jewel. The drop in the series system is correspondingly low and does not exceed 0.4 volt at full load. The copper losses and consequent heating effect are extremely low.

9. Deviations from the voltage and frequency at which the meter is adjusted may be as great as 10 per cent. without materially affecting the calibration.

The new Stanley meter is to be sold with or without a three-year guarantee of accuracy, as the customer may dictate.

## Wisconsin Telephone Association.

The annual convention of the Independent Telephone Association of Wisconsin was held at the Hotel Pfister, Milwaukee, on January 27th and 28th. President Richard Valentine of Janesville occupied the chair. In his opening address Mr. Valentine said: "There have been incorporated during the last year in Wisconsin 32 companies, representing a capital stock of $264,340. These are mostly farmers' companies or exchanges in the smaller towns of the state. The only exchange that is being constructed at the present time in the state, of any great size, is the one at Green Bay. There is a company there that is building an exchange, and is capitalized at $250,000. They are putting in five miles of underground work, and have already something like 2,000 poles set. The capital is furnished by Chicago people. They expect to build exchanges as far up as Marinette and Oconto, and down through Green Bay; they are not only building in Green Bay, but they are also to build in Chippewa Falls. They are setting poles there now, and when they get through with that work they expect to take up Oshkosh and Fond du Lac. The exchange in La Crosse has been almost entirely rebuilt. They have put in a great deal of underground work and a full central-energy plant, and have advanced their rates.

"We have all of us a mighty sight better toll service within 20, 30 or 40 miles of our exchanges than the Bell company had a dozen years ago, and I think if we will all stand together and keep out of the Bell entanglement, there is not the least doubt but that eventually we will have as good toll lines as the Bell company furnishes today. In Ohio the Independent company has better toll-line facilities than the Bell company. You can talk from Cleveland to Pittsburg, St. Louis and Indianapolis, Grand Rapids, and all up through into Michigan; in fact, all through that whole country."

J. C. Harper addressed the convention in relation to what is known as the "telephone bill," which was introduced at a former session of the Wisconsin Legislature, but which failed to become a law. It is a bill favored by the Independents and said to have met bitter opposition on the part of the Bell company. The bill is intended "to prohibit discrimination in the charges of telephone rentals in different cities and villages," to quote the title. Cities and villages are to be divided into 16 classes, according to population, and telephone charges in each class must be uniform. If this were the law no telephone company could reduce its tolls to little or nothing to "run out" a competing exchange in a particular town. Specific rates are not fixed, it is discrimination that is aimed at. The bill is to be introduced again in the present session of the Wisconsin Legislature.

J. J. Nate of the Minneapolis office of the Stromberg-Carlson company spoke of the situation in the Northwest. He said the Independents are building their toll lines all over the country. The Tri-state Company at Minneapolis has built to Grand Forks, La Crosse, Winona, Austin and Sioux Falls, practically, and has built to Duluth, with cross lines going out all over that territory, and the toll-line receipts warrant the company in the extension of that system.

As a committee on legislation the chair appointed J. C. Kuoni of Sauk City, J. C. Harper of Madison, J. M. Baer of Appleton, Philip Sheridan of Green Bay and E. A. Miller of Hixton. President Valentine was added to the committee. He made this statement: "We are going to send copies of that bill to the legislatures in every state in this Union, and I believe that the bill can be passed here, and can be passed in other states, and if it is, it certainly will be an immense help to the Independent telephone business; it cannot help but be, because it will eliminate a whole lot of opposition that we are having now."

Mr. Davenport described the work under way in Green Bay and vicinity. The exchange is building for 3,000 lines' capacity; the present installation will be for 1,500 telephones, full central-energy, and full multiple operation on all-copper circuits. A 1,000-capacity, 500-telephone system is going in at DePere. Mr. Baer explained that the new exchange in Green Bay was on the fourth floor of the Sheridan Building. The company has decided to run a lead cable up the outside of the building, this conduit being

[illegible]

company.

"Last spring the Independent companies, from Pittsburg to Kansas City, got together and agreed upon a working basis, and employed competent men to put the toll lines in shape, so the system practically as one property, and they are so situated now that they are operating from Central Kansas, or Topeka, Kan., through to Indianapolis, and operating also from Indianapolis through to Cleveland and Pittsburg; the heavy wires are not up so as to operate through continuously from Pittsburg to Kansas City, but half of the distance is covered with No. 8 circuit, and this year it will be completed clear through. The eastern people who formed a nucleus around the Philadelphia combination, that is Philadelphia, Baltimore, etc., have a No. 8 wire through to within a few miles of Pittsburg; so that by the time the first line I speak of to Pittsburg is completed, the line will be completed through to Baltimore and Philadelphia, and, in fact, there will be two lines—a southern line, and the other more central—following the Pennsylvania Railroad through by way of Altoona and Harrisburg. The development through that section is growing very rapidly and lines are speeding in from all centers through this main trunk line. The situation in the Northwest, I am told, is very similar. You have lines running from Duluth and Superior to some points in South Dakota and also from La Crosse through to St. Paul and Minneapolis connecting with that same system, so that it will not take a great amount of development now to build a line connecting the Northwest with this main system down in the central part of the United States and also from this line in the central part of the United States down into Texas. There are also arrangements made to build a general long-distance line from Louisville on south down to the southern states so as to connect up with Southern Kentucky, Tennessee and on down through that section. The Chicago developments, of course, you are all more or less familiar with. They have an exchange there of some 10,000 or 12,000 telephones, and I do not think it will be a great while before the Independents will get a connection with the Chicago people. The officers say they are ready, and three or four long-distance companies I know are ready to build into Chicago. The situation on the Pacific Coast is in very good shape and the chances are that the entire matter will be developed so as to practically have one long-distance system. I do not mean by that one ownership, but it will be operated in one system just as the Pennsylvania railroad operates all its railroads as one system, while they have different corporations owning the different properties—or the Vanderbilt system—but the ownership will be kept local in these different properties for some time to come.

"There is, as you probably know, quite a movement on foot in New York city at the present time. The New York papers have taken it up and local authorities are inquiring into the way their conduit system is being used—or practically stolen, as they put it—by certain other companies; and the proposition looks more favorable today for building in New York than it has for some time in the past.

"We have taken very careful statistics in Ohio and they have been completed within the last 30 days, and they show between 196,000 and 197,000 Independent telephones. They also show, in round figures, 97,000 Bell telephones, and that is counting all they claim for Hamilton County, where the Independents do not have any telephones to speak of at the present time. So we have more than two to one. We have also fully three to one toll stations and exchanges, as we reached three times as many cross-road postoffices and towns and cities in the state as the Bell people reached.

"The National association, which has been in existence now for some years and which was in a measure reorganized last September at the St. Louis meeting, was consolidated last Saturday with the Interstate association. At the Interstate association meeting at Chicago a month ago they appointed a committee consisting of five gentlemen to take up the matter of consolidation with the National association. That committee met at Indianapolis last Saturday and agreed upon this sort of a consolidation. The new association is called the National Interstate Telephone Association. It is to be run by a committee consisting of the five appointed by the National, until the next meeting, which is called for Chicago on June 7th and 8th."

The matter of a standard sign for all Independent companies, local and long-distance, throughout the United States, was brought up by Mr. Hoge. On motion the association officially adopted the sign (displayed in the convention hall) which was recommended at the recent St. Louis meeting.

H. A. Nuttall of Chicago gave a talk on "The

Ways and Wiles of the Bell Telephone Company," explaining the Bell sub-license system.

Dr. George W. Wilder, professor of telephony in Armour Institute of Technology, read an interesting paper on "Simultaneous Telegraphy and Telephony." H. P. Mitchell, E. C. Lewis and others took part in the discussion.

Don Farnsworth, interested in Independent telephone securities, explained why he was gathering statistics of stock and bondholders of all Independent telephone companies.

At the afternoon session of Thursday a committee headed by H. C. Winter of Madison, the secretary of the association, reported in favor of the Wisconsin association affiliating itself with the new National Interstate Association. The report was adopted.

Mr. Winter reported that the association has 64 active and 29 associate members—about three-fourths of the Independent telephone interests of the state. He concluded: "Complete and accurate statistics of the telephone business are difficult to secure, but a careful estimate based on the data procured gives up 275 Independent telephone companies, with an investment of $4,000,000, with 1,200 toll stations, 350 exchanges and 37,000 subscribers, of which number about 10,000 are rural subscribers."

These officers were elected:

Président—Richard Valentine, Janesville.

Vice-president—J. C. Kuoni of Sauk City.

Secretary-treasurer—H. C. Winter, Madison.

The executive committee consists of W. van Middelsworth, Racine; Philip Sheridan, Green Bay; J. C. Harper, Madison; W. F. Goodrich, La Crosse; H. V. Bartlett, Chippewa Falls; John M. Baer, Appleton; E. A. Miller, Hixton, and J. C. Crowley, Superior.

The next annual meeting is to be held on December 20 and 21, 1905, in Milwaukee.

Delegates elected to the convention of the National Association in Chicago in June are Richard Valentine of Janesville (ex-officio), John M. Baer of Appleton, W. F. Goodrich of La Crosse and J. C. Harper of Madison; alternates, Prof. George W. Wilder of Chicago, Philip Sheridan of Green Bay and Charles Schernecker of Sun Prairie.

### Convention Notes.

F. B. Patten took care of the interests of the American Electric Fuse Company.

The John A. Roebling's Sons Company was well represented by William H. Slingluff and Bond Wisler.

The International Telephone Manufacturing Company of Chicago had a fine exhibit. H. H. Davenport was in charge.

C. L. Fisher, representing the Automatic Electric Company, was at the convention looking after the interests of his company.

Charles H. North, president and general manager, looked after the interests of the North Electric Company of Cleveland, Ohio.

F. E. Rotchka, state representative of the Kellogg Switchboard and Supply Company of Chicago, did energetic and skilful work for his company.

The Electrical Supply Company of Madison, Wis., was ably represented by "Burch of Madison." The company had a practical exhibit in room 10.

E. R. Harding of the Holtzer-Cabot Company was in attendance with a fine line of exhibits. He looked out for the welfare of his company with tireless zeal.

The Monarch Telephone Manufacturing Company was represented by W. H. Trimm and E. E. Yaxley. A full line of telephones was shown and the new Monarch switchboard was "much in evidence."

The Sterling Electric Company of Lafayette, Ind., displayed a line of telephones, protectors and switchboard parts. It was represented by W. E. Doolittle, president, and C. R. Brown of the sales department.

The Kusel & Kusel Company of Chicago was represented by I. J. and H. J. Kusel. Its KK magnetic Ring-Thru coil attracted considerable attention, and the company received several orders for automatic exchange equipments.

The Milwaukee Telephone Company exhibited its new automatic intercommunicating telephones and weatherproof transmitter. The exhibit was in charge of F. J. Whittlemore, president of the company, and William H. Hahn, secretary.

The Julius Andrae & Sons Company of Milwaukee was represented by H. P. Andrae, J. C. Schmidtbauer, H. S. Green and W. W. Tracey. A 200-capacity Bell-Express switchboard and a complete line of telephones and supplies were shown.

The Standard Underground Cable Company of Pittsburg was represented by E. J. Pietzcker and J. E. O'Neill of the Chicago office. They had on exhibition a full line of all sizes, kinds and capacities of high-grade telephone cables and other wires used in telephone construction.

The Standard Telephone and Electric Company, represented by H. M. Eldred, manager, exhibited a 100-line capacity switchboard, telephones of all styles and a small-sized switchboard for small exchanges. A regular switchboard operator distributed the Standard souvenir transmitter button. Upon the switchboard the Standard company has introduced a loose sleeve plug and rubber-insulated drop cores and clips upon the drop shells enabling the exchange manager to remove the drop free of the jack from the rear of the board.

The Dean Electric Company of Elyria, Ohio, exhibited a full line of telephones and switchboard parts in parlor No. 17. Ray H. Manson, from the engineering staff, was on hand to introduce the delegates to the many valuable features and novel workings of the new Dean apparatus.

The Eureka Electric Company of Genoa, Ill., received its friends in parlor No. 1, where it exhibited, among other things, a 100-line switchboard equipped with new self-restoring drops. The company was represented by Messrs. R .S. Mitten, sales manager, and C. W. Robbins, electrical engineer.

Henry D. Goodwin, 1329 Wells Building, Milwaukee, was the official reporter of the Wisconsin Independent telephone convention. Mr. Goodwin has done convention work for technical societies and the technical press for many years, is well posted on technical matters, and gets out good reports of such conventions promptly.

Frank B. Cook of Chicago, manufacturer of protective apparatus and construction material, was represented by F. W. Pardee, general manager; G. C. Fricke, Wisconsin representative, and H. R. Cook. A novelty was a working model of Cook's new No. 8 self-soldering protector. The soils were connected through testing instruments and were operated as fast as the solder cooled.

A. Meinema told his friends about his new selective-ringing, lockout telephone system. He is equipping a suitable factory capable of supplying the demand. The capacity of his system has been enlarged to 20 stations instead of 15, as at first. M. B. Austin & Co. of Chicago will be associated with Mr. Meinema in his new venture. The factory will be located at 56 and 58 West Van Buren Street, Chicago.

The Independent Telephone Manufacturing Company of Madison, Wis., exhibited in room 10, the exhibit being in charge of the company's new engineer and superintendent, A. F. Adams. Among the many interesting new things this company is producing is the "quick-changing" induction coil, Ludington patent test set and the connecting device for four-party selective telephones.

The Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., appeared in the persons of E. C. Lewis of Chicago and J. J. Nate of Minneapolis. It made a good exhibit, including the new "non-interfering" telephone, by which subscribers can call each other without disturbing "Central," or, by pressing a button, can signal the operator without ringing any other bell.

The Electric Appliance Company of Chicago exhibited a 50-line section of its new Eaco self-restoring drop switchboard, also several types of telephones which it manufactures. The Dinsmore automatic intercommunicating telephone attracted considerable attention. J. B. McMullin, the Wisconsin representative, and S. A. Dinsmore, manager of the telephone department, did the honors and distributed some useful souvenirs.

One of the most interesting exhibits at the convention was that of the Vought-Berger Company of La Crosse, Wis. This company showed, among other things, its combined bell and drop-type switchboard for country service, as well as a 100-drop express-type switchboard. There was a "legalized lottery" of a beautiful cabinet desk telephone done in Flemish oak, made by the Vought-Berger Company. Distributed throughout the hotel lobby and hall were placards announcing that this handsome cabinet would be given to the representative of one of the various Independent companies drawing the lucky number. The drawing took place Thursday afternoon, and the fortunate man was Mr. Teasdale of the Monroe County Telephone Company of Sparta, Wis. The company was represented by J. G. Ball, its northwestern representative.

## TELEPHONE MEN.

A. O. Cole of Minnesota Lake, Minn., has been appointed manager of the Minnesota Lake Telephone Company.

Charles C. Deering has resigned as manager of the Mutual Telephone Company of Des Moines, Iowa, to accept a position as secretary and manager of the Boone County Telephone Company.

## NEW COMPANIES.

The Nashville Mutual Telephone Company of Nashville, Mo., has been incorporated.

The Whitefish (Mont.) Co-operative Association has been incorporated with a capital of $25,000, and will put in a telephone system.

The Waitsburg (Wash.) Rural Telephone Company has been incorporated with a capital stock of $10,000 by J. W. Morgan, Gustav Vollmer, A. W. Phillips, W. B. Brooke, E. M. Denton, Frank Jones and Walter Price. The company will build and operate telephone lines in Walla Walla, Asotin, Columbia and Garfield counties, Wash. The principal place of business is Walla Walla, Wash.

## Ohio Telephone Notes.

According to the action taken at the annual meeting of the stockholders of the Citizens' Telephone Company of Delaware the capital stock will be increased from $100,000 to $125,000. The officers chosen by the board are: President, W. M. Haseltine; vice-president, W. G. Hornell; secretary and general manager, G. H. Carter; treasurer, F. P. Hills.

The annual report of the officers of the Akron People's Telephone Company, Akron, shows gross receipts for the year 1904 of $90,516.55. Operating expenses were $51,669.92, and fixed charges $17,628.34, leaving a surplus of $21,218.29.

An excellent statement has been made by the Newark Independent Telephone Company of Newark. During the last year the number of subscribers has increased from 1,203 to 1,811 and the toll receipts have increased 100 per cent. in two years. The company spent $10,000 out of its earnings in extensions and yet paid dividends on both common and preferred stock. Altogether $21,038 was spent in enlarging the plant. In all 75,000 feet of cable extends to all parts of the city and an exchange worth $10,000 is maintained at Granville. The plant is worth fully $180,000. It was decided at the annual meeting to increase the capital stock from $100,000 to $150,000 and use the money received from the surplus stock for enlarging the plant and building lines into the country to supply the demands of the farmers. The officers chosen a few days ago are as follows: President, Harry Swisher; vice-president, John C. Brennen; secretary, C. H. Spencer; treasurer, Edward Kibler. C. E. Hollander is the manager.

It is stated that the farmers' mutual telephone companies will be taken into the state association on a working basis in order to prevent any alliance with the Bell interests, which was threatened in some places. There will then be three departments in the association—the toll lines, city and village companies and the farmers' mutual companies. The latter will receive all the aid and attention that the others do and all will be cemented into a bond of friendship and mutual help. C.

## Michigan Telephone Matters.

The telephone fight in Caro between the Independent and the Bell interests continues. The original system in that country was known as Moore's Telephone System, under the management of W. J. Moore of Caro, who has been operating exchanges and toll lines in the "Thumb" for the last 10 or 12 years, and, for the last three, operating the Bell interests in the same territory. This system had the field largely to itself until the advent of the Valley Telephone Company, competition manifesting itself principally in the towns of Caro and Vassar.

The members of the Mount Clemens Business Men's Association have signed an agreement to discontinue their Bell telephones if the rates are raised. The matter of an Independent telephone line will also be investigated and the city attorney has been authorized to look up the telephone company's franchise for operating in the city.

The new Home Telephone Company of Ypsilanti has resumed the work of tearing up the pavements preparatory to laying conduits. This work was stopped some time ago by an injunction which has been dissolved. This new company will be the rival of the Michigan Telephone Company, and expects to be installing telephones within two weeks.

The Citizens' Telephone Company of Muskegon has had its semi-annual meeting and declared a dividend of four per cent. Reports show that the company has 1,154 telephones in service.

The Michigan State Telephone Company is about to lease all that remains of the old Detroit Telephone Company property, barring the franchise which calls for cheap telephones. All underground work, cables, etc., will be turned over to the Bell interests. Consideration for the leasing of this property is $500 per month. This action will produce something for the creditors of the old Detroit company. W.

## Telephone News from the Northwest.

The Becker Electric Company of Becker, Minn., seeks to interest farmers of the vicinity in rural electric-light and telephone service.

The People's Telephone Company of Superior, Wis., seeks permission to bond up to $100,000.

The Leslie Rural Telephone Association, near Osakis, Minn., will increase its capital stock to $13,000 and build new lines in the spring.

A telephone line is projected north from Alexandria, Minn., along the new extension of the Soo line, through Forada to other points.

The Morrison County Telephone Company has decided to connect Little Falls, Minn., and Staples by telephone.

A bill is to be introduced into the Minnesota Legislature providing for the control of the telephone and telegraph companies by the state railroad and warehouse commission.

The People's Telephone Company is planning the erection of a modern exchange building at Superior, Wis., and the remodeling of its entire system. A large amount of conduit work will also be done.

The Citizens' Telephone Company will erect a new exchange building at Racine, Wis., and put in an automatic system. It is thought that the entire improvement will cost about $150,000.

Jacob Ramstad and others have formed a rural telephone company at New London, Minn.

R. L. Parker and others have incorporated the Bremer-Butler Telephone Company at Waverly, Iowa, with a capital of $10,000.

The Union Electric Telephone Company is planning extensive improvements to its system at Davenport, Iowa, and Rock Island, Ill. K.

## Indiana Telephone Items.

Thomas O'Rourke has resigned as local manager of the Delaware and Madison Counties Telephone Company to go to Shreveport, La., to take charge of a similar plant. He is succeeded by W. J. Chance, formerly of Connersville, whose headquarters will be in Anderson.

The strong demand for telephone securities continues to be the feature of the local stock market. The bid for the New Long-distance advanced another point over its recent high mark, but none was offered.

The final hearing in the United States court in the suit of the city of Evansville vs. the Cumberland Telephone Company to oust it from the streets of the city on the ground of expiration of charter rights, which was to have been taken up January 18th, has been postponed until April. The attorneys for the city desired to file an additional brief.

The Crawfordsville Independent Telephone Company is figuring on installing an automatic system.

The Lebanon Telephone Company has, it is reported, decided to put in an automatic system instead of the central-energy system, as contemplated. Whether the automatic system has been developed to the point that co-operative lines can be accommodated properly, the Lebanon company thinks of trying. S.

## GENERAL TELEPHONE NEWS.

The Western Slope Telephone Company of Craig, Colo., has been absorbed by the Colorado Telephone Company.

The annual meeting of the stockholders of the Asheville Telephone Company was held recently at Asheville, N. C., and officers were chosen as follows: President, W. T. Gentry; vice-president, Mrs. D. R. Craig; secretary and treasurer, D. I. Carson.

The Trades Council of Spokane, Wash., has given indorsement to the application of the Independent Telephone Company for a franchise. A representative of the council is now in Los Angeles looking into the workings of the independent system in that city.

At a special meeting of the Board of Aldermen of Goldsboro, N. C., a franchise was granted to the Carolina Telephone and Telegraph Company to operate a long-distance exchange in that city. It is understood that the company will have connections all over the eastern part of the state.

The annual stockholders' meeting of the Pennsylvania Telephone Company was held in Harrisburg recently, and it was decided to increase the capital stock of the company from $3,0000,000 to $5,000,000 for the extension and improvement of the system. The board of directors elected A. R. Shellenberger, president; H. S. Huidekoper, vice-president; J. H. Grosman, Jr., secretary and auditor; W. C. Mink, treasurer, and L. M. Kinnard, general manager.

The Manitoba (Canada) Legislature has denied the applications for incorporation of the Northwest and the Independent telephone companies. In this matter Hon. Robert Rogers stated that there could be nothing to prevent the government from undertaking the ownership and operation of a telephone system of its own. The ministry would accept the responsibility, and during the year would make a close examination of the advantages of a government-owned telephone system throughout the province.

The annual meeting of the stockholders of the Hamilton County (Neb.) Farmers' Telephone Association was held at Aurora, Neb., recently. The report of the secretary showed that the company has more than 800 telephones in use in the county, whereas there were about 400 in use one year ago. The business of the association is conducted by a board of five directors, elected annually. The new board re-elected D. L. Toof of Aurora as president and J. K. Hartnell of Stockham as vice-president. The association at the present time has not a very great number of instruments in the city of Aurora, but a movement is on foot to wire the city and put the telephones in on a regular rental basis.

## MANUFACTURERS AND DEALERS.

The Green Telephone and Electric Manufacturing Company of 171 Second Street, Milwaukee, installed the hotel telephone system recently put into the Cook House at Rochester, Minn.

"Use your think tank" is the suggestion offered by a small pamphlet issued by the Wesco Supply Company of St. Louis, which offers some material for thought concerning Wesco telephones. Wall telephones, desk sets and wide battery-box telephones are illustrated as well as the Wesco solid-back transmitter and the various parts which go to make up the subscriber's instrument.

## Telephone Exchange in Neepawa, Manitoba.

What is known as the "growing-exchange" system has been installed in Neepawa, Manitoba, which has many new features in the construction of the parts. A brief description of the system will be of interest. Fig. 1 shows a front view of a 200-line section of the "International" self-restoring drop switchboard. The drop is of the tubular type, constructed of a magnet coil with fine silk-covered magnet wire wound over a soft iron core, with the spool encased in a soft-iron tube to absolutely insure against cross-talk or induction between the lines on the switchboard. The armature is pivoted on the rear of the drop and is provided with a long pin forming a latch through the shutter at the front of the board so that at the slightest impulse of the generator at the subscriber's instrument the shutter

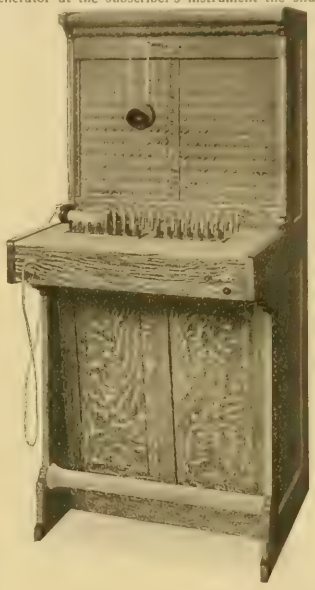


Fig. 1. Front View of 200-line Section of Switchboard.

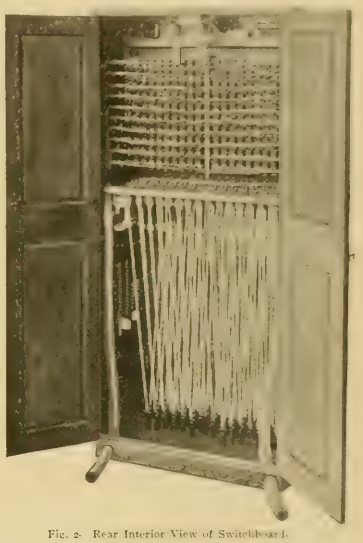


Fig. 2. Rear Interior View of Switchboard.

TELEPHONE EXCHANGE AT NEEPAWA, MANITOBA.

is unlatched and indicates the call. A small trigger is placed in the spring jack in the path of the plug and so arranged that when the plug is inserted into the jack the trigger automatically restores the drop shutter. The line equipments are held in position on the strip by the ferrule of the jack which screws into the jack base, firmly clamping these parts.

The clearing-out drops or "disconnect" signals are placed in the bottom row and immediately above the cord circuits. The board is equipped with 15 pairs of connecting appliances, each pair consisting of a ringing and listening key with ring-back key, a pair of plugs, cords, pulley weights, cord terminals and the necessary wiring. The plug-shelf is covered with heavy belt leather to provide a cushion for the plugs when returned after disconnection and also to prevent the top of the board from being marred from the continual impact of the plugs. The plugs are compact but are of sufficient size to enable making every part strong and durable.

The combination ringing and listening key and ring-back key are compactly mounted upon one base. The long key, shown toward the front of the board, is a regular ringing and listening cam. It is so connected that when an operator inserts a plug into any of the subscribers' line jacks and presses the corresponding cam toward the board it throws in and connects the operator's instrument with the particular line.

After the mate plug is inserted into the line jack of the subscriber wanted and the key is pulled toward the operator it cuts in the generator and rings the subscriber's bell. When the key is in the ringing position it is automatically restored when the operator releases the pressure on the cam. The key may, however, be locked in the listening position so that an operator can carry on a long conversation with a subscriber, if necessary, without holding the key in position. When it is desired to ring back on the line originating the call the small button back of the regular ringing cam is pressed toward the board, which throws the generator on the answering cord.

Fig. 2 is an interior view of the rear of the switchboard, showing the wiring of the line equipments, the night bell, the operator's instrument induction coil, the central-energy coil, the cord circuits, etc. The wiring shown is for either a generator-call or central-energy system. As constructed and used at the present time it is for generator-call and local-battery system.

[illegible] by cutting out the generator and installing a condenser [illegible] from the hook, and the disconnecting signal may be thrown by replacing the receiver. This enables re-equipping any exchange on the installment plan, making the change in sections and when completed costing practically no more than if the change were made at any one time.

All the outside construction at Neepawa was rebuilt; all of the heavy leads of open wire were provided with standard No. 20 B. & S. gauge conductor double-wrapped paper-insulated lead-sheath cable of the highest grade, making the change practically a cable-construction system. The cables are terminated in Moon fused iron terminal heads, provided with galvanized iron boxes, which fully protect the cables and the exchange in the best manner possible. At the office the cables terminate in Novelty pot-heads, from which the lines are run to an American lightning arrester and distributing rack.

The contracts for the exchange equipment and outside work were awarded to the International Telephone Manufacturing Company of Chicago.

## EXTENSIONS AND IMPROVEMENTS.

The system of the Sunset Telephone Company has been completed and is now in operation at Sparks, Nev.

The Rocky Mountain Bell Telephone Company has petitioned for a franchise to establish an exchange at Morgan City, Utah.

The Pacific States Telephone and Telegraph Company has authorized the extension of its long-distance line at Lind, Wash., to take in Pasco. It will furnish long-distance telephones for Connell, Hatton, Cunningham, Eltopia and Mesa. The company is putting in an exchange at Medical Lake.

At a directors' meeting of the Kansas Telephone and Electrical Company of Parsons, Kan., the name of the company was altered to the Parsons Home Telephone Company and an increase of $20,000 in the capital stock of the company was authorized. The company has in operation a new 600-line switchboard, recently installed by the International Telephone Manufacturing Company of Chicago, and has almost finished the complete rebuilding of its cable and wire plant throughout the city. Both the switchboard and cable plant are built with a view of an ultimate capacity of 1,000 subscribers. The company will string 27 miles of copper to Cherryvale, making connection with the long-distance lines of the Kansas City Home Telephone Company, and will build a copper circuit east to Pittsburg, Kan., and connect with the Kinloch lines at that place. The iron lines to Oswego, Cherryvale, McCune and Pittsburg will be rebuilt and used for local toll service.

## Series Alternating Arc Lighting.[1]

By E. P. Warner.

In many of our larger cities, the lighting systems at present in use, and a number of which have been installed within the last 10 years, are so far from filling the demands of economy and certainty of operation that it will not be long before the increased service and reduced cost demanded will bring about their replacement by systems more fully filling all requirements.

In the series-alternating arc-lighting system of today we have a most practical, I may say beautiful, means by which the necessary electrical energy can be supplied to the different sections of a large city. Instead of a large number of small lighting stations scattered about the city, with their attendant nuisance of smoke, noise and dirt, their high cost to maintain and operate and many other objectionable features, we can have large stations located at a considerable distance from the city, where land would be comparatively cheap, also condensing water and fuel. From this station supply mains at high pressure can be run to any desired number of distributing stations equipped with transformers and regulators. Such a station would be practically noiseless and smokeless.

In the past we have heard much regarding the relative lighting efficiency of different classes of arc lamps. The change from an open-arc system to the alternating-enclosed-arc system often brings up the question of comparative intensity of light. Lighting committees and station managers must be satisfied regarding that point before they can make an intelligent selection of a system. The old commercial standard open-arc lamp of 450 watts or 2,000 nominal candlepower, as adopted by the National Electric Light Association, has been an accepted standard for many years. Lamps of lower wattage have been used extensively, but the 450-watt lamp has come to be pretty generally recognized as best adapted for street lighting.

A 450-watt alternating-enclosed-arc lamp is fully equal to the old open-arc direct-current lamp for street illumination in respect to the amount of light given, and far superior to it in the matter of lighting effect, as demonstrated by the increased field of vision.

In the substitution of series-alternating arc lamps for the open arc in tower lighting, the results have been exceedingly gratifying. Lamps were used of about 420 watts at the arc with 18-inch metal shades, white enameled on lower surface. It was found that the light at and near the base of the tower was very much greater, while the general average lighting at a distance from the tower was fully equal to that given by the open arc.

In the equipment of a station for the operation of series-alternating arc lamps the choice of suitable switching and controlling devices becomes an important matter; not that these details are extraordinary in number or complication, but for the reason, as often happens, that there are several good ways of doing the same thing.

A switchboard should have a system of stab switches, one for each of the two terminals of a circuit, so arranged that it may be transferred from one system of supply to another, and so that any circuit can be readily disconnected from its source of supply. The first provision is made with a view to permanency of operation of a circuit. Failure of a transformer or regulator should not compel the shutdown of a circuit for more than a very short length of time, and a simple means should be provided for bringing into service a new source of supply. This is ordinarily an extra regulator and transformer, properly installed and connected to the switchboard, held ready for use in emergency. In very large installations it is necessary to have a number of such extra transformers and regulators, with connection buses running the entire length of the board, thus permitting the connection to any arc circuit by means of stab switches. Transfer buses for interchanging the circuits are not used in the present practice to any great extent, it being found unnecessary to make transfers very frequently or to any very great extent. A good reliable ammeter should be installed in each of the arc circuits. This need not be an expensive instrument, but should be one reasonably accurate, and allowed to always remain in circuit while same is in use. Where very high potentials are used it is customary to use a current transformer to actuate the ammeter, in order to insulate it from the circuit, and thus render it more safe to handle and reduce the liability of crossing to other instruments on the board. Where aerial lines are used, a good system of lightning arrester should be installed at a point on the circuits immediately after entering the station. It has been found desirable to dissasociate the lightning-arrester installation entirely from the switchboard proper, making it a special feature of the installation.

Transformers and regulators can be installed in a separate room or building, if desired, and, generally speaking, this is a good plan, for the reason that it more or less isolates different portions, thus reducing the risk of injury or loss from fire. The transformers used in many of the systems, where inductive regulators are employed, are of the ordinary constant-potential type, and may be either oil-insulated or air-cooled.

The usual practice today in the matter of regulators is to have all regulators of full-load capacity, so that they not only serve as current regulators for small changes of load and voltage, but act also as safeguards in case of a complete short-circuit of an arc circuit.

One of the most prolific sources of trouble on outside construction work lies in the lamp suspensions. Where lamps are suspended from span wires crossing the street, it is not uncommon to find a very poor insulator interposed between the lamp and the span wire. This often puts the full strain of the extreme voltage of the system between a lamp and the suspension wire to ground. Heavy leakage and general low line insulation is the result of such construction. In many cases the line loop extending from the pole to the lamp is brought to a small wooden cross-arm equipped with small porcelain knob insulators at each end, and from there extends downward to the terminals of the lamp, which is in turn insulated from the small wooden cross-arm by a single porcelain insulator, the cross-bar itself being practically uninsulated from the span wire when the lamp is hoisted into position. Under these conditions the line insulation is secured only by the small porcelain knobs at the end of the cross-bar and the surface of the cross-bar itself, which in ordinarily stormy weather is entirely insufficient. Under the conditions described above, the lamp itself is also subjected to severe strain by reason of its insufficient insulation from ground.

No superintendent of a station who has proper regard for the safety of the lives of his employes will permit them to handle a live lamp while standing on the ground, and no matter what breakdown test a lamp may be said to stand, the employe should not place reliance on it, but should as thoroughly insulate himself from ground as though the lamp were alive in all parts.

Now a few words as to the desirable features in the series-alternating arc lamp:

First—It must be one in which the operating parts are few and of such design and construction that stock repair parts can be used in repair with facility and dispatch.

Second—The parts should be so assembled and attached as to facilitate removal and replacement, also to give ready access for examination and adjustment.

Third—All material used should be of a character to best resist the action of the elements and ordinary wear and tear encountered in actual service. The quality of material used and its application should be a matter of careful scrutiny to the station manager, as therein lies part of the secret of reliable and continuous service. Do not let first cost be the prime factor in your choice of a lamp.

Fourth—Regarding the performance of the lamp and the safeguards provided, I would say that it should be capable of regulating the voltage of the arc to the point adjusted within three volts in either direction, and when operated with a current of 7½ amperes should give a life with each trimming of approximately 90 hours.

It is found in practice that variation in the sizes of the carbons, in the character of the core, in the density of the material used in the carbons, will considerably affect the length of life. The power factor of an arc lamp varies with the quality of the carbons, with the position of the arc in the globe and also with the character of the cored material. It has been found possible in experimental practice to maintain an alternating arc using two cored carbons of very rich material at unity power factor, but such results have not as yet been obtained commercially. With the ordinary carbons obtainable today, a general average power factor of 90 per cent. in the arc can be obtained reliably.

In the choice of enclosing globes it has been found that ordinary clear glass gives the greater general satisfaction, the distribution or diffusion of the light from the arc affected by the globe being practically as good as from any form of tinted or opalescent globe after one or two hours' operation. Practically the only reflector which can be used in combination with the alternating arc lamp is one placed above the arc and outside of the outer globe. I would say in this connection that certain users are making use of the reflector without employing an outer globe, making use of special tempered glass inner globes, which will stand the action of the elements very well. This is even accomplished in tower lighting, where the force of the wind is very great, and rain and snow have full sweep. Reflectors which are very small cannot be applied practically to the alternating arc, for the reason that the upper lobe of light is so disposed that it cannot reach a reflecting surface which is very close to the central line of the lamp.

It has come to my attention in a number of cases that the central-station men engaged in making preliminary tests of arc lamps have endeavored to compare the different lamps offered on the basis of number of hours service with one trimming. In this they have apparently lost sight of the fact that the number of hours service with a trimming is controlled solely by the carbons and the amount of light given, the lamps having, in fact, nothing whatever to do with the result. In order to give a good steady light of sufficient power, it is necessary to admit a certain amount of air to the enclosure, restricting this amount only to the point where high lighting efficiency and reasonable length of life are obtained. We reach a point in this line of research where one line crosses the other; there we must stop, knowing that a displacement in either direction will give unsatisfactory results.

In this connection I would say that nearly all the reputable manufacturers of arc lamps of the present day are practically unanimous as to the most desirable conditions in respect to the above features, and it is only the unprincipled dealer who tries to influence the customers by claims for greater life than can be given with satisfactory lighting power.

### Discussion (in Abstract).

A. A. Morton, Pittsfield, Mass.: There is one thing I think ought to be brought out very prominently in this arc-light question, and that is, that it is impossible for us to get together and say that the series-alternating system is the thing for everybody to put in. I have done a good deal of traveling through this part of the country, and while I think that the series-alternating system is what we are all coming to, and have got to put in eventually, it does not seem to me that we can take up every plant and say that now is the time for them to put the series-alternating apparatus in. There are cases I have run across—a good many cases lately—where I have gone into the matter to some extent, and where it does not seem advisable to me for the central station to change over from direct-current to alternating-current lamps. There are several reasons for that. Some reasons lie in the plant, local conditions, and some lie in the conditions of the city council. I think that one of the principal difficulties in changing over from alternating current to direct current is the point of the city council. Mr. Warner called attention to the fact that he thought it was necessary to have an ammeter in every circuit; then he brought out later the fact that the central-station man does not depend so much on his ammeter as on the accuracy of his regulator. It is my experience that it is unnecessary to have an ammeter in every circuit. We are building two circuit regulators, a good many of the other companies are doing so. I think if you put one ammeter to each regulator you will have all that is necessary. You adjust your current once, and the possibility of its getting out of adjustment during one night's run is comparatively small.

H. Almert, Oak Park, Ill.: I would like to ask Mr. Morton if that ammeter reads the current for the whole circuit?

Mr. Morton: It will read the current for one circuit. You adjust with a plug when you start up. Of course, each regulator is supposed to have a standard adjustment, and then you plug in when you start up your circuit. Your readings are O. K.'d for one circuit, and then you change over to the other circuit, and it is O. K.'d there.

Mr. Almert: If you have a dozen circuits the same ammeter will do for all?

Mr. Morton: Yes; although I think it is wise to have an ammeter for each regulator.

Mr. Almert: The National Electric Light Association has threshed out the photometry of arc lamps pretty thoroughly; but I do not know exactly at this time what the difference in the light efficiency of the two arcs, the direct and the alternating, is. It is considerable, there is no question about that. One property I am connected with has a series-enclosed direct-current arc lamp operating on 6.2 amperes, and it certainly requires at least 7½ amperes of the alternating current on a constant-potential circuit to give anything equivalent to the same light. I should like a little information about the ratio there.

T. F. Grover, Fond du Lac, Wis.: While I cannot give the difference in efficiency of the two lights, I agree with the gentleman who just spoke in reference to the inability to adopt an alternating system of arc lighting exclusively. I had this matter up with our City Council in Fond du Lac some three years ago, when we were about to renew our contract; and I found it was impossible to renew our contract with an alternating-light system. The committee appointed by the council had looked over different plants and decided they wanted direct current and enclosed lamps; and it was "up to" our company to furnish them direct current and enclosed lamps or let them put them in themselves. Consequently we renewed the contract with direct-current enclosed lamps. It was decided by the committee of our council at that time that they received more light from the direct-current lamp.

George Cutter, Chicago: I believe that in all currents, especially the alternating current of 4,000 volts or over, the trimmer should not touch the lamps while in circuit at all, and I was quite pleased to hear the expression of this view from Mr. Warner. I have met the same opinion from many engineers, and believe that will be the practice. There is a tendency in some quarters not to pay sufficient attention to insulators for the high-voltage alternating-current over the lamp, between the lamp and its supporting cables. It is quite common, however, to put in a cut-out switch that is supposedly absolutely efficient. Some of them are safe for this purpose, and some of them can be so thrown as to still leave the lamp in contact with the live circuit. Now those switches are not always sufficiently insulated from the hoods that are made over them, and, as a result of such construction, a means may

1. Abstract of a paper read before the Northwestern Electrical Association in Milwaukee, January 19, 1905. Mr. Warner is an electrical engineer of the Western Electric Company.

be afforded to the current of escaping so as to cause some unfortunate accident. I have been called upon to help out some companies where citizens of the town were killed by coming in contact with guy wires made dangerous by failure of the insulating device above the lamp; and it is to be regretted that so many lamps will be put in on these high voltages without a proper insulator between the supporting wire and the lamp. I believe, with Mr. Warner, that no lamp can be made, or, at least has not been developed as yet, with insulation between the cover of the lamp and the active circuit part, which is safe for 6,000 or 7,000 volts, and which will remain so out in the weather—not so much because of the action of the weather itself, for the lamp is pretty well covered, but chiefly in the shaking that the lamp gets, not only from the action of the alternating current in the lamp, in the mechanism, but because of the wind. A few little raps on the insulation are insignificant, but hanging up in the weather these lamps get little bits of raps by the millions that result in the disintegration of the insulating materials, so that, while lamps are made today that have good insulation for 6,000 or 7,000 volts between the conducting parts of the case, it cannot be depended upon, for safe practice, after they are out in use.

### The Weston-Jewell Case.

Judge Kohlsaat's order granting a preliminary injunction in the case of the Weston Electrical Instrument Company against the Jewell Electrical Instrument Company was entered on January 24th. The opinion giving the judge's decision in the case (relating to claims 8, 12 and 13 in patent No. 392,387, granted to Dr. Edward Weston on November 6, 1888, for an electrical measuring instrument) was given in the Western Electrician last week. The case came to a hearing in Judge Kohlsaat's court on November 29th. There was a large number of interesting electrical exhibits put in, mainly by the complainant company. William Kenyon of the firm of Kenyon & Kenyon, New York, and Charles A. Brown of Chicago were counsel for the complainant; W. Clyde Jones appeared for the defendant. Dr. Edward Weston was present in person and assisted in showing to the court the different appliances. There were also present F. B. Badt, the western agent for the Weston Electrical Instrument Company, George M. Willis, consulting engineer, and many other electrical people, who showed much interest in the demonstrations and the law case.

### Business Opportunities Abroad.

The Alexandria Tramway Company, Alexandria, Egypt, has received permission to build several electric-railway lines in that city.

The Frankfort Gazette announces the proposed construction of an electric railroad to connect the city of Mannheim with the town of Duerkheim, Germany.

The Companhia Carris de Ferro de Lisboa, in Lisbon, Portugal, has applied for a concession to build several electric street railroads in Lisbon.

An electric railway is projected in Cadiz, Spain, by Ubaldo Fuentes Birlaya.

The authorities of Suez, Egypt, have entered into a contract with G. Beyts & Co. to erect an electric plant for lighting that city.

The town of Tanta, Egypt, is to contract for an electric-lighting plant.

The municipality of Villeneva y Geltra in Spain is open for proposals to light the town by electricity.

The controller-general of ports and lights administration at Alexandria, Egypt, will receive bids for the construction of a lighthouse at Sanganed Reef, near Suakin.

### South Side Elevated Traffic in 1904.

The year 1904 was relatively a poor year for the South Side Elevated Railroad Company of Chicago. The total earnings of the company were equal to 5.53 per cent. of the capital stock. The income from passengers was $1,523,421 compared with $1,629,360 for 1903. Maintenance, loop rental, etc., amounted to $969,975, and the total operating expenses were $1,574,829, so that the net earnings were $80,082 less than for 1903. The daily average of passengers carried during the year was 83,247. In 1902 the daily average was 78,566. President Carter, speaking of the sale of bonds for the new extensions and as to the progress of the work, in the report said that the purchase of the necessary real estate has been pushed with all promptness and most of the right-of-way has been acquired. Few condemnation suits will be necessary, and it now seems apparent that the right-of-way will be ready in ample time for the erection of the steel structure. The foundations for the third track and for the main or east and west line in Englewood are being rapidly put in.

The early construction of an electric railway between the big mines of Shoshone County, Idaho, and Cœur d'Alene City is contemplated, and capitalists are now investigating the matter. The proposed route runs from Cœur d'Alene through Fourth of July Canyon, and by the old Mission to Wallace. After the road is placed in good running order the grade is to be gradually improved until freight can be hauled.

## CORRESPONDENCE.

### Great Britain.

London, January 21. It is not often that Mr. Trotter, the electrical adviser to the Board of Trade, has such a damaging report to make with regard to a large electricity supply undertaking as the one just issued with regard to the serious breakdown in the supply system which took place at Bradford a short time ago. Mr. Trotter sums up the causes of the accident as follows: (1) The lead sheaths of the cables were not electrically continuous across the joint boxes. (2) Leakage currents have been allowed to pass and appear to have been undetected, or, if detected, they had not been localized or removed. (3) No fuses had been provided. (4) No arrangements had been made for preventing an extensive stoppage of supply. It also appears that the Board of Trade regulations, Nos. 8 and 28, dealing with the maximum leakage current allowed on a system, and the prevention of electrolytic damage, respectively, have not been complied with. The report goes on to recommend that the system of distributing mains in Bradford should be separated into sections corresponding approximately to different feeders, and that these sections should be interconnected only through suitable circuit-breakers or fuses, arranged so as to be easily inspected. An improvement in the switchboard at the works is also recommended. From all accounts, it does not appear that the present staff at Bradford is altogether responsible for the bad state of affairs, for with the comparatively poor salaries which prevail in municipal employ, officials are constantly on the move into better positions. Hence, apparently, the blame can be traced to no particular individual. Probably the poor organization existing in the mains department has been handed on during frequent changes in its personnel. A report by the chief electrical engineer certainly points to such being the case, and that the system is at last beginning to be made to suffer in consequence.

Referring to my note last week concerning a proposed conference of London Borough Councils to determine a common course of action in opposition to the several companies who are proposing to seek powers to supply electrical energy in London, in the next session of Parliament, the meeting, which was duly held, was unfortunately not quite of so harmonious a character as one could wish for the benefit of the cause which it has to uphold. A tendency on the part of the delegates to rake up old grievances, and the fact that some authorities only affected by one or two of the bills did not see their way to pay the same proportion of the costs of the opposition as those affected by several bills, introduced into the proceedings an air of levity and a want of dignity which, no doubt, will be skillfully put to use by the companies when the matter comes to be threshed out before Parliament in a few months time. However, resolutions were eventually passed which pledge all the authorities represented to oppose, and to bear some proportion of the costs. An executive committee was appointed to attend to details. Independent action is to be taken against these power bills by the authorities affected by them outside the London County area. Already several petitions have been lodged against some of them on small technical points in the very earliest stage of the parliamentary career, so that the amount of opposition on really material grounds will be very considerable.

Some English engineers, among them being Sir John Wolfe Barry and Colonel Crompton, have been studying the underground system of pneumatic parcel dispatch in Chicago and are very much "taken" with the principle. Colonel Crompton impressed the value of the system upon the Royal Commission on London Traffic as a means of alleviating the present congestion in the streets by relieving them of the large number of small parcels-delivery carts now upon them. It was not surprising, therefore, to see that it is proposed to form a company with a capital of $20,000,000 to inaugurate such a system in London. Of course, parliamentary sanction will have to be obtained, and Sir John Wolfe Barry is engineer to the scheme, which will be placed before Parliament this session.

The question of adopting electric traction is again attracting the attention of one or two of our main-line steam-railway companies. An interesting experiment is to be carried out by the London, Brighton and South Coast railway with single-phase traction upon a short section of line in London, under the guidance of Mr. Philip Dawson and Major Cardew. The Great Western Railway Company is also about to make a start upon the conversion of some of its local lines in London upon the third-rail system, similar to that adopted for the Inner Circle. The reason for this is that the Great Western company has running powers over the Inner Circle, and consequently the same system is imperative. A 10,000-kilowatt power station is to be erected, the contracts for which have been let. In fact, this was decided upon some time ago and was announced in these notes, but the matter appears now to have been actively taken up again, and a start is to be made forthwith.

The National Telephone Company has been asked by several provincial towns to reduce its charges for subscription. This has come about as a result

### Dominion of Canada.

he believed, would be electric, not steam.

The first exhibition ever given in Canada of the working of the [illegible] was made a few days ago [illegible] ian Building, where messages were received from a station on St. Lambert Hill.

Application will be made at the coming session of the Quebec Legislature for a bill to incorporate the Longueuil Tramway Company. The object of the company is to build an electric railway from Montreal to Longueuil, and through other parishes of Chambly County, either by the Victoria Bridge in summer, or, in winter, to Montreal or Maisonneuve, across the ice. The capital stock is fixed at $100,000, and authority is asked for the issue of $25,000 of bonds.

The report that the Mackenzie and Mann interests had purchased the Niagara, St. Catharines and Toronto electric railway, for Canadian Northern railway purposes, is contradicted by Mr. Frederick Nicholls, president of the board of directors of the former railway. He said the line has been purchased by a syndicate independent of any other company.

It is stated that the Montreal street railway is now seeking a 32-year extension of its franchise, and has made a definite offer to a committee of the City Council. The company's existing franchise has 18 years to run, so that the proposed extension would give it a franchise of 50 years from the present time. The exact terms of the proposed agreement with the civic committee have not yet been given out, but it is understood that, in return for the extension desired, the company will make a number of important concessions to the city. In addition to the ordinary percentage of its earnings, which it now pays into the civic treasury each year, the company is willing to pay a further sum of $110,000 per annum for the space of 20 years. The company also guarantees to pave the space between its tracks and to a distance of 18 inches outside its rails at its own expense, and in summer will sprinkle all the paved streets on which its tracks are laid.

W.

### New England.

Boston, January 28.—Among the bills introduced into the Massachusets Legislature for the session now under way is one to permit the Boston Elevated Street Railway Company to acquire by purchase the West End Street Railway Company, of which the former road is now the lessee. The preferred stock of the West End road is now guaranteed an eight per cent. dividend annually and the common stock a seven per cent. dividend, under the terms of the lease. It is proposed that preferred Elevated stock shall be exchanged for the West End stock.

The Worcester Consolidated Street Railway Company has secured the right to locate its tracks in the town of Sterling, thereby making the construction of a proposed new line between Worcester and Leominster possible. The new route will shorten the running time by one hour between the two municipalities.

The Boston Wire Department continues this year the work of having telegraph, telephone and electric-light wires placed underground by ordering the change from overhead to underground in certain sections of the East Boston and Charlestown districts. There will be about two miles of thoroughfare cleared in each district.

On the petition for a receiver for the Hampshire and Worcester Street Railway Company, Judge Holmes at Worcester appointed George S. Taft of that city in such capacity.

The Lowell and Boston Street Railway Company's property, for some time in disuse but formerly operated between Woburn and Billerica on the route from Boston to Lowell, has been sold at auction for $16,000, subject to a mortgage of $90,000, to Edward P. Metcalf of Providence, R. I.

The bill to incorporate the Boston and Providence Electric Railway Company, the Shaw project designed to give rapid service between the two cities, has been submitted to the Legislature of Massachusetts. The capital stock is named as $1,500,000, and the incorporators are James F. Shaw, Phineas W. Sprague, George A. Butman, Bertram Sumner, Fred C. Hinds, G. K. Wheeler and Henry F. Ross.

The story has been current in Springfield during the last week that the Consolidated road is after more Massachusetts properties. The statement is made that negotiations for a controlling interest in the Springfield and the Holyoke street-railway systems have been instituted, also that the Northampton system is wanted. The Springfield railway pays eight per cent. dividends on $1,968,000 stock and

the Holyoke railway a like interest on $700,000 stock.

Returns from the several Massachusetts street-railway companies show that only 14 out of 74 operating in the state paid earned dividends last year, although 11 more had funds wherewith dividends were paid. Five companies went into the hands of receivers in 1904, and 30 failed to earn expenses and fixed charges.

A bill for the incorporation of the Derry and Manchester Street Railway Company has been introduced in the New Hampshire Legislature. It provides for a capital stock of $100,000. Among the incorporators are Walter M. Parker of Manchester and Edwin N. Whitney of Derry. B.

## New York.

New York, January 28.—The blizzard on Wednesday, when nearly 10 inches of snowfall was recorded, led to a general suspension of surface traffic throughout Greater New York early in the evening. A few car lines began to run on Thursday morning, but traffic has not been entirely resumed up to this evening. The Brooklyn Rapid Transit Company coped with the snowfall better than any other company, its track-clearing machinery being highly organized, and the multiplicity of its routes allowing traffic to be diverted without very serious inconvenience. As a matter of fact, the traffic over Brooklyn Bridge was never entirely suspended, but the struggle to get into what few cars were running resulted in a large number of injuries to would-be passengers. Similarly excited crowds swarmed the subway stations, but the Interborough company managed to deal with the situation. On Thursday the subway conveyed no less than 411,000 passengers. On the elevated platforms at South Ferry there were many disgraceful scenes, and at one time the police had to fight their way through the mob in order to allow incoming passengers to alight from the cars.

January has been a very busy month in regard to the discussion of transit matters. Nearly every suburb of Greater New York has made official and unofficial claims to improved facilities; and out of the whole discussion emerges a real demand for more subways. It is even suggested that the construction of the Manhattan Bridge should be deferred, and a second subway to Brooklyn proceeded with, as being, if not less expensive, at all events quicker, to get into operation.

Alderman Griffenhagen has been urging the Board of Aldermen to pass an ordinance to compel the Interborough Rapid Transit Company to issue transfers between the subway and surface cars at Broadway and Sixty-sixth Street, the only point where these lines intersect.

Mr. Grout's official inquiry into the cost of electric lighting is still pending. By some error it appears that on Friday Mr. J. Williams, assistant secretary of the New York Edison Company, was arrested in connection with his refusal to give evidence at the recent hearing, but Mr. Williams was almost immediately released, and the proceedings stayed until a legal point can be decided by the Court of Appeal.

Plans have been approved for the establishment of a small experimental electric-lighting plant, to be erected by the city at a cost of about $75,000, for the lighting of Williamsburg Bridge. It is expected that the cost per lamp will be less than under the existing method of lighting by the New York and Brooklyn Edison companies; but it is also expected to utilize city waste for fuel, and, if this is successful, the cost of operation will be materially reduced. Bids for the plant will be advertised within a few days' time.

A sum of about $25,000,000 is now in dispute in reference to the claim of the city for unpaid franchise taxes for the last four years. It has been decided that the tax does not violate the constitution of the state, but the corporations are endeavoring to prove that the franchise tax violates the federal constitution.

Rotary converters and switchboards are now being placed in the five sub-stations of the Long Island railroad. These sub-stations will receive current at 11,000 volts from the central power house at Long Island City, for supplying to the protected third rails at 600 volts. At Hammels sub-station a very large storage battery is to be put in to help out the power supply during hours of unusual traffic.

Foundations are now laid for a large six-story model factory building, which is being put up by the Bush Terminal Company in South Brooklyn. Space in this building will be rented to manufacturers, who will be able to obtain on the premises what electrical power they may need. The building is near the docks, and a trolley freight line will facilitate the handling of raw and manufactured material.

The Holophane Glass Company, the Economical Electric Lamp Company and the Bryan-Marsh Company have removed their New York offices from 123 Liberty Street to 271 Fulton Street.

The Fire Department is asking for an appropriation, not exceeding $70,000, for extensions of the fire-alarm system to all parts of the Borough of Queens.

The Board of Aldermen has taken initial action with a view to obtain a reduction of the local telephone charges. Alderman Tolk avers that rates are much cheaper in other large cities. There are seldom any complaints as to inefficient service, but the real argument hinges around the statement that the more extensive the business becomes, the more expensive it is to conduct. It is impossible to convince laymen that this is the case, seeing that in every other line of business the buyers gets a discount for large quantities, and so the public, discontent at the prospect of having to pay even higher prices as the local service is still farther extended, is forcing official action. D. W. W.

## Southeastern States.

Charlotte, N. C., January 28.—G. W. Hunley and T. L. Caudle of Wadesboro, N. C., were in Charlotte, N. C., recently to confer with capitalists in regard to the building of the proposed electric railway from Wadesboro to Winston, a distance of over 100 miles. The Whitney Reduction Company of Salisbury is interested also, this company having possession of a great waterpower on the Yadkin River, near Salisbury, where the power may be generated. It is said that the Whitney Reduction Company and the High Point Interurban Company may reach an agreement about the proposed road by which the two companies will co-operate.

The City Council of Rome, Ga., has appointed a committee to draft a bill to be presented to the Legislature authorizing the town to build and operate its own electric-light plant, the outfit to cost about $20,000.

The Atlanta-Marietta electric railway in Georgia is nearing completion and it is expected that it will be opened for traffic in April.

City Attorney Bourne of Asheville, N. C., is at work upon amendments to the city charter looking to municipal ownership of the electric-light plant. The city now spends $7,500 annually for 112 arc lights.

The new electric-light system at Washington, N. C., has been started and a 2,000-candlepower light has been placed on almost every corner.

The new electric drive for Clifton mills No. 3 at Clifton, S. C., where 35,000 spindles and 1,000 looms are in operation, has been started up, the power plant having been installed by A. T. Thompson & Co. of Birmingham, Ala.

The town of Statesville, N. C., is agitating the question of a bond issue, to include $10,000 for electric lights. J. C. Steel is interested.

Over $100,000 has been subscribed for the electric railway from Atlanta, Ga., to Anderson, S. C. The town of Lithonia, Ga., and other towns are interested in the project. The new electric-light plant at Lithonia has been started.

The first series of $30,000 of electric-light bonds has been received by the town of Martinsville, Va., and is being prepared for delivery to the purchaser, the First National Bank of Columbus, Ohio.

The suit filed January 2d and that filed January 11th in the litigation between the New York Trust Company and the New Orleans Railways Company have been dissolved by consent of both parties interested. The same order holds good for the suit filed in New Jersey.

Bids for the purchase of $100,000 bonds of the Carrollton Light and Power Company of Louisiana were opened at New Orleans and the bid of John M. Huger was accepted. This company is a part of the New Orleans Railways Company. The new bonds are to take the place of bonds of the Carrollton company to be retired. L.

## Ohio.

Cleveland, January 28.—Considerable speculation was indulged in among the traction men at the Dayton meeting as to what disposition will be made of the Appleyard roads. It was thought that something might be done at that time to take care of the properties through the organization of a syndicate, but so far as known the matter did not progress that far. There is little doubt, however, that the Philadelphia syndicate is turning every stone to get these roads and will probably do so. The bonds of the Central Market Street Railway Company are said to have been deposited in Boston and the syndicate may obtain the control of the road by buying them. The control of the city line, the Columbus, London and Springfield and the Dayton, Springfield and Urbana would give the syndicate a good foothold in the central and western part of the state, since the Cincinnati, Dayton and Toledo has already been taken over on lease to the Cincinnati Northern Traction Company, headed by S. C. Cooper, W. H. McAllister, N. S. Keith, E. H. Berry and D. J. Downing.

Several business men met at Zanesville a few days ago and arranged to organize a company to build a line from Zanesville to New Philadelphia, connecting the Columbus, Newark and Zanesville with the Tucker-Anthony line at the latter point and filling in the gap between Cincinnati and Cleveland. Among the men are S. A. Weller of Zanesville, J. H. Beach of Coshocton, W. A. Ginn of Columbus and Frank McCormick of New Concord. The organization was formed as follows: President, Frank McCormick; secretary, Samuel Nicholson, Coshocton; treasurer, H. A. Sharp, Zanesville.

The People's Heat, Light and Power Company of Springfield has been organized and will have a capital stock of $1,500,000. A number of wealthy men of the city are interested in it. A plant costing $500,000 has been planned.

Master Commissioner B. R. Cowan of Cincinnati has been engaged in taking evidence in the fight between the city of Columbus and the Columbus Railway and Light Company on the price of lighting for commercial purposes. The council some time ago fixed a price of five cents per kilowatt-hour and the company secured a temporary injunction to prevent its enforcement.

Trouble seems to have developed in formulating an association for taking care of the accident claims against the traction companies. Some time ago a plan was presented by which the companies were to pay over the percentage of the earnings reserved for accident claims to a central association that would take care of all these matters. However, some roads run over a private right-of-way and have few accidents, while others on the public highway have more expenses of this kind. Some of the roads have accumulated quite a fund and others have used most of their allowance. This inequality makes it a difficult matter to settle upon an equitable plan to conduct the business. However, it is said that some plan may yet be advanced that will be satisfactory.

Reports of the officers of the Columbus Railway and Light Company for last year show a gain of about seven per cent. in the receipts over the year before. After paying some floating indebtedness and charging off other items the company has a surplus of $120,000.

A mortgage for $4,000,000 has been given by the Toledo, Marshall and Northern to the Knickerbocker Trust Company of New York, it is reported. The company was incorporated to build an electric railway from Montpelier, Ohio, to Bay City, Mich., and work is to be commenced in a short time.

Service between Springfield and Bellefontaine has been inaugurated on the Appleyard lines.

The contract for lighting the city of Toledo has been renewed for a period of two years with the Toledo Railways and Light Company at $83 per light, the old price. Some concessions were made in the way of furnishing free lights for city buildings and power for bridges.

On complaint of the Farmers' Loan and Trust Company of Wheeling, W. Va., J. K. Geddis of Zanesville has been appointed receiver for the Ohio River and Western Railroad Company, one of the Appleyard properties, but which has been in dispute. It is said the company holds $600,000 Appleyard bonds.

The Sandy Valley Light, Heat and Power Company of Canton has been incorporated with a capital stock of $25,000 by W. L. Davis, G. B. Willis and others.

Arthur Linn has resigned the assistant secretaryship of the Utica and Mohawk Valley railway to take a position with a traction company at Clarksburg, W. Va.

Surveys have been made from Springfield to St. Paris for the Springfield, Troy and Piqua Traction Company and it is said construction work will be commenced on the line in the spring.

Expressions from a large number of Cleveland people would indicate that the three-cent fare in the zone marked out will not be satisfactory. Some plan will probably have to be devised that will take in the entire lines of the system. O. M. C.

## Indiana.

Indianapolis, January 28.—Indiana capital has recently been invested in a large power plant in Colorado which, in its possibilities, bids fair to be second only to the plant at Niagara. Dr. Henry Jamison is president and F. B. Schmid secretary, both of Indianapolis.

An automobile bill has been drafted by the subcommittee of the House committee on roads. It provides for a state license and registration, a fee charge of $1 and makes requirements for danger signals and lights. The speed is limited to 10 miles an hour in cities and 20 miles in the country. The penalties are pretty severe as to fines and imprisonment.

The bill to repeal the railway subsidy act has been approved by the House by a vote of 57 to 39. If the bill is ratified by the Senate it will no longer be possible to vote a tax in aid of a steam or electric railway in this state.

Walter McCannaha of Centerville, a director of the Columbus, Greensburg and Richmond Traction Company, reports that it is the intention of the people backing the road to build an air line from Cleveland, Ohio, to Louisville, Ky., using the Columbus, Greensburg and Richmond line as one of the divisions.

The Indiana Central Traction Company, recently promoted and incorporated by Jerome Herff at Peru, has decided to build an electric road from Peru to Hammond instead of a line from Peru to South Bend. The newly projected route will connect Mexico, Macy, South Mud Lake, Fulton, Kewanna, Lake Maxinkuckee, Bass Lake and Knox.

Service on the new single-phase system of the Indianapolis and Cincinnati Traction Company's line between Rushville and Morristown has been temporarily discontinued on account of the burning of a transformer in one of its two cars. The service will be renewed upon the arrival of three new cars now en route from St. Louis.

The Big Four railroad has put on a 30-day round-trip ticket between Shelbyville and Indianapolis for 90 cents. The electric line formerly sold a round-trip ticket for 75 cents, but the conductors are now

collecting 40 cents each way. The steam road is getting some of its lost patronage back by reason of the cut to 90 cents.

The project to build an interurban road between Clinton, Ind., and Paris, Ill., has been revived. Great interest is manifested in the enterprise.

A bill has been introduced in the Legislature to prohibit county commissioners from granting franchises on country roads to railways, steam or electric. A bill has also been introduced to amend the present law requiring toilet facilities in interurban cars where the run is 18 miles or more, so as to read "28 miles," and providing that the act shall not apply to lines that maintain toilet rooms in station buildings not over 15 miles apart.

The Indianapolis, Hartford City and Celina Traction Company has asked the City Council of Noblesville for a 50-year franchise. Surveyors on the line have reached Noblesville from Frankton. From Noblesville the line will take a direct line to Indianapolis by way of New Britton, Fisher's Station and Castleton.

The test car of the electric-railway commission has begun to make daily trips between Carmel and Noblesville over the Indianapolis and Northern electric line. Friday evening the speed was tested and seven miles of straight, level track was covered in six minutes and 30 seconds. This time was made in the face of a stiff breeze. Those in charge of the tests believe that they will result in some radical changes in the construction of interurban cars whereby a great saving of power may be had. The test car and apparatus cost $30,000.

The Indiana Appellate Court in the case of the Indianapolis Street Railway Company vs. O'Donald has decided that the driver of a wagon can proceed to drive across the street-car track at a street crossing without being chargeable with negligence when, and only when, he has reasonable ground for believing that he can pass in safety if both he and those in charge of the car act with reasonable regard for the rights of others.

New equipment has been installed in the engineering department at Purdue University and a new line of research will be opened. The equipment includes an engine designed by J. A. Meriam, a graduate of the class in mechanical engineering of 1895, called the Meriam-Abbott gas engine. It is of 18 horsepower and is self-starting. When in operation the engine pumps an air cylinder full of compressed air, so that when the engine has stopped the chamber is full. When ready to start the compressed air puts the engine in motion. Another addition to the laboratory equipment is that of the Rider hot-air pumping engine. For experimental purposes the engine is one of the most valuable in the laboratory. S. S.

## Michigan.

Detroit, January 28.—The Detroit Edison Company, it is understood, will make extensive improvements on its Delray plant if the present business keeps up, and it is expected that another plant just like the one now in operation will be built. A new turbine has been contracted for, to be installed in the present plant, together with other machinery. Extensions have been made to Grosse Pointe, where the beautiful summer homes of Detroit men are being supplied with electricity. The Edison company is furnishing all the current used by the Detroit United Railway between Clark Avenue and Wyandotte on the river-road lines, and feed wires are now being erected to connect with the Fort Street line.

The M. B. Wheeler Company after spending two years in acquiring flowage rights on the White River and planning for the building of dams is now in a position to go ahead with an organization looking to the supply of light and power to Whitehall, Montague, Fremont, Muskegon and ultimately Grand Rapids. The company will be capitalized at $1,500,000 and it is understood that arrangements have been completed for its financing. Messrs. A. O. Wheeler, R. H. Updyke and W. W. Hyde, with other Grand Rapids and New York capitalists will be associated with M. B. Wheeler in this new company.

The Toledo, Marshall and Northern Railroad Company, which proposes to build an electric line from Montpelier, Ohio, to Bay City, Mich., has filed a $4,000,000 mortgage to the Knickerbocker Trust Company of New York to secure the payment of gold bonds for this amount, running 50 years at five per cent. The mortgage covers properties in the counties through which the line will be built. It is proposed to construct the line between Marshall and Olivet first. This line has been graded for many years and was made ready for the ties a second time about five years ago. It is thought that the road will be a surety now.

Detroit's corporation counsel has prepared a bill which will enable the Municipal Lighting Commission of Detroit to furnish light for business houses and private residences.

The Shaw Electric Crane Company of Muskegon has just turned out the largest crane ever made by the company. It is a 130-ton electric crane and was shipped to Olean, N. Y., to be used in handling locomotives, which it can pick up and carry from one shop to another. The crane weighs over 100 tons.

The Menominee Electric Manufacturing Company's plant at Menominee, valued at $50,000, was destroyed by fire on January 23d. The insurance was $40,000.

S. P. Kineon has been granted a franchise in the city of Grand Rapid[illegible] to lay [illegible] out his plan of [illegible] a franchise for [illegible] will be considered later.

The interurban electric railroad company [illegible] say that it will be impossible for them to [illegible] freight unless the attitude of the city is changed in regard to a tax placed upon the [illegible] At present the city charges 50 cents a car every time a freight car moves in or out of the city limits whether the car is filled or empty.

The city of Saginaw is considering the advisability of discontinuing its arrangement with the Bartlett Illuminating Company for electric light and of establishing a municipal electric-lighting plant. It is proposed to bond the city for a little over $140,000 for the purpose of equipping a plant which shall light the streets and also to do commercial lighting.

The Grand Rapids Edison Company at its annual meeting held in Grand Rapids this week authorized the purchase of additional apparatus to increase the capacity of its plant, which will involve an expenditure of $100,000. The old set of officers and directors were re-elected.

The Michigan Central railroad is contemplating the equipping of its road from Detroit to Jackson with electricity. Van Buren Township has been petitioned for a franchise to this end.

The Detroit Edison Company is seeking a franchise for furnishing power outside of the city of Detroit. It is rumored that there is some connection between this deal and that of the Michigan Central railroad, and that it is possible that the Edison company will be the company to furnish power for the operation of electric cars over the Michigan Central tracks between Detroit and Jackson. C. G. W.

## Northwestern States.

Minneapolis, January 28.—The National Railway Construction Company, which has the contract for the construction work on the St. Louis River for the Great Northern Power Company, has let the sub-contract for a spur track from Fond du Lac, Minn., to the site of the dam to Thomas & Truax of Duluth at $20,000.

The McBride Electrical Company of St. Paul, Minn., was the lowest bidder for electric wiring at Fort Snelling, Minn., at $1,999.

The short-circuiting of a feed wire caused nine large transformers of the Twin City Rapid Transit Company to burn out in Minneapolis last week, entailing a loss of about $6,000.

The new electric-lighting plant at Wittenburg, Wis., has been completed. Otto Eckhoff will have charge of it.

A. Ripley of Oshkosh proposes to build a trolley road from Waupaca to Scandinavia, Wis.

The Calumet and Hecla Mining Company is erecting an electric plant at Hubbel, near Virginia, Minn., which will develop about 10,000 horsepower.

The Canadian electrochemical plant at Sault Ste. Marie, Ont., has been closed down and the machinery sold. The plant cost upward of $500,000.

Charles A. Hutchinson heads the Duluth Electric and Construction Company, which has incorporated at Duluth, Minn., with $50,000 capital.

The Minnesota Power and Trolley Company is negotiating for the sale of its bonds and proposes to commence work on its dam at Elk River, Minn., by April 1st.

It is reported that the Chicago, Burlington and Quincy railroad will extend the narrow-gauge trolley line from Lead, S. D., to Terry, a distance of 3½ miles.

The Wisconsin Light and Power Company has been granted a franchise at La Crosse, Wis. A plant will be erected at once in North La Crosse. R.

## Rocky Mountain States.

Salt Lake City, Utah, January 27.—By the terms of an agreement with the Utah Light and Railway Company, the interurban company of which Barney Mahler of Cleveland, Ohio, is the chief promoter has been given a right-of-way through certain streets of Salt Lake City. The line when completed will extend from Payson to Brigham City, Utah. The company is now striving to gain similar concessions in Ogden.

The Truckee River General Electric Company proposes the early establishment of a plant of 2,000 horsepower on the river at Marmol, near Reno, Nev. Electrical energy will be transmitted from this source to Reno, Carson and Virginia City.

George T. Back of Cody, Wyo., representing eastern capitalists, is making final arrangements for the installation of a power plant in Cody.

The county commissioners at Walla Walla, Wash., have granted to Edward S. Isaacs a franchise and right-of-way for the construction of an electric-railway system through a large portion of the valley.

Leading manufacturers and merchants of Spokane, Wash., at a recent meeting, indorsed the plan of the Spokane Interurban Company for the construction of its proposed system through the Palouse from Spokane to Moscow, Idaho. It is proposed to raise the necessary assets among local capitalists. The estimated cost of the road, exclusive of branches to be constructed later, is $3,250,000.

The Barber Lumber Company is at work on its [illegible] awarded to the Westinghouse company. G.

[illegible] tion Company.

W. M. [illegible] soula, Mont., making arrangements for the proposed electric street railway. The road will necessitate either the building of a new bridge across the Missoula River or the enlargement of the present wagon bridge.

The J. W. Hopkins Company of Steamboat Springs, Nev., is figuring on a complete electric plant for the development of the Great Western mines at Steamboat Springs and for the lighting of the hotel which the company intends to erect there in a short time.

W. K. Harbor has purchased the electric-light plant at Fort Benton, Mont. New machinery will be bought and the plant placed on a paying basis.

## Pacific Slope.

San Francisco, January 26.—The Gridley Electric Light and Power Company is preparing to build a plant on Hazel Street, Gridley, Cal. R. M. Bisbee is the sole stockholder of the company.

An electric-light plant is to be installed at Calistoga, Cal., by H. H. Brown and G. S. Cutler, who have been in San Francisco procuring the necessary machinery and making the arrangements for its completion.

A change of plans has delayed the starting of work on the plant of the Century Electrical Works at Point Richmond, Cal. The company first intended to manufacture electrical supplies, but it is now the intention to also manufacture electrical railway supplies and probably contract for constructing electric roads. The plant will cost $35,000.

Arrangements have been made whereby the Seattle Electric Company of Seattle, Wash., will buy out the Ballard Electric Company of Ballard, Wash., with the exception of the pumping plant.

E. P. Wheeler, manager of the Mineral Hill Mine at Cononcully, Wash., states that the plans of the company for the year include the installation of an electric plant on Salmon Creek, from which 4,000 or 5,000 horsepower can be developed to furnish power for the mine, light for the county seat and power for an electric railway to be built from Cononcully to Alma, Wash.

Eastern capitalists are planning to build an electric road to the mines of the Mount Baker District, Wash. Construction will be determined upon when a sufficient number of companies have subscribed stock toward the venture. Robert F. Estis is the representative at Bellingham, Wash.

Nelson Bennett of Tacoma, Wash., has been awarded the contract for building the power plant at Post Falls, Idaho, for the Washington Water Power Company.

Manager J. D. Crary of the Grays Harbor Electric Light and Power Company has left for the East to confer with stockholders regarding the purchase of about $75,000 worth of new machinery, most of which will be used in changing over the electric-light plant in Aberdeen, Wash.

The Portland Consolidated Railway Company intends to build an interurban railway between Portland and Hillsboro, Ore. Work will commence as soon as the most feasible route can be selected. The estimated cost of establishing the line and placing it in commission will be about $1,000,000.

The Arcata Light and Power Company has been incorporated by B. Brizard, L. J. Archer, V. R. Bury and others, with a capital stock of $50,000. The principal place of business is Arcata.

The Southern California Lumber Company is erecting an electric-lighting plant at Terminal, Cal., under the supervision of Superintendent Burke.

Theresa M. Oelrichs has awarded to the A. J. Coffee Company of San Francisco the contract for the electrical work in the Hotel Fairmount on California and Mason Streets. The contract price is $35,490.

The City Council of Seattle, Wash., has passed an ordinance authorizing the issuance of $250,000 bonds for the enlargement of the municipal lighting system and the construction of a distributing system.

F. A. Brand, president of the Benicia Iron Works at Benicia, Cal., has petitioned the board of trustees of that city for a franchise to build and operate an electric railway in Benicia.

W. S. Rheem, superintendent of the East Shore and Suburban railway, has awarded a contract to L. E. Grant to construct a power house, car barn and depot for that company on its property at Point Richmond, Cal. The contract price is $8,000.

The supervisors of Inyo County, Cal., have granted

a franchise to the Nevada Power Mining and Milling Company to erect electric-light, heat, power and telephone lines along the public highways of Inyo County. A.

## PERSONAL.

Prof. W. E. Goldsborough, director of electrical engineering at Purdue University, has become associated with J. G. White & Co. of New York city, where, later on, he will be permanently located. Part of his time, for the present, will be spent in Lafayette, Ind., the seat of Purdue.

The report that William Marconi is to marry an Italian princess is now denied. Its successor is the assertion that a marriage has been arranged between Mr. Marconi and the Hon. Beatrice O'Brien, fifth daughter of the late Lord Inchiquin and half-sister of the present Baron.

C. R. Strother of the Charleston Electrical Supply Company of Charleston, W. Va., who has had the installation of the electric plant for the Luray cavern in West Virginia under his care, is now at Logan Court House, W. Va., installing a 100-kilowatt alternator for the city light plant, to be run from waterpower developed by the Guyandotte River.

Charles H. Baker, formerly of Chicago, who founded the Snoqualmie Falls Power Company of Seattle and Tacoma and promoted and planned the White River Power Company, has sold a controlling interest in both companies to a party of capitalists, who have elected N. H. Latimer, manager of the Dexter Horton Bank of Seattle, as president. Mr. Baker is planning an early trip to Japan and China for pleasure and rest and for the purpose of exploring the waterpower and electrical possibilities of these countries. The capacity of the Snoqualmie Falls plant as built six years ago by Mr. Baker is 19,000 horsepower and of the White River plant 50,000 horsepower.

William Sellers, a well-known manufacturer residing in Philadelphia, died January 24th from the effects of an operation performed some weeks ago. He was in his 81st year. He was head of the firm of William Sellers & Co. and was president and subsequently reorganizer of the Midvale Steel Company at Nicetown, Pa., in 1873. Throughout his life he was active in many industrial enterprises. He was more than once signally honored. In 1875 he was made a corresponding member of the French National Society for the Advancement of Industry in Paris, and in 1889 he was made a Chevalier of the Legion of Honor by the French government. He is survived by a widow, one daughter and three sons.

W. N. Stevens, who has for some time filled the position of assistant mechanical engineer of the Rapid Transit Subway Construction Company, has accepted a position with J. G. White & Co. of New York city. Mr. Stevens had much to do with the design and construction of the Twelfth Street power house of the New York Edison Company. He also has had charge of the design and construction of the mechanical equipment of the Seventy-fourth Street power house and has lately been engaged on the work of designing and building the Fifty-ninth Street power house and other adjuncts to the construction and equipment of the Rapid Transit railroad in New York city. Mr. Stevens also made the plans for the machinery of the power house for the tramways of Sydney, Australia.

Thirty former associates of Mr. Calvert Townley, who recently resigned from his duties as general agent of the Westinghouse Electric and Manufacturing Company in New York, entertained Mr. Townley at dinner at the Hotel Astor, New York, on the evening of Friday, January 27th. After a brief complimentary speech by Mr. Charles A. Terry and a response by Mr. Townley there was a remarkable exhibition of legerdemain given by Mr. Thomas B. Arnold, the eastern representative of the Latrobe Steel Company, who is described as a veritable wizard in tricks of this nature. Others present were Messrs. Frank H. Taylor, William F. Zimmermann, F. B. H. Paine, E. W. T. Gray, Newcomb Carlton, T. W. Siemon, Paul T. Brady, Seth C. Adams, W. C. Webster, C. B. Humphrey, Charles F. Scott, F. N. Kollock, Jr., E. St. John, D. C. Manson, F. L. Townsend, W. C. Ward, W. E. Drake, H. P. Jones, George E. Miller, J. M. Curtin, W. L. Conwell, W. S. Rugg, O. T. Smith, C. C. Owens, P. R. Owens, Charles Robbins, H. D. Prichard, W. H. McGregor and J. K. Robinson of Iquique, Chili. Mr. George Westinghouse sent a telegram regretting his inability to be present. Mr. Townley's new title is that of assistant to Charles S. Mellen, president of the Consolidated Railways of New Haven, the electric-railway holding corporation of the New York, New Haven and Hartford Railroad Company.

## ELECTRIC LIGHTING.

The municipality of Twodau, Bohemia, Austria, contemplates the introduction of electric lighting.

A seven-year contract to light the city streets of Mason City, Iowa, has been granted to the Brice Gas and Electric Company.

The Chicago City Council has granted a franchise to the Gerts-Arnold Company for the right to lay pipes not more than four inches in diameter in North Avenue from Dayton Street to Wells Street for electric light and power, the company to pay 10 per cent. compensation.

A franchise for the erection of an electric-light, heat and power plant at Clarinda, Iowa, has been granted the Lee Electric Light Company.

The Graceville Electric Light and Water Company of Graceville, Fla., has secured a franchise to operate an electric-light plant. Construction will shortly begin.

The Palmyra (N. Y.) Gas and Electric Company has been incorporated with a capital of $25,000. The promoters are Carlton Hunt, Charles Schwarm and George Sheppard of Palmyra.

A franchise has been granted by the city of Brownsville, Texas, to the People's Ice and Manufacturing Company for the erection of an electric-light plant. Work will be begun at once.

The Seattle Electric Company has a large force of linemen stringing wires to furnish light and power in Ballard, Wash., under a franchise recently granted L. V. Brewer and transferred to the electric company. The Seattle Electric Company and the Ballard Electric Company own the poles jointly.

The governmental railway authorities of Belgium have for some time been engaged in their workshops at a station in Verviers in building a locomotive eqiupped with a dynamo and accumulators for the distribution of electric lighting through the train of several cars. The accumulators are not to be placed in the cars, on account of their weight. The new cars intended for this experimental train will soon make the trial trip from Verviers to Brussels and return.

It has been practically settled that the capital stock of the North American Company, now $17,000,000, will be increased in the neighborhood of $5,000,000 to take over from the St. Louis syndicate, now holding the shares, $2,000,000 of the stock of the Laclede Gaslight Company and $2,500,000 of the stock of the Union Electric Company of St. Louis. These two companies, respectively, furnish gas and electricity to St. Louis, and the North American Company now holds $6,000,000 of the $8,000,000 of Laclede stock and $2,500,000 of the $5,000,000 of Union Electric stock. Representatives of the syndicate, which is composed of leading St. Louis capitalists, will enter the North American Company's board of directors.

The formation of a new lighting corporation capitalized at $6,500,000 and to be known as the Western United Gas and Electric Company is reported at Joliet, Ill. The new company's purpose is to furnish light, principally gas, to 30 cities and towns in Kane, Will, Du Page and Cook counties. Included in the combination, it is said, are the Fox River Light, Heat and Power Company of Aurora, the Elgin Gas Company of Elgin, the Joliet Gas and Light Company of Joliet and the La Grange Gas and Light Company of La Grange. Under the consolidation a gas plant costing $1,000,000 will be erected at Joliet on the Drainage Canal, from which gas will be piped to the cities and towns. Col. I. C. Copley, who is now manager of the Aurora company, will be president of the new combination, it is said.

## ELECTRIC RAILWAYS.

D. B. Stockton and C. L. Pike have secured a franchise for an electric road in the neighborhood of Delta, Colo.

The Bilbao-Santander Railway Company will use electric power in operating the line from Bilbao to Las Arenas, Spain.

The Canton-Akron Railway Company is planning to increase the power facilities at its main station at Canton, Ohio, and is preparing to install a steam turbo-generator of 2,700 horsepower. Additional boilers and auxiliary equipment will also be installed.

The Chicago City Railway Company and the Union Traction Company have secured a temporary injunction restraining the city from enforcing the universal transfer ordinance passed by the council on January 16th. On February 14th Judge Grosscup will hear arguments in the matter.

The petition of the Tampa Electric Company asking permission for the use of a number of prominent streets of the city for the extension of its street-railway lines has been granted by the Board of Public Works of Tampa, Fla. The company expects to commence work on these extensions at once, and if carried to completion as contemplated Tampa will have as complete and far-reaching electric street-car service as any city south of Atlanta.

The Sioux City Traction Company of Sioux City, Iowa, expects to spend a large sum of money and employ several hundred laborers in making general improvements and additions to its system the coming summer. Part of the company's 50-mile street-railway system is narrow gauge and all will be brought to standard. In addition a band of men will be employed on the construction of the new heating and lighting plants, the franchise for which was granted at the recent election. The plans for these projects are now in the hands of the company's engineers, who will soon be in a position to make public their report.

## POWER TRANSMISSION.

The Mexican Light and Power Company proposes to transmit electrical power to the district of Tamascaltepec, Zacualpam, Sultepec, Taxco and Malinaltenango, Mexico. W. A. Ferguson, electrical engineer of the company, has gone to the regions to make a final survey for the erection of a transmission line. The transmission line from the City of Mexico to El Oro is now well under way and it is understood that by June the famous mining camp will be using electric power.

The Rhinelander Power Company of Rhinelander, Wis., has begun work on its new power house, which will develop 2,500 horsepower when completed and will cost $60,000. Two 400-kilowatt 60-cycle Bullock generators are being installed, and these will be driven by eight 34-inch waterwheels built by the Dayton Globe Iron Works. There will be six miles of pole line and one sub-station. The power house and dam will be of solid concrete construction. The plant is to be completed by September 1st.

## PUBLICATIONS.

"Sunshine" is the appropriate name, and a pretty girl in red is the picture, on a handsome calendar sent by the Central Construction Company of Oshkosh, Wis., which does electrical contracting and deals in electric supplies.

The H. T. Paiste Company of Philadelphia is sending out a collection of advertising literature in the shape of little leaflets describing some of its numerous products, such as P-K cartridge-fuse cut-outs, panel cut-outs and boxes, rosettes, receptacles for window lighting, etc.

An illustrated circular from the Model Stoker Company of Dayton, Ohio, leaves little unsaid regarding the company's model automatic furnace with its improved stoker apparatus. The construction and operation of the furnace are thoroughly set forth in the circular together with seven reasons why the company believes its product to be the best on the market.

The Allis-Chalmers Company of Milwaukee is about to issue a new publication devoted to the Gates rock and ore breakers and auxiliary machinery. Apparatus of this sort, both stationary and portable, is described and illustrated fully. The ore breakers are of the gyratory type, finally developed in 1885. The auxiliary apparatus described consists of overhead travelers, hoists, etc.

Bulletin A of the Jeffrey Manufacturing Company, Columbus, Ohio, is devoted to a complete description of a novel coal and ash distribution plant installed by the company. The bulletin will be followed from time to time with similar descriptions of interest with the hope that the descriptions will be a help to the patrons of the company in keeping in touch with the most modern methods as well as in furnishing a reference series in the line of economical disposal of material.

The London Times makes the interesting announcement that it is about to begin the publication, every Wednesday, of an Engineering Supplement "intended, broadly, to represent British engineering and science from a national point of view." Among those who are cited as in sympathy with the project are Lord Kelvin, Sir William Ramsay, Sir John Wolfe Barry, Emil Garcke, Dr. Fleming, Hon. C. A. Parsons, Professor Unwin, Sir William Preece, James Swinburne and A. A. Campbell Swinton.

"Mineral Resources of the United States" for the year 1903 has been issued by the United States Geological Survey, of which Mr. Charles D. Walcott is director. David T. Day is the chief of Division of Mining and Mineral Resources. The book contains 1,205 pages, embodying a great amount of statistical data concerning mineral products of the country. The chapter upon stone has been enlarged upon and printed in pamphlet form. Considerable technical and descriptive matter is also contained in the reports besides the merely statistical information.

Oil switches and oil circuit-breakers are treated in a circular issued by the Westinghouse Electric and Manufacturing Company. The circular contains a complete description of this line of apparatus as manufactured by the Westinghouse company. The switches are essentially knife switches immersed in oil, the blades being connected to the common operating lever by specially treated wooden rods. Besides oil circuit-breakers for pressures up to 33,000 volts, a line of high-tension circuit-breakers is described for pressures of 45,000 and 60,000 volts, meeting the demands for the highest pressure in practical service.

H. C. Cushing, Jr., of 220 Broadway, New York, author of "Standard Wiring for Electric Light and Power," as adopted by the Fire Underwriters of the United States, has just brought out the 1905 edition of this book, completely revised. Mr. Cushing, in revising this new edition, was successful in securing the services of Mr. F. E. Cabot, secretary of the Boston Board of Fire Underwriters, and chair-

man of the electrical con[illegible] the Underwriters National Electric Asso[illegible] t him with that part of the book which [illegible] the underwriters' rules and requirements, and also the [illegible] of Mr. George T. Hanchett, consulting electrical engineer and member of the American Institute of Electrical Engineers, in checking up and revising many valuable tables and formulæ to aid practical wiremen and contractors in determining the proper sizes of wires for all manner of construction work for both alternating and direct currents. This new edition is handsomely bound in flexible leather.

## SOCIETIES AND SCHOOLS.

William H. Blood, Jr., the chairman of the committee on district heating for the National Electric Light Association, expects to present a full and important report on this branch of central-station industry. The other members of this committee are C. R. Maunsell of Topeka, Kan., and R. S. Wallace of Peoria, Ill.

Much interest is being manifested in the annual dinner of the American Institute of Electrical Engineers, to be given at the Waldorf-Astoria, in the grand ballroom, on February 8th, and devoted especially to signalizing the triumphs of electric traction. There will be a number of interesting speakers, and an original menu has been prepared appropriate to the occasion. Two novel features will also be introduced—a mutoscope exhibition of steam and electric-railway work and the taking of a picture of the ballroom and company by means of special Cooper Hewitt illumination.

## TELEGRAPH.

The crew of the United States repair ship Burnside recently spliced the break in the cable between Seattle, Wash., and Valdez, Alaska, which had been out of commission for three months. When the cable was raised it was found that a whale had become entangled in the wires and perished. It is believed that the whale was the cause of the damage.

## SPACE TELEGRAPHY.

The Brazilian government has concluded a contract with Siemens & Halske for two space-telegraph installations—one on the island of Cobras and the other on the cruiser Riachuelo.

The wireless message from the Mallory Line steamship Denver, on its recent trip north, reporting its position as 10 miles south of Diamond Shoals lightship off Cape Hatteras, is said to have been clearly read by the De Forest operator at Cleveland, Ohio. Similarly a message from the Bermuda of the Quebec Steamship Company, when 200 miles from New York, was read at Cleveland, it is declared. The De Forest operator at Port Huron, Mich., also reports reading a message from the Red "D" liner Philadelphia when the latter was 130 miles out of New York. These performances are considered quite remarkable considering that the ships are equipped with one-kilowatt apparatus and short masts.

## MISCELLANEOUS.

[illegible] on February [illegible] [illegible].

A petition of Benjamin V. W[illegible] [illegible] poration of a company to carry on [illegible] freight-transportation business in Boston, similar to that of Chicago, has been presented to [illegible] Legislature. It is asserted that prominent financiers are behind the measure.

The carbon silicide in the form of crystals found in the residue from dissolving the iron meteorite from Canyon Diablo, Ariz., has been named "moissanite," in honor of Dr. Henri Moissan of France. The name was given at the recent meeting of the New York Academy of Science and the Electrochemical Society. The newly discovered silicide is harder than any known substance, except the diamond and is identical with carborundum, the abrasive produced artificially in the electric furnace, but never discovered in nature.

Benjamin Conigisky of Peoria, Ill., is said to have been awakened from a sleep of five weeks' duration only by the application of electricity. Mr. Conigisky is a student of the occult and, according to the story, succeeded in hypnotizing himself, from which spell he could not be revived. A current was applied to his spinal column. One electrode was applied at the base of the brain and another to the end of the spinal column, and the full force of the battery being turned on, the patient awakened and the indications are that he will recover his health. At any rate, so the newspapers have it.

## TRADE NEWS.

The business of the electrical supply firm of Miller & Voss of Fort Worth, Texas, will be continued by Mr. Voss instead of by Mr. Miller, as was reported recently.

The National Electrical Supply Company of Washington, D. C., has secured the contract for the work on the electrical features of the inaugural ball in Washington next month. Some very fine effects are anticipated.

The Chicago Solder Company has succeeded the Kester Electric Manufacturing Company. In other words, the Kester company has changed its name to one more appropriate. The change is in name only. A. J. Witherell is president and F. G. Dickerson, secretary of the company.

The Federal Sign Company of Chicago, in which J. M. Gilchrist is interested, has been reorganized for the purpose of increasing its eastern business in the sale of electric signs. The name of the company has been changed to the Federal Sign System (Electric). W. J. Norton will be the general eastern manager and W. H. McClane will have charge of the New York office.

At the annual meeting of January 9th the stockholders of the Wagner Electric Manufacturing Company of St. Louis elected as directors James W. Bell, Albert Blair, James Campbell, S. M. Dodd, W. A. Layman, S. B. Pike and J. C. Van Blarcom. Mr. Dodd is president, Mr. Belf vice-president, Mr. Blair secretary and Mr. Layman treasurer and man-

[illegible]

[illegible] election has averaged something above $4,000,000 a month, or at the rate of $48,000,000 a year. The previous year's output of $41,000,000 was the largest year's business up to that time. When the new turbine-engine plant at West Lynn., Conn., begins operations within a few weeks, the month'y output may be considerably increased.

Among the Illinois incorporations licensed on January 23d were the Edison Appliance Company, the Edison Repair and Supply Company, the Edison Light Company, the Edison Electric Illuminating Company and the Edison Equipment company, all of Chicago. The capital stock of each is $2,500 and the same names—Clayton R. Taylor, Percy B. Eckhart and Thomas G. Deering—appear as the incorporators of each company. The first two, according to the articles of incorporation, will manufacture electrical app[illegible] [illegible] light and power, the fourth will furnish electric light and supplies and the fifth will deal in electrical sundries.

A large southern dealer in poles does not agree with the recent decision of volunteer investigators that, while white cedar is very desirable for pole purposes, the industry is not sufficiently developed to enable southern interests to get a satisfactory supply. The Carolina Pole Company of Wilmington, N. C., which until recently has handled only enough poles to supply a stated trade given by the Bell telephone companies, within the last year has enlarged its output to cater to the trade generally. The company says that southern white cedar is bound to come into general favor for pole purposes, not only on account of its beauty, being exceptionally straight, free from knots, and holding a splendid taper, but on account of its durability, lasting in the ground nearly equal to locust, and being perfectly sound throughout, which is frequently untrue of other cedars.

## BUSINESS.

Taking the season of the year into consideration, the Northwestern Storage Battery Company of Chicago says that the demand for its batteries has been highly satisfactory. These batteries are made for every description of stationary and portable work and have been improved from time to time, until now they are declared to have reached a high degree of perfection. Intending battery users will be furnished all desired information on application to the manufacturer.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued (United States Patent Office) January 24, 1905.*

780,502. Third Rail. Alfred H. Hopkins, Chicago, Ill. Application filed November 18, 1904.

A depending contact portion or head is furnished with a shed and a connecting web. A bracket is [illegible] at its head to the web of the rail, under the shed.

780,503. Controller for Alternating-current Electric Motors. Ray P. Jackson, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed June 6, 1904.

Alternating-current energy is sent into a subdivided main transformer winding. A translating device having a terminal connected to the winding and means for connecting the other terminal to the points of subdivision of the main transformer winding is associated with an auxiliary transformer. The primary winding has one terminal connected to a terminal of the translating device and means connect the other terminal to points of subdivision of the main transformer winding. Other means connect together the terminals of the secondary winding. (See cut.)

780,504. Controller for Alternating-current Motors. Ray P. Jackson, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed June 6, 1904.

A subdivided main transformer winding is connected to a source of alternating current. A translating device has a terminal connected to the winding and means for connecting the other terminal to the successive points of subdivision of the main winding. An auxiliary transformer, comprising three windings, with means for connecting the first of these windings between successive points of subdivision of the main winding, means for temporarily connecting the second auxiliary transformer winding to the source of energy, and means for temporarily short-circuiting the third auxiliary transformer winding complete the apparatus.

780,523. Contact for Electric Hand Lamps. George L. Patterson, New York, N. Y. Application filed April 6, 1904.

A stationary contact having an upturned projecting lip and a spring contact having a longitudinally movable button adapted to engage with the lip for locking it in electrical connection comprise the patentable parts.

780,525. Telephone Dial. Charles D. Reeve, Grand Rapids, Mich. Application filed June 9, 1904.

A variable-signal transmitter includes a dial, an electric lamp for illuminating the dial and a pivotally mounted circuit-closing lever having a pair of projecting

NO. 780,503.—ALTERNATING-CURRENT CONTROLLER.

NO. 780,547.—STARTING SWITCH.

NO. 780,580.—MOTOR CONTROL.

pins. One pin forms one of the terminals of the lamp circuit and a receiver hook plays between the pins and carries the second terminal of the lamp circuit. An auxiliary means independent of the receiver hook moves the lever to circuit-breaking position.

780,544. Thermal Cut-out for Electric Circuits. Theodore Varney, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed September 22, 1902.

In a casing is a conductor having a high degree of tenacity and conductivity and a low melting point. Terminals of higher conductivity than the conductor are secured to its ends and a spring is located outside the casing and adapted to break the conductor when the melting point is substantially reached. A [illegible] shunt is also located outside the casing and adapted to form a low-resistance path for the passage of the current around the spring.

780,545. Means for Measuring the Energy of Alternating-current Circuits. Miles Walker, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed February 28, 1903.

Means for measuring the energy of alternating-current circuits [illegible] wattmeter having its movable member connected to one side of the circuit, a series transformer in the other side of the circuit having its secondary terminals connected [illegible] of the wattmeter and a non-inductive resistance having its terminals connected to those of the transformer secondary and having its middle point connected to the main circuit between the transformer and the translating device.

780,547. Starting Switch for Electric Motors. John B. Wiard, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 27, 1904.

A resistance connected at [illegible] of its extremities to points on the [illegible] winding of the motor

is associated with a centrifugally operated switch member adapted to short-circuit the intermediate points on the resistance, the member and the extremities of the resistance being connected to a point on the rotor winding through grounds on the motor frame. (See cut on preceding page.)

780,550. Electropneumatic Control System. Eugene R. Carichoff, East Orange, N. J., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 30, 1904.

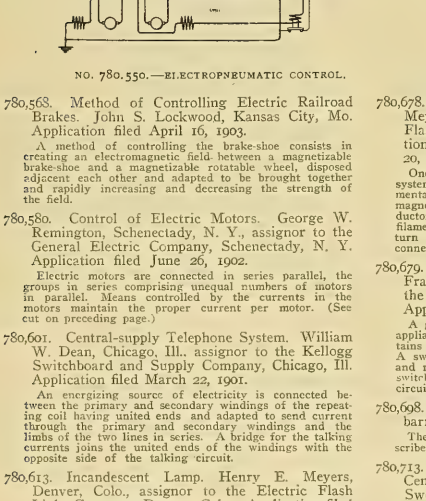
Normally open switches are connected to pressure-operated pistons. A valve is arranged to connect the pistons to a source of pressure to cause them to press the switches toward their closed position and to atmosphere to cause them to release the switches. Means for obstructing the closing of a portion of the switches, and means for controlling the obstructing means are also provided. (See cut.)

780,555. Electric-igniting System for Vapor Engines. Albert E. Doman, Elbridge, N. Y., assignor to the Elbridge Electrical Manufacturing Company, Elbridge, N. Y. Application filed July 7, 1902.

Sparking terminals of a gas engine are connected to a dynamo and its working circuit. A variable-resistance device and electromagnetic operating means are both connected in series in the working circuit.

780,564. Charging Storage Batteries. John L. Hall, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 13, 1903.

Combined with a generator and a storage battery is an automatically opening charging rheostat provided with a control magnet having two windings. One winding is connected across the generator terminals and the other winding is connected across the battery terminals and arranged to act always in opposition to the first winding.



NO. 780,550.—ELECTROPNEUMATIC CONTROL.

780,568. Method of Controlling Electric Railroad Brakes. John S. Lockwood, Kansas City, Mo. Application filed April 16, 1903.

A method of controlling the brake-shoe consists in creating an electromagnetic field between a magnetizable brake-shoe and a magnetizable rotatable wheel, disposed adjacent each other and adapted to be brought together and rapidly increasing and decreasing the strength of the field.

780,580. Control of Electric Motors. George W. Remington, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 26, 1902.

Electric motors are connected in series parallel, the groups in series comprising unequal numbers of motors in parallel. Means controlled by the currents in the motors maintain the proper current per motor. (See cut on preceding page.)

780,601. Central-supply Telephone System. William W. Dean, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed March 22, 1901.

An energizing source of electricity is connected between the primary and secondary windings of the repeating coil having united ends and adapted to send current through the primary and secondary windings and the limbs of the two lines in series. A bridge for the talking currents joins the united ends of the windings with the opposite side of the talking circuit.

780,613. Incandescent Lamp. Henry E. Meyers, Denver, Colo., assignor to the Electric Flash Light Company, Denver, Colo. Application filed November 24, 1902.

An incandescent lamp comprises a pair of transparent shells, one within the other and formed with a stem in common.

780,620. Trolley-wire Finder. Joseph P. Reed, Muncie, Ind., assignor of one-half to Salathiel R. Babcock, Muncie, Ind. Application filed September 17, 1904.

A trolley pole is provided with an upper forked end and a journal bolt carrying the trolley wheel. A bifurcated trolley finder is constructed of a single piece of metal bent to form two parallel arms or bifurcations, both of which arms are drilled at their central portions to pivotally receive the journal bolt.

780,622. Electric Signaling Device for Railways. George Schreiber, Roubaix, France. Application filed April 25, 1902.

A normally open electric circuit contains a circuit-closer adapted to be actuated by a passing train to close the circuit and actuate the signal.

780,641. Automatic Electric Switch. Egbert R. Dull, Chicago, Ill. Application filed January 12, 1904.

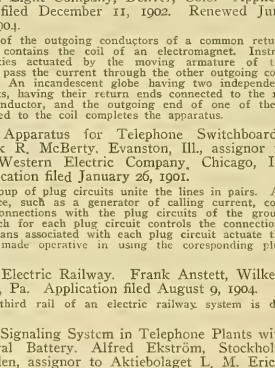
A metallic contact switch element and a carbon contact switch element comprise the unit, the elements having stationary members and coaxially pivoted movable blades arranged for dissimultaneous connection with their respective stationary members. A yielding connection is placed between the movable blades of the two elements and means are associated with one of the connected blades for moving both.

780,663. Method of Operating Printing-telegraph Receivers. John M. Joy, New York, N. Y., assignor to the Page Machine Company, New York, N. Y. Application filed August 1, 1902.

The method of operating a printing-telegraph receiver consists in transmitting alternating current over the line for selecting the characters to be printed, then changing from alternating current to direct current and automatically increasing the normal strength of the direct current momentarily to cause the printing of the character selected.

780,664. Printing-telegraph Receiver. John M. Joy, New York, N. Y., assignor to the Page Machine Company, New York, N. Y. Application filed August 5, 1902.

A transmitting station, a receiving station and electrical connections between the two, including a printing telegraph receiver, and transmitting mechanism for sending impulses over the line embody also a motor for actuating the mechanism for the receiver, electromagnetic means for controlling the operation of the motor, and means at the transmitting station independent of the transmitting mechanism and connected to control an electromagnetic switch at the receiving station for preventing the operation of the motor and controlling means.



NO. 780,852.—STATION SIGNAL.

780,678. Incandescent Lamp Socket. Henry E. Meyers, Denver, Colo., assignor to the Electric Flash Light Company, Denver, Colo. Application filed December 11, 1902. Renewed June 20, 1904.

One of the outgoing conductors of a common return system contains the coil of an electromagnet. Instrumentalities actuated by the moving armature of the magnet pass the current through the other outgoing conductor. An incandescent globe having two independent filaments, having their return ends connected to the return conductor, and the outgoing end of one of them connected to the coil completes the apparatus.

780,679. Apparatus for Telephone Switchboards. Frank R. McBerty, Evanston, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed January 26, 1901.

A group of plug circuits unite the lines in pairs. An appliance, such as a generator of calling current, contains connections with the plug circuits of the group. A switch for each plug circuit controls the connections and means associated with each plug circuit actuate the switch made operative in using the coresponding plug circuit.

780,698. Electric Railway. Frank Anstett, Wilkesbarre, Pa. Application filed August 9, 1904.

The third rail of an electric railway system is described.

780,713. Signaling System in Telephone Plants with Central Battery. Alfred Ekström, Stockholm Sweden, assignor to Aktiebolaget L. M. Ericsson & Co., Stockholm, Sweden. Application filed October 20, 1902.

A line relay is excited during the whole time the telephone receiver is removed from its switch hook and a cut-off relay is actuated when a plug is inserted in the subscriber's jack. Means controlled by the cut-off relay cut out the calling signal when the plug is inserted.

780,716. Method of Agglomerating Magnetic Ore. Elmer Gates, Chevy Chase, Md., assignor to Theodore J. Mayer, Washington, D. C. Application filed January 14, 1901. Renewed November 5, 1902.

A method of agglomerating magnetic sand consists in establishing an electric arc between opposing surfaces, feeding opposing streams of sand over the surfaces, and causing the streams of sand to fall freely from the surfaces so as to break the arc originally formed and establish arcing from one of the falling streams to the other, thereby fusing and agglomerating the sand into small lumps of a size varying substantially from that of a wheat grain to that of a bean.

780,724. Dynamo for Train Lighting. James F. McElroy, Albany, N. Y., assignor to the Consolidated Car Heating Company, Albany, N. Y. Application filed June 6, 1902.

Combined with a dynamo-electric machine centered upon a driving axle are centering extensions between the machine and axle and longitudinal supporting bars supported at one end from the upper side of the axle and supported at the other end from the truck.

780,749. Fan Mechanism. Samuel R. Bechtel, Lafayette, Ind., assignor to Thomas Duncan, Lafayette, Ind. Application filed October 23, 1902.

The mechanical features of an electric fan, such as bearings, etc., are described.

780,754. Electrically Operated Valve. Oscar Junggren, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 24, 1903.

The valves are operated by electromagnets which actuate plungers in line with the steam.

780,767. Electric-railway Trolley. Russia R. Weeks, Cincinnati, Ohio. Application filed April 14, 1904.

Upward cam extensions are placed upon the arms or forks at opposite sides of the trolley wheel with reversely inclined, chamfer-grooved edge portions beginning with and extended upward beyond the perimeter in position for engagement with the trolley wire.

780,769. Electric Meter. James J. Wood, Fort Wayne, Ind. Application filed February 11, 1904.

In an electric meter are a disk armature having a large central opening, its spindle passing centrally through the opening, and yielding supporting means interposed between the disk and spindle.

780,770. Electric Meter. James J. Wood, Fort Wayne, Ind. Application filed May 10, 1904.

In an electric meter an armature spindle, a lower bearing therefor and laterally movable means for clamping the lower end of the spindle while free from the bearing are the essential features.

780,842. Method of Receiving Electromagnetic Waves or Other Feeble Signal Impulses. Frederick K. Vreeland, Montclair, N. J., assignor to the Wireless Telegraph Exploitation Company, New York, N. Y. Application filed August 1, 1904.

A method of detecting electromagnetic waves or other feeble signal impulses consists in polarizing by a local source of electromotive force an electrolytic cell, passing the waves or impulses to be detected through the cell in parallel with the polarizing current and observing the variations in flow of the local current.

780,852. Station Signal. John L. Wrenn, Washington, D. C., assignor of one-half to John C. Fennie and John A. Goldsborough, Washington, D. C. Application filed November 24, 1903.

A station signaling apparatus comprises an electric circuit, a signal operated thereby, a switch for closing the circuit to operate the signal, a sand-glass mechanism for discontinuing the signal after a predetermined interval, and means carried by the switch-operating mechanism for reversing the sand glass. (See cut.)

780,870. Magnetic Separator for Ores or Similar Materials. John T. Dawes, Liverpool, England. Application filed December 28, 1903.

A moving conveyor receives the material and a second moving conveyor is placed above the first moving conveyor. A magnet pole is located above the second moving conveyor. A shield is disposed under the second moving conveyor between the outer extremity of the magnet pole and the first moving conveyor and parallel to and in contact with the side of the first moving conveyor. Part of the top of the shield under the magnet pole is level with the first moving conveyor.

780,885. Railway Electric Signal. Slaughter W. Huff, Baltimore, Md. Application filed January 17, 1898.

A continuous main circuit throughout the system is formed in part by the track rails and embodies one continuous or return conductor embodied in one rail of the track. The other rail of the track is divided into insulated sections providing main sections between stations and lead sections at the approach of each signal station. Batteries inserted in multiple in the main circuit, conductors connecting the main insulated sections, making the main circuit continuous past the insulated lead sections of the track at the signal stations, a conductor connecting each lead section to an intermediate point in the main circuit, batteries at the stations introduced into the main circuit in multiple, and signal-actuating devices connected with and controlled by the main circuit at the respective stations complete the apparatus.

## EXPIRING PATENTS.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on January 31, 1905:

377,021. Electric Temperature Regulator. L. F. Easton, La Crosse, Wis.

377,046. Armature for Dynamo-electric Machines. E. J. Berge, Elgin, Ill.

377,073. Protecting Device for Electrical Apparatus. A. S. Hibbard, New York, N. Y.

377,083. Electrical Auxiliary-signaling System. G. F. Milliken, Boston, Mass.

377,107. Electric Railway. R. M. Hunter, Philadelphia, Pa.

377,110. Telegraph Instrument. W. S. Logue, Baltimore, Md.

377,118. Insulating Electric Conductors. R. Schefbauer, Dresden, Saxony, Germany.

377,210. Electrolyte Compound. G. B. Pennock, Brooklyn, N. Y.

377,215. Traveling Current Collector for Electric-railway Motor Cars. W. M. Schlesinger, Philadelphia, Pa.

377,217. Alternating-current Motive and Regulating Device. E. Thomson, Lynn, Mass.

377,218. Electric Belt. G. W. Totman and P. C. Totman, Cassadaga, N. Y.

377,239. Electric Locomotive. E. M. Bentley, New York, N. Y.

377,236. Electric Motor. E. M. Bentley, New York, N. Y.

377,237. Plug Switch for Telephone and Telegraph Circuits. G. H. Cole, Atlanta, Ga.

377,255. Regulation of Electric Motors. D. Higham, Philadelphia, Pa.

377,319. Electric Motor. C. T. Mason, Sr., Sumter, S. C.

377,340. Galvanic Battery. D. Urquhart, Westminster, and R. Nicholson, South Norwood Park, County of Surrey, England.

377,344. Railway Telegraph. C. W. Williams, Cave City, Ky.

# WESTERN ELECTRICIAN

**EVERY SATURDAY**

Vol. XXXVI. CHICAGO, FEBRUARY 11, 1905

## A 20,000-volt Continuous-current Group for the Vienna Polytechnic.

By Emile Guarini.

The laboratory of the Imperial Vienna Polytechnic has recently been supplied by a manufacturing company in Geneva, Switzerland, with a very interesting group capable of furnishing three-phase current at 5,000 volts or continuous current at 20,000 volts. This group, as shown in the accompanying picture from left to right, comprises the following, all mounted upon the same shaft:

1. A continuous-current dynamo capable of yielding one ampere at 20,000 volts (the highest tension obtained direct with continuous current). Its speed is from 600 to 700 revolutions.

2. A small energizing dynamo producing current at 110 volts.

3. A three-phase alternator which, by means of a coupling ad hoc, yields 5,000, 2,500 or 1,250 volts at 750 revolutions. The current may be, at 5,000 volts, with cos $\Phi = 1$, 12.9 amperes; for cos $\Phi = 0$, 436.74 amperes. The excitation is also at 110 volts.

4. A 440-volt, 70 to 80-ampere motor, the special feature of which is that its speed is capable of modification within sufficiently large proportions to admit of different periodicity in the alternator. These variable speeds (0 to 600 revolutions a minute) are obtained by means of the starting gear, while the speed from 600 to 750 revolutions is effected by means of the field rheostat.

The following are a few details of the 20,000-volt machine (it has so far yielded 25,000 volts), which constitutes what may really be regarded as almost a marvel.

Generally speaking, this interesting machine is of simple construction; it is a bipolar dynamo resembling in its exterior appearance a modern alternator with radiant poles. The inductor is of iron turned inside of a bipartite ring forming the armature, which, therefore, is of the fixed type. The coils of the armature, to the number of 48, are located in an equal number of grooves provided in the ring. They are insulated by means of specially prepared paper. Each elementary coil comprises 500 windings of copper wire of half a millimeter in diameter and insulated by means of silk. There are therefore 24,000 windings, the resistance of which when running is 700 ohms, with a normal productive capacity of one ampere. These coils, made beforehand by means of a form, can be easily and rapidly inserted in, or removed from, the grooves in the armature.

The commutator, composed of 96 segments, separated by air spaces is stationary, contrary to the usual types of dynamo. The continuous current is collected by means of two small metal clips which slide along the interior of its surface.

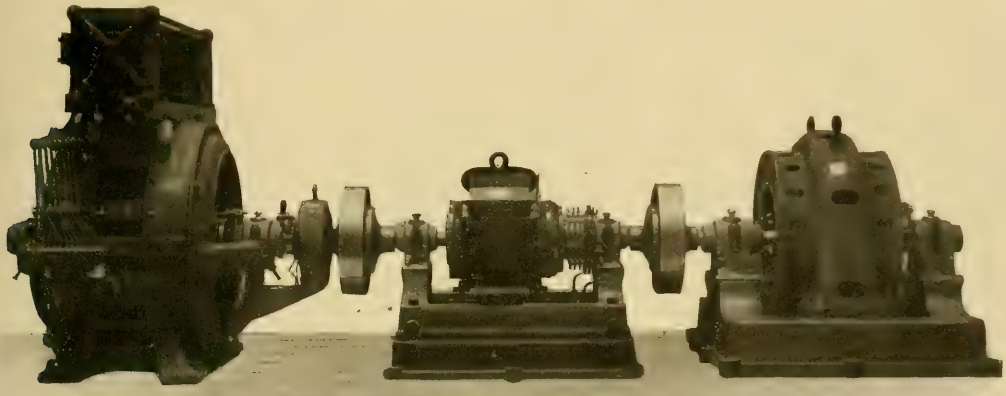
As it was feared that arcing might take place between the segments of the commutator, due to the marked difference in tension existing between each of them (an average of 500 volts), shunt wound condensers were placed between the sheets of the commutator. This arrangement has given the most remarkable results. These condensers are mounted upon the machine.

As I have already stated, the energizing current is supplied by a small separate dynamo just as in the case of an ordinary alternator. It is carefully insulated from the ground, as is also the rheostat controlling the energizing current. The minimum excitation provided is 14 amperes at 80 volts, but practically eight amperes only are sufficient to give 23,000 volts at the normal speed of 600 revolutions.

The normal voltage specified for this generator is 20,000 volts, but it has easily been increased for several minutes at a time to 25,000 volts, which was the maximum demanded in connection with the purpose for which it was intended. The constructors are of opinion that it would not be difficult to attain even higher voltages. The problem is, before anything else, a question of dimensions and, consequently, of price. In this case, however, it would be preferable to have recourse to several machines of this type mounted in series; this would enable the highest possible voltages to be realized without any other precaution than merely insulating the plant from the ground, which, of course, can easily be done.

The armature has an interior diameter of 58 centimeters in the clear. Thus, at 600 revolutions the peripheral velocity of the inductor is 18.22 meters per second. This is very moderate, 50 meters per second being often exceeded.

The service which this machine has already rendered and can still render is very considerable. In high-tension service it enables all losses caused by the branches of trees touching the lines to be discovered; these losses cannot be determined by means of the galvanometer. It also serves for testing high-tension cables and it affords a field for curious experiments in connection with the combination of gases under the influence of a very high-tension arc, and more especially in connection with the combination of nitrogen and oxygen for the manufacture of nitric acid. Finally, it may be employed for making various experiments which it has hitherto been impossible to carry out.



A 20,000-VOLT CONTINUOUS-CURRENT GROUP FOR THE VIENNA POLYTECHNIC.

## Searchlight for Mount Hood.

By [illegible]

[illegible] the Lewis and Clark Exposition grounds at Portland, Oregon, [illegible] Mt. St. Helens, Mt. Rainier and Mt. Adams. It is planned to place a searchlight [illegible] on the crest of Mt. Hood, which is [illegible] feet above sea level. [illegible] Exposition. This searchlight from [illegible] is expected to pierce the darkness [illegible] and its gleam on the nearby peaks will be startling. Its flash on Mt. Ranier, which is 100 miles from Mt. Hood, may perhaps be seen from the cities bordering on Puget Sound, such as Seattle and Tacoma. From vessels off the coast 120 miles distant the flashes might be seen on a clear night, and at Portland and the Exposition grounds the gleams should be plainly visible.

Mt. Hood is the pride of Portlanders. Its lofty peak may be seen from the city streets, and late in the afternoon when the rays of the setting sun bathe it in the Alpine glow one may see visitors standing on the corners and gazing at it in admiration.

To place the searchlight on this mountain requires quite a bit of engineering skill and labor, which will cost about $30,000. A short tower of wood and iron, the upper part for the searchlight and the base for the apparatus and operators, will be built on the summit. The transmission line has to be built down the north side of the mountain to Cooper's Spur, and from there to a point in the neighborhood of Cloud Cap Inn, where a temporary generating plant will be installed. The construction of the tower and the delivery of the necessary material and apparatus are the difficult parts of the construction work. This will be overcome by the use of a steel hoisting cable and sleds, and all of the material can be delivered on the summit by this means, as the side of the mountain toward Cloud Cap Inn is favorable to this mode of transportation. The sleds will be run over the trail used yearly by the mountain climbers. Parts of the transmission line will have to be carried over glaciers, and special construction will be necessary for this work. Iron poles painted white so as not to absorb any heat will be placed in the ice to carry the cables.

A flat surface on the summit of the mountain has been selected as the site for the tower. Here the debris will have to be cleared away and the engineers will have to blast for solid foundations. The tower will be erected on iron posts sunk in the ice and will be composed of wood, iron and steel. In order to protect the operators from the

severe cold of the mountain at night the transformers and motors will be arranged so that they can be controlled from the operating room. After the sun goes down everything on Hood freezes solid.

In addition to the searchlight effect from the summit the establishment of the apparatus affords means for a general illumination of the mountain by arc lights. One hundred arc lights will be distributed on the side of the mountain facing Portland. Besides the use of the searchlight and arc lights red fire will be used in great quantities and several times each evening the mountain will have the appearance of a Vesuvius. This latter feature has been tried several times by the people of Portland and the effect produced was beyond description. Fifty pounds of red powder were used and the whole side of the mountain looked as though on fire.

The placing of the tower on Mt. Hood may be the beginning of the movement for the establishment of an astronomical observatory on this majestic peak of the Cascade range.

## Development of Telephone Talking Circuits.

By Charles H. Coar.

Of the many telephone talking circuits now in vogue, possibly the first and most simple one which employed a battery for speech transmission is shown in Fig. 1. This consists of merely a transmitter, receiver and battery arranged in series with each other and the line wires ($L^1$) and ($L^2$). If a receiver were introduced at point (A) while during conversation into the transmitter (T), it would reproduce the conversation because of the change in current

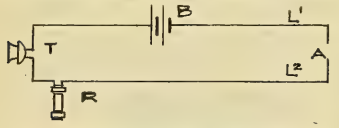



FIG. 1. SIMPLEST FORM OF BATTERY TELEPHONE.

strength occurring in the line. This change in the line-current strength is due to the variable resistance of the transmitter (T) during action.

Such a circuit is still employed in many instances, notable among which are several intercommunicating systems now for sale by manufacturers, but it would give very poor satisfaction over any great length of line from the fact that in this arrangement the changes in the current strength would in most instances be such a small variation of the total-line resistance as to make transmitter action scarcely audible.

To overcome this fault and to make speech transmission more audible through greater resistances or over longer lines the circuit is divided by means

FIG. 2. SIMPLE TELEPHONE WITH INDUCTION COIL.

of an induction coil, which includes in its low-wound or primary circuit a transmitter and battery and a receiver and line wires in series with the high-resistance or secondary winding. The primary of this induction coil is composed of a comparatively few turns of insulated copper wire wound on an iron core composed of strands of iron wire, while the secondary has a greater number of turns of smaller wire wound directly over the primary winding or on the same core. In this arrangement it will be noticed that the transmitter and battery are in a circuit of low resistance, and consequently any change of current strength in this circuit will manifest itself much more strongly. During the flow of current in the primary winding, lines of force are set up in and around the iron core, which change as the current strength varies. These changes in the magnetic field surrounding the iron core cause a corresponding fluctuating current of much higher intensity to be set up in the secondary, because of the many turns of wire which compose this winding. Thus the induction coil acts as a step-up transformer by reproducing the current changes from low intensity in the primary to changes of high intensity in the secondary and consequently in the line. It will be readily deduced that the current changes as reproduced by the secondary flow through

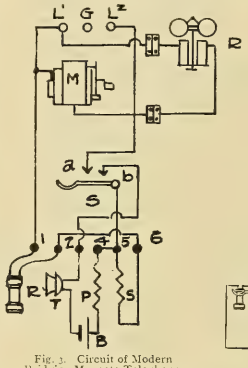



Fig. 3. Circuit of Modern Bridging Magneto Telephone.



higher resistances and, therefore, speech transmission is made possible over greater resistances or longer lines.

Fig. 2 illustrates the arrangement just described. Fig. 3 shows the circuit arrangement of a modern bridging magneto telephone in which ($L^1$) and ($L^2$) are the line-binding posts, invariably placed at the top of the box containing the switch-hook, magneto and ringers. The usual arrangement, as shown, is to provide the magneto generator with an automatic shunt so arranged that the generator circuit stands open, except when the crank is being

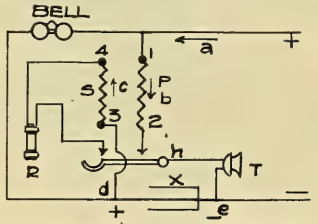



FIG. 7. SUBSCRIBER'S CIRCUIT FOR COMMON-BATTERY SYSTEM.

turned, and also to provide a ringer wound with from 1,000 to 2,500 ohms resistance, so that it can be bridged permanently across the line without affecting the talking currents to any great extent. When the receiver is off the hook the circuits are as follows: Positive current flows from battery (B) through the transmitter (T) up to contact (b), through the switch-hook (S) and back to the negative pole of the battery, through the binding posts (4) and (5) and primary winding (P), thus completing the primary circuit. While the transmitter is actuated, currents are induced in the secondary winding (S) of the induction coil, which pass through the binding posts (6) and (2), then through the receiver and out to ($L^1$), through the line and back to ($L^2$), contact (a) and through the switch-hook to post (5), thus completing the circuit. In this arrangement all the rings are sent and received while the receiver is on the hook.

Whenever the number of telephones in one vicinity is too large to place them on one circuit some other means has to be adopted which will make it possible to connect the different circuits together. Fig. 4 shows one of the simplest cord circuits adapted to this purpose, with bridging telephones. In Fig. 4 (L) and ($L^2$) represent the subscribers' lines, which terminate in the single point jacks and drops ($D^1$) and ($D^2$), respectively. The cord circuit is equipped with two single-conductor plugs, (C) designating the calling plug and (A) the answering, also a ringing key (R. K.), a listening or operator's key (L. K.), a clearing-out signal (E), a magneto generator (G), and the operator's telephone and induction coil arranged in the usual manner. The operation of this circuit is as follows: When subscriber ($L^2$) turns the crank of his magneto it summons the operator by throwing the line drop (D) in the usual manner, after which the operator inserts the answering plug (A) into the proper jack, thus opening the drop circuit of the line, after which communication can be established with the subscriber by pressing the listening key (L. K.) into contact. After ascertaining what number the calling subscriber wants the operator picks up the calling plug (C) of this pair of cords and inserts it into the proper jack, after which the called subscriber's bell is rung by the operator when she turns the magneto generator (G) and presses the ring key (R. K.) at the same moment. As soon as the called subscriber answers no more attention is given this connection by the operator until the clearing-out signal (E) is displayed, thus showing that the subscriber has rung off, after which the connection can be pulled down, leaving the lines (L) and ($L^2$) in their normal condition.

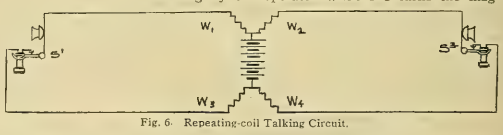



Fig. 6. Repeating-coil Talking Circuit.

The circuits shown in Fig. 5 are similar to those shown in Fig. 4, with the exception that Fig. 5 illustrates a cord circuit for bridging metallic lines. The key shown performs two different functions by moving the one-lever cam in different directions, that of ringing the subscriber and connecting the operator's set onto the cord circuit.

In the system just described local batteries are employed at each telephone for talking purposes in addition to the magneto generators which are used for calling. These local batteries require no little attention if good service is desired in addition to being quite a source of expense, and the magneto generators themselves are usually one of the most costly parts of a telephone. These facts soon became evident when telephone exchanges grew comparatively large, and for these reasons principally designing engineers aimed to centralize a battery or other source of current which could be employed both for signaling and talking purposes. Out of

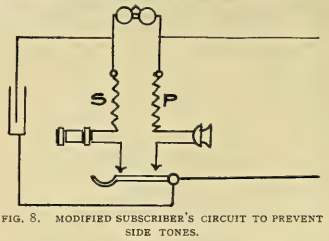



FIG. 8. MODIFIED SUBSCRIBER'S CIRCUIT TO PREVENT SIDE TONES.

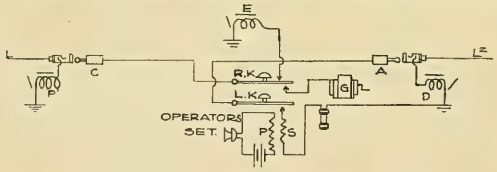



Fig. 4. Simple Cord Circuit.

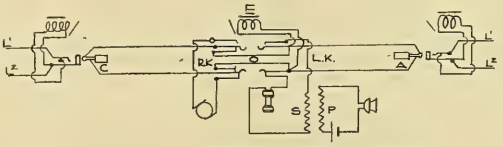



Fig. 5. Cord Circuit for Bridging Metallic Lines.



these endeavors a talking circuit, the theory of which is shown in Fig. 6, was designed by Mr. Hammond V. Hayes, and the principle involved is in use at present in a great many of the successful central-energy systems of today.

In Fig. 6 ($S^1$) and ($S^2$) represent the two subscribers' stations, which consist of a receiver and

transmitter connected in series with each other through a switch contact at each station. The telephones receive their current supply from the battery (B) through the repeating coil windings ($W_1$) ($W_2$) ($W_3$) ($W_4$). These windings are placed upon the same core and are of equal resistance. The battery is fed to the telephones through taps ($C^1$) ($C^2$), which are made at the center of the windings which compose the coil. It will be seen that the battery feeds the two telephones in multiple.

When the transmitter at one station is actuated it

FIG. 9. OPERATOR'S SET WITH PARTS IN SERIES.

causes fluctuations in the current strength supplying that station, and as this current fluctuates corresponding fluctuations occur in the magnetic field surrounding the coil through which the current is passing.

These magnetic fluctuations act inductively from one coil to the other, and consequently the current changes in one telephone are reproduced inductively in the other. The coil windings vary as do systems, some systems employing coils in which each of the four windings composing the one coil have up to 3,300 turns of wire.

In Fig. 7 is shown one of the usual circuit arrangements for instruments adapted for use with common-battery systems. The two-line wires are represented by the positive and negative signs. In this arrangement the bell coils are usually 1,000 ohms in resistance and are connected in series with a condenser (X) of one microfarad capacity across the line as shown. The primary (P) of the induction coil has about 17 ohms resistance and is placed across the line from point (1), which is the outer terminal of this winding, to a contact point at the switch-hook. The secondary winding (S) has about 14 ohms resistance and is connected from a point (d) through its inner terminal (3), thence through the receiver windings (R) to the contact at the switch-hook (h). One terminal of the transmitter (T) is connected to the line at the point (e), while the remaining terminal is connected to the body of the switch-hook.

Both the primary and secondary windings of the induction coil are wound in the same direction. When the hook is up and the transmitter is normal it will have a certain resistance, and current will flow in the direction of arrow (a) from the positive side of the battery through the winding (P), in the direction of the arrow (b), thence through the switch-hook and transmitter to the negative side of the battery, thus completing the circuit. Between points (e) and (h) there will be a certain electrical potential, depending on the resistance of the remainder of the circuit. The condenser (X) will also become charged to this same degree of potential and the charge will be of the polarity shown. When the transmitter is spoken into its resistance is suddenly reduced and the potential between (e) and (h) must also be reduced, thus allowing a discharge of the condenser to take place in the direction of the arrow (c), through the winding (S) and receiver and switch-hook, which causes a current to be induced in the winding (P) in the direction of the arrow (b). This induced current is in the same direction as the line current and consequently aids it.

When the transmitter again returns to its normal position the potential will be raised between the points (e) and (h) and current will therefore flow into the condenser through the winding (P) in an opposite direction to the arrow (c) until its potential is equal to that existing between (e) and (h). Thus it is that the condenser acts as a reservoir of current which evens the current supply to the transmitter during its action. In addition to this the condenser is so arranged that it prevents a flow of constant current occurring through the ringer coils. If the coil connections are reversed in the circuit just described—that is, if terminal (1) be connected to the hook and terminal (2) to the line—the speech transmission from this set will be poor. With terminals (1) and (2) connected properly and (3) and (4) reversed the incoming-current variations will be muffled. These effects are also evident when the coil connections are reversed, because the induced currents from one coil tend to retard the line current flowing in the other coil winding. In the coil mentioned there are 1,700 turns [illegible] and 1,400 in the [illegible]

A modification of the circuit shown in Fig. 7 is shown in Fig. 8, in which the ultimate purpose is to prevent side tones, or, in other words, to prevent all the little local noises being reproduced in the speaker's ear. In this arrangement the transmitter and primary of the induction coil are placed across the line, while the receiver and secondary are placed in series with the condenser in a separate circuit. In this way the transmitter is removed somewhat from the local or listening circuit, and consequently the little noises are much modified.

Two different circuit arrangements for operator's sets in central-energy systems are shown in Figs. 9 and 10. In Fig. 9 the primary winding, condenser and retardation coil are in series with each other, while the transmitter apparently divides these into two parts. The condenser is applied in this primary circuit to counteract the effect of the retardation coil upon the rapid transmitter current fluctuations in the following manner: To prevent an excessive flow of current to the transmitter an impedance coil of 200 ohms resistance is placed in series with it. In this instance the impedance is made inductive by inclosing iron in order that any stray currents or cross-talk from other operators' sets supplied from the one set of bus bars will become blocked or ineffective in this circuit. This impedance under these conditions would render the transmitter almost inoperative, because it would lie directly in the path of the transmitter-current fluctuations, which would be greatly retarded and distorted by the inductive windings of the coil. The

FIG. 10. OPERATOR'S SET, CONDENSER DIVIDING PRIMARY CIRCUIT.

condenser is placed in the circuit to counteract the effect of this retardation on the transmitter fluctuations because of the well-known theory that self-induction and capacity tend to neutralize each other.

Fig. 10 shows a circuit which gives very much the same results, but differs in that the condenser here divides the primary circuit and also the impedance coil is of lower resistance, because the primary winding of the induction coil is directly in series with it and the transmitter.

Fig. 11 illustrates what is known as the anti-side-tone circuit for operator's sets, and consists of a special-wound induction coil, in which the primary is divided into two equal parts, which are connected in parallel as shown. The secondary winding is also halved, but this is done in order to make a tap at the center point of the winding. The operator's receiver is shunted around one-half of the secondary winding, in which position it is only subjected to one-half of the induced current in the secondary winding. Thus the receiver in this set will produce but half of the current generated in the secondary, and in consequence the local noise is lessened. The multiple arrangement of the two halves in the primary circuit is employed to overcome impedance. The impedance of a coil is proportional to the [illegible]

The usual retardation coil is placed in series with [illegible]

FIG. 11. ANTI-SIDE-TONE OPERATOR'S CIRCUIT.

rent through it. In this arrangement the transmitter should be more sensitive to local noises while the receiver is less sensitive.

A connecting cord and subscriber's circuit of a central-energy system is shown in Fig. 12. In this arrangement of circuits a subscriber summons the operator by taking off his receiver, which allows a flow of current to occur from the battery (B) through the line, telephone and line relay, which is magnetized, thus attracting its armature, which in turn causes the subscriber's 20-volt line-signal lamp ($L^1$) to light, informing the operator that a connection is desired. The operator answering this line then picks out of her allotment of cords one cord termed the answering cord (A) and inserts the plug into the answering jack of this line. When the answering plug is inserted into the answering jack, current flows from the central battery through the sleeve connection of the jack and plug to the cut-off relay ($R^1$), which operates, thus cutting off all the line apparatus at this point. Current for talking purposes now flows out from the central battery over the two limbs or parts of the cord-repeating coil, and through the supervisory relay ($R^2$) to the tip and ring connections of the plug and jack. The operator then places her set in communication with the subscriber by operating her listening key lever in the proper direction. After ascertaining the connection the calling subscriber desires the operator picks up the calling or remaining cord of this one pair and touches the tip of the plug to the sleeve connection on the multiple jack of the called line. If no click is heard at this time it shows the line is not in use and the connection is completed in the usual manner of ringing the subscriber by means of the ringing key (R. K.).

FIG. 12. CONNECTING-CORD AND SUBSCRIBER'S CIRCUIT OF CENTRAL-ENERGY SYSTEM.

In this circuit the supervisory relays ($R^3$) and ($R^4$) control two 12-volt supervisory lamps ($L^2$) and ($L^3$) in such manner that the lamps are shunted out as soon as no current exists between the tip and ring connections of the answering and calling plugs, respectively. Thus, as soon as a connected subscriber replaces his receiver on the hook the supervisory signal on that portion of the cord circuit affected will light. These supervisory lights give the operator complete supervision over whatever connection she has made.

The purpose of the 31-ohm shunts ($S^1$) and ($S^2$),

which are placed around the supervisory relays, is to provide a non-magnetic path for the talking currents to traverse, which would otherwise be retarded considerably by the magnetic properties of the relays. The purpose of the repeating coil in this cord circuit has already been explained in description of Fig. 6.

A cord circuit, such as has been just described, is used only in making connections between any two subscribers of one exchange. Where several exchanges in one locality furnish connections from one exchange to another, other circuit schemes are employed which are termed trunk circuits. Trunk circuits are designated as incoming or outgoing, depending on which end of the circuit is referred to.

The incoming or "B" ends terminate in plugs adapted to fit the jacks of the board at one position or more, depending on the number of trunks, while the outgoing ends terminate in multiple jacks, which are regularly distributed among the different "A" or answering positions of the switchboard. The "A" and "B" ends are of course in different exchanges in this instance. Fig. 13 shows a trunk circuit which is adapted for ringing two subscribers selectively by means of the automatic ringing keys ($R.K.^1$) and ($R.K.^2$). The operation of the trunk circuit is as follows: When the "A" operator receives a call for a subscriber in the "B" exchange, she informs the "B" operator over the order wire of the number desired, and the "B" operator then assigns one of the idle trunks to the "A" operator, who places her calling plug into this trunk-jack.

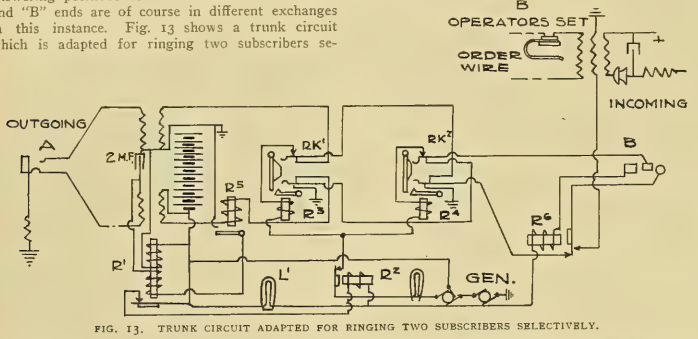



FIG. 13. TRUNK CIRCUIT ADAPTED FOR RINGING TWO SUBSCRIBERS SELECTIVELY.

The "B" operator picks up the plug of this trunk and tests the called line for busy in the usual manner, and if no click is heard the connection is completed. When the trunk plug is inserted into the multiple jack the relay ($R^4$) operates and the lamp ($L^1$), which is the disconnect signal of the trunk circuit, will light. This is shunted out, however, as the "A" operator has a connection up which places a ground on the trunk-jack. This ground allows current to flow through one winding on relay ($R^1$), which in turn places the relay ($R^2$) around the lamp ($L^1$) as a shunt, thus extinguishing it. The trunk ringing is done by the "B" operator, who simply presses either of the automatic ringing keys, which are held in ringing position until the called-for subscriber removes his receiver. This, then, so lowers the resistance of the ringing circuit that sufficient ringing current will flow through the relay coil to release the plunger and thus cease ringing and restore the circuit to talking condition. When the called subscriber removes his receiver from the hook, current will flow through the relay ($R^5$), which in turn causes a current to flow through the remaining winding on relay ($R^1$). This shunts out the supervisory signal in the calling cord of the "A" operator's pair, thus showing that the subscriber called for has answered. When the "B" subscriber hangs up his receiver ($R^3$) is released and the "A" supervisory lamp will light, thus showing that the called subscriber has replaced his receiver when the connection is pulled down. When the "A" operator pulls down the connection it releases relay ($R^1$) because of the absence of the ground connection in the trunk-jack, and consequently the shunt is removed from around the trunk disconnect signal ($L^1$), which then lights and informs the "B" operator that the trunk is idle. She then pulls down the connection.

The purpose of the condenser in the trunk-repeating coil is to separate the two parts of one-half of this coil in such manner that a path will be provided for talking currents without allowing a flow of battery to occur over them. The special winding in the "B" operator's induction coil is to facilitate making "busy" tests. In making tip contact with the multiple of a busy line a flow of current will occur through this winding to earth, thus producing a click in the operator's receiver by induction.

## Sprague's Cable Coupler for Multiple-unit Systems.

In the operation of a number of electric cars on the multiple-unit system it is obviously necessary that some means be provided for coupling the various wires running from car to car quickly and in such a manner that the coupling cannot come apart or the continuity of the various circuits be broken. An improved coupler for this purpose has been patented by Frank J. Sprague of New York city, which is illustrated by Figs. 1 and 2, the former showing the coupling and jumper cable and the latter a detail of the coupling itself.

The coupler is provided with a protecting casing of metal, which is bolted to the under side of each car platform. In the casing a block of insulating material is tightly fitted, and the plugs which constitute the contacts are placed parallel to each other and extend through and project from the face of the insulating material. Three contacts are in the same line or plane; but two others are placed on each side of this plane and consequently not shown in Fig. 2, so that the contacts as a whole form a cluster with the outermost contacts in a circle.

A hinged cover is attached to the front of the casing and is closed when the coupler is not in use. The conducting wires are connected to the rear ends of the plugs. The couplers at the abutting ends of the cars are connected through a jumper. This consists of a flexible cable containing the connecting wires and terminating at each end in suitable couplers. Each of these couplers comprises a protecting casing in which is a block of insulating material and sockets to which the coupling wires are connected and which are contained in the block of insulating material. There is a protecting cap for the connections between the coupling wires and the sockets and a key which mates with a keyway in the protecting casing of the coupler on the car, so that the two will go together in one way only. The casing of the coupler at the end of the jumper fits inside of the casing of the coupler attached to the car. The two casings are therefore unlike and complementary.

On the casing of the jumper coupling is a horn which is engaged by the cover of the coupler attached to the car. The cover latches over the horn and locks the pair of couplers together. The sockets of the jumper coupler mate with the plugs of the coupler attached to the car platform and are likewise positioned so as to secure the most compact physical arrangement and to permit their inclosure by a cylindrical protecting casing of the smallest possible diameter consistent with a sufficient separation of the contacts from each other and the casing for their proper insulation. This is especially important because the jumper is portable and the weight of the couplers at the ends should be as little as possible.

The connecting cable of conducting wires between the two couplers of the jumper requires a high degree of flexibility, and in order to secure this the conducting wires lead spirally through the cable in the usual way.

It will be seen that the contacts in the couplers at the ends of the jumper are sockets which are completely protected by the metal casing. This manner of construction is of importance, since the jumpers are portable and the trainmen in handling the jumpers are apt to strike them carelessly or by accident, and if the form of coupler with plug contacts and cover such as is used on the car, were used on the jumper, the danger of breakage would be much greater.

Another form of coupler embodying the same general principles is described in the patent, in which the coupler is placed in the middle of the cable joining two cars, no jumper cable being used and each coupler being therefore always on its own car.

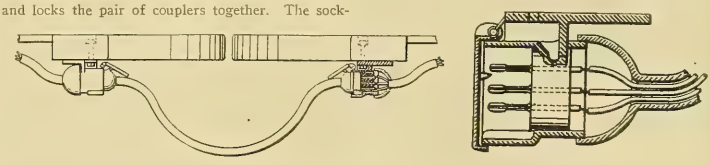


FIG. 1. FIG. 2.

SPRAGUE'S CABLE COUPLER FOR MULTIPLE-UNIT SYSTEMS.

## Annual Meeting of Western Electric Company.

The annual meeting of the stockholders of the Western Electric Company was held in the general offices of the company on February 2d. A total of 8,240 shares was represented in person and 103,558 by proxy, making 111,789 shares represented out of a total of 120,000 outstanding.

All the directors were re-elected. Officers will be elected in a few weeks. The board of directors is composed of E. M. Barton, W. R. Patterson, A. D. Wheeler, H. B. Thayer, C. W. Amory, Thomas Sherwin, Henry S. Howe, Alexander Cochrane, F. P. Fish, A. C. Bartlett and Charles Williams, Jr.

The secretary's report for the fiscal year ended November 30, 1904, showed that the total sales for the year were $34,454,000, as compared with $30,256,000, a gain of 7.2 per cent. Net earnings were not stated, there being some delay in the accounts of the foreign plants, but it is certain that they will show a material decrease over those of the previous year.

President Barton, in answer to inquiries of the stockholders for more information regarding earnings, said that the foreign plants of the company had a more profitable year than in a number of years, but that business in this country was done on a small margin of profit, and consequently the net earnings for the year were less than in the previous year. He characterized the year as fair, rather than poor. The outlook, he said, was considerably improved, as the company had on hand an increased volume of the more profitable kind of orders.

The new Hawthorne plant of the company, situated on the Belt railroad, is rapidly nearing completion, and Mr. Barton said that manufacturing would begin there on May 1st. He said this year, however, the new plant would be really getting ready for effective operation, and no great improvement in the company's business could be expected from it. Ultimately, however, he said, the management "hoped to get returns from the investment there."

Mr. Barton said the new plant was pretty well paid for as far as it had gone, and he saw no reason for expecting any capital changes for the company during the coming year.

## Odd Electrical Fires.

The quarterly fire report of the National Board of Fire Underwriters contains reports of 30 fires of electrical origin which in the majority of cases were the result of careless handling rather than any inherent defect of the electrical apparatus. One fire originated rather peculiarly, from the fact that a bird saw fit to build its nest in an electric sign. Moisture collected in the nest, causing a short-circuit on the back of a receptacle, setting fire to the sign.

Incandescent lamps are dangerous bedfellows, as is shown by one fire which was caused by the use of an incandescent lamp as a warmer under the bedclothes on a cold night.

In another instance a piece of tapestry, through which ran a metal thread, formed a connection between the canopy of an electric fixture and a grounded switch plate. A defect in the fixture allowed the grounding of the circuit through the thread.

## Electrical Apparatus for the Agglomeration and Separation of Ores.

Electrical apparatus is often advantageously used in the treatment of magnetic ores, either for the separation of the particles of ore from the powdered rock and other non-magnetic substances or for the agglomeration of the particles into masses more suitable for feeding to the furnace. Edison's work in this direction is well known. Two patents have been granted recently for apparatus of this sort, one to John Thomas Dawes of Liverpool, England, upon

FIG. 1. DAWES' ELECTRICAL APPARATUS FOR THE SEPARATION OF MAGNETIC ORES.

a "Magnetic Separator for Ores or Similar Materials" and the other to Elmer Gates of Chevy Chase, Md., for a "Method of Agglomerating Magnetic Ore."

In the apparatus of Mr. Dawes the principle involved relates to machines in which the powdered ore or other granular material is fed in a layer upon a moving surface and the magnetizable particles attracted toward a magnet pole above. Fig. 1 is a side view of a machine having the outer shield and hopper removed.

The moving surface for carrying the material to be separated consists of a drum (1), preferably of non-magnetic material, secured on a shaft. A hopper is provided for feeding the material onto the drum in a thin layer. Any suitable form of feed appliance may be used. The material is carried

FIG. 2. GATES' ELECTRICAL APPARATUS FOR THE AGGLOMERATION OF MAGNETIC ORES.

forward beneath a disk (10), the lower face of which is arranged a short distance above the upper portion of the periphery of the drum and approximately tangential to the face of the drum. The disk is secured on a shaft, rotating in bearings, secured to the frame, and is rotated from the shaft by bevel gears. The shaft has a keyway, and the wheel is provided with a key fitting into the keyway, so that the shaft may move axially through the wheel to allow of adjusting the disk.

An electromagnet (16) has one pole (17) arranged above and close to the disk and the other pole (18) arranged within the drum at a short distance from the inner face, so that an intense magnetic field is produced, into which the material is carried by the drum. As the material passes along the magnetizable particles are attracted [illegible] by the upper pole and [illegible] the under surface of the disk, which, by its rotation, carries them out to the end (19) of the pole, whence they fall into a hopper or receptacle. The non-magnetic particles of the material are carried forward by the drum and fall into another hopper or receptacle. The magnet is mounted on a slide, which, by means of a screw and wing-nut or other convenient adjusting devices, can be moved up or down to vary the distance of the magnet poles from the periphery of the drum as desired.

When there is a large proportion of magnetizable particles in the material, they are liable to collect in a bunch under the disk about the outer extremity of the pole, and to prevent such a bunch coming in contact with the drum and the particles being detached and carried into the hopper by friction, the end of the pole (17) is extended outward at (19) nearly to the periphery of the disk, and the particles collect between the extremity of the pole and the extension on the shield, the upper part of which and the inward projection are interposed between the extremity of the pole and the drum and keep the particles of the bunch entirely out of contact with the drum. As the disk rotates and brings more particles to the end of the pole the particles gradually fall down into the hopper. Any particles adhering to the disk are removed by a scraper, carried on springs (37), and fall again onto the drum.

For a different purpose is the device of Mr. Gates, which is shown by Fig. 2. The invention relates to the treatment of magnetic-iron ore, commonly termed "magnetic sand," for the purpose of causing the incipient fusion and union of the particles into lumps or nugget-like particles of larger size adapted for more advantageous use in the final-reduction furnace. To this end there is established an electric arc between the ends of two oppositely located feed troughs or guiding surfaces, and into the arc is fed the magnetic sand from opposite directions, whereupon the electric arc will pass from one body of the falling sand to the other and effect the fusion of the particles into small lumps.

Fig. 1 represents in side elevation an apparatus adapted for the practice of the invention. Referring to the diagram, hoppers are shown for supplying the magnetic sand to inclined feed troughs. Each feed trough is mounted upon a standard of conducting material, preferably carbon, and is itself of conducting material, so that when two troughs are located opposite each other and are then brought together and included in an electric circuit the subsequent separation of the meeting ends of the trough will cause an electric arc to span the interval between them. As indicated in the figure, the opposite terminals of the circuit may be conveniently connected to the standards, and the standards are movable toward and from each other upon the supports.

Beneath the discharge ends of the troughs is located a tray, into which the streams of fused particles fall and are temporarily accumulated. From this tray the particles drop into a hopper, discharging into a rotatory screen, and below the rotatory screen are located two other hoppers.

The opposing ends of the inclined troughs are brought together, so as to establish continuity of the electric circuit in which they are included. The troughs are then drawn apart, causing an arc to span the interval between the ends. The magnetic sand is fed to the troughs from the hoppers and descends the inclines. In passing the ends of the troughs the falling streams approach each other, and the arc, seeking the path of least resistance, passes between the falling streams, decreasing in length by reason of the decreased resistance offered by the shorter interval spanned by it. Care is taken to feed the magnetic sand at a speed in excess of that necessary for the utilization of all of the energy of the current, and as a consequence the current is fully utilized, since it always finds in its path material upon which to act. The effect of the passage of the current is to fuse or agglomerate the magnetic sand into the condition of small lumps, varying in size from a wheat grain to the size of a bean. The passage of these lumps into the hopper is momentarily checked or retarded by their accumulation in the tray, where they are partially cooled, but from which they overflow and drop while still hot into the hopper. Thus the fused particles of magnetite are brought into contact with the particles previously deposited in the tray and which have passed the state of fusion, the result being that the fused particles adhere to and agglomerate with the previously fused but now partially cooled particles in the tray and form lumps of magnetite of increased size. These lumps, together with the attendant excess of unfused sand, are received into the rotatory screen, and in passing [illegible]

## Death of George S. Bowen.

[illegible] in Chicago he entered business with his brothers, with whom he remained until the fire in 1871, in which the firm lost several millions of dollars. In 1861 he was chosen president of the Young Men's Library Association, and in 1867 was instrumental in the organization of the Woolen Manufacturers' Association of the Northwest, being its first and only president.

Mr. Bowen was for several years associated with the old Vandepoele company in the introduction of its electrical system in the United States and abroad and was the first manufacturer of the Star towers for city lighting. Elgin was the first city to use

GEORGE S. BOWEN.

the system of high lighting, but the use of the towers was soon extended to other cities. For many years Elgin was known far and wide for its light towers, and investigating experts came to see the system from Australia, Japan, Mexico and England. Mr. Bowen was a firm believer, in the early days, of the superiority of electric power, and predicted that it would ultimately supersede the direct application of steam for railway and manufacturing purposes.

Mr. Bowen was elected mayor of Elgin in 1872 and in 1883 was president of the Elgin Electric Light Company, whose plant was later bought by the city. He then, with several others, organized the Elgin Board of Trade. On February 18, 1885, as the result of a call issued by Mr. Bowen and others, electric-light men of the United States met in Chicago and organized the National Electric Light Association, of which in 1890 he was made an honorary member.

Prominent in industrial, social and religious affairs, Mr. Bowen served the public in various capacities. He was at one time treasurer of the Grace Church, Chicago, president of the Protestant Orphan Asylum, Chicago, for two years, one of the principal organizers and builders of the Chicago and Pacific railway, now part of the Chicago, Milwaukee and St. Paul and was but recently chosen president of the North Pacific Trading Company.

In 1854 he was married at Salisbury Center, N. Y., to Julia E. Byington. Mrs. Bowen and two children, George E. Bowen and Mrs. Anna C. Byington, survive him.

The accompanying portrait gives a good idea of Mr. Bowen's appearance at the time when he was actively concerned in electrical affairs. In the '80's Mr. Bowen was well known to the comparatively few electrical men of that day in Chicago and vicinity. He was interested not only in electrical science, but in all progress and good works. He foresaw the great development of applied electricity, but allowed the accumulation of material benefits from this conviction to pass to others with greater talent for the concrete utilization of industrial opportunities.

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Iowa Telephone Association (annual meeting), Des Moines, March 13th and 14th.

Ohio Independent Telephone Association (annual meeting), Columbus, March 30th.

Iowa Electrical Association (annual meeting), Hotel Julien, Dubuque, Iowa, April 19th and 20th.

National Electric Light Association (annual convention), Denver, June 6th, 7th and 8th, and Colorado Springs, June 9th and 10th.

International Association of Municipal Electricians (annual convention), Erie, Pa., August.

Ohio Electric Light Association (annual convention), Hotel Victory, Put-in-Bay, August 16th to 18th.

American Electrotherapeutic Association (annual meeting), Academy of Medicine, New York city, September 19th, 20th and 21st.

RUBBER AND PLATINUM are two substances that enter into electrical manufactures to a considerable extent, but which are not produced in the United States to an appreciable degree. Rubber may possibly be cultivated in the Philippines (although the prospect is not particularly flattering), but as to platinum, it is likely that this country will continue to be dependent on Russia for its supply unless some source of the metal now unknown should be discovered. This is unfortunate, for pure platinum is valued at $19 an ounce, and during 1903 the imports of this highly prized metal were valued at $2,055,933. In the same year the platinum produced in the United States was valued at only $2,080. American platinum refiners would welcome a supply of the metal from this country, and will, we are sure, gladly analyze specimens. It may be that some enterprising prospector or other person will yet discover a depost of platinum in the United States, which is so rich in other minerals. If such a supply existed in any considerable quantity, the owner of it could consider his fortune as made.

PUBLIC OWNERSHIP with private operation, as in the case of the New York subway, may be all right, but public ownership including public operation is usually lax, sluggish and unprogressive. "Public buildings are the poorest, most costly and slowest of construction. Public service in the buildings, in the elevators and by the janitor is bad. The horses drawing the city wagons are the most pitiful specimens seen on the streets. Out of $95,000 in Criminal Court fees imposed last year only 10 per cent. was collected for the city's use. All things and all lines of business intrusted to public care suffer in comparison with the private-business world. And still the advocates of public, political, graft ownership keep up their call." This is a part of a communication in a Chicago daily newspaper. It is somewhat exaggerated—it seems difficult for anybody to discuss the municipal-ownership proposition without exaggeration and with the restraint of calm, good sense—but, in Chicago at any rate, it hits off the general situation pretty well, although such a building as the Public Library certainly stands as an exception to one of its series of condemnations. But private ownership is undeniably more efficient. Governments, national, state and municipal, have certain inalienable functions to perform, but in their very nature—in this country at any rate—they are not well fitted, by experience, organization or aptitude, to carry out industrial enterprises through a long space of time, with changing regimes. The Philadelphia gas plant affords one example. Private selfishness brings many evils in public-service work, but municipal operation is not the remedy to be adopted to escape from them.

THAT college professors are underpaid, both in technical and classical schools, is notorious. Dr. Henry S. Pritchett touches on this regrettable state of affairs in his recent report as president of the Massachusetts Institute of Technology. He says that the remuneration of American college teachers has been relatively diminished rather than increased. He avows his absolute belief in the statement of Sir William Ramsay that unless teachers are better paid the institutions of learning in this country are sure to deteriorate. There promises to be increasing difficulty in securing good men. The professor must devote six or eight years to preparation and then accept a position as an assistant at $700 or $800 a year. "He will be a man of unusual attainments if at the end of 10 years he has been advanced to an assistant professorship at $1,500 a year." Furthermore, he has been so engrossed by classroom tasks and administrative duties that little time or strength is left for research work. College professors are, as a class, devoted and self-sacrificing, and "some solution must be found which shall give the teacher greater freedom from the administrative side of the work and which may at the same time increase his compensation."

This is certainly an important subject. Men of ability, experience and tact are needed to teach and to influence the young men in the colleges—to say nothing of the value of original investigations. The whole teaching force of the country receives a far smaller compensation than the importance of its vocation entitles it to obtain. Wealthy men, in endowing colleges and establishing foundations, may well bear in mind the worth and needs of the faithful, underpaid professor and make specific provision for adequate salaries.

Unipolar dynamos, or, to use the more modern and correct term, homopolar dynamos have taken on a new significance as far as practical utility is concerned now that the steam turbine has reached a stage of development which admits of the serious contemplation of the homopolar machine as a commercial possibility. In the light of the reawakened interest which has been manifested lately in this type of generator, the two articles given this week—"The Unipolar Dynamo," by Mr. J. Seidener, and the "Acyclic (Homopolar) Dynamo," by Mr. J. E. Noeggerath—are timely. The fact that a practical working machine of so large a capacity as 300 kilowatts has actually been constructed, as has been demonstrated by Mr. Noeggerath, is, to say the least, somewhat surprising. The chief feature of advantage in these machines appears to lie in the sparklessness of the current collection due to the absence of a commutator, and it is a curious fact also that the chief difficulties which arise in their operation are connected with this very point of current collection. However, it must be remembered that the machine is as yet only in the first stage of its development, which must necessarily bring out many weak points. The development of the new generator offers a field for much original work and, as many are interested in the subject, the matter will probably not be allowed to rest until the real value of the device has been ascertained.

NEW YORK, at the instance of the Herald of that city, is paying some attention to the high telephone rates which prevail within its borders. The daily newspaper named has a good deal to say about the exactions of monopoly and has been interviewing Mr. S. P. Sheerin of Indianapolis, who is one of the most prominent and successful of Independent telephone operators. Mr. Sheerin was naturally nothing loth to state his side of the case. "You people here in New York," he declares, "with your exorbitant telephone rates, are helping the monopoly to fight its losing battles in the West. Western states and states of the Middle West are enjoying cheap telephone service. Where the trust's profits have been curtailed it is making the metropolis pay the deficit. In other words, Indiana, Ohio, Michigan and Illinois are getting the benefit, while New York 'pays the freight.'"

This is interesting certainly, but it is to be remarked that the former Bell telephone monopoly, although it has been subjected to severe handling in the West, particularly in Ohio, Michigan and Indiana, is still putting up a pretty brisk fight. Chicago has been long familiar with agitations for reduced telephone rates, and it has a competing exchange company, which, however, serves only the downtown business district. Nevertheless, the Bell prices have not been materially reduced, and the old company is doing a flourishing and increasing business. The statement of this fact is not intended in any way to deprecate telephone competition, for we believe that the entrance of the Independents into the field has been of great benefit to the whole telephone industry. It has popularized the use of the telephone, cheapened the rates in many places, put the Bell companies on their mettle and brought profit to many worthy gentlemen who have engaged in the business in opposition to the older companies. The battle between Bell and Independents goes merrily on, and while the erstwhile monopoly appears to be losing in some places, in others it is more than holding its own, with renewed vigor and no little skill. New York is one of the few Bell citadels still uninvaded, and it will be interesting to observe whether the present telephonic disturbance there will assume proportions that will bring the actual operation of a competing system appreciably nearer. Perhaps not, but at any rate a full and fair discussion of the situation will probably bring to the average New Yorker some ideas relating to the actual results of telephone competition of which he had been in ignorance. But the discussion should be fair and good-natured; even an ex-monopoly is entitled to justice, while not a few of the Independents give honest service at an honest price.

## The Chicago Automobile Show.

Not only automobile enthusiasts, but the general public as well, are more than pleased with the automobile show in Chicago of this week. All the week the Coliseum has been thronged with people. One perhaps is interested in an $8,000 touring car, another may be intent upon a spark plug or a new kind of lubricant; but the majority are present to see everything—and to be seen.

This is the fourth annual exhibition of the National Association of Automobile Manufacturers and in the number and appearance of exhibits excels any yet held in Chicago and perhaps any ever held in this country. The same cars and appliances which were shown at the New York show last month are here and the great expanse of the main floor of the Coliseum, being larger than that of the Madison Square Garden, allows of better grouping and more striking effects in the arrangement of the exhibits. Electric signs appear everywhere in the galleries and on the main floor, and the whole scene presents an animated appearance.

In all 392 cars of all types are on exhibition. The floor space let was 51,000 square feet. Most of the exhibits, of course, are gasoline machines, but electric vehicles are by no means put in the background for all that, and they attract much attention on account of the beauty of their appearance and the simplicity of their construction when compared with the almost bewildering intricacy of the gasoline machines.

The Pope Motor Car Company of Indianapolis, Ind., showed an excellent line of electric vehicles, including a one-ton truck, runabout and a coupe-top Chelsea, besides other cars using electric drive. The top of the Chelsea is so made as to be easily removed, making then a neat and compact road wagon. The strong point about the Pope machines is the herringbone type of gear for transmitting the power from the motor shaft. This type of gear runs with no perceptible noise and is inclosed in an oil and dust-proof case and with a little care will run for years without renewal. Double-row ball bearings are a feature of these machines, contributing to their light-running qualities. Mr. H. E. Wagner was in attendance to explain thoroughly the details of the machines.

Out of the nine vehicles exhibited by the Woods Motor Vehicle Company all were electric except one. Among the cars were a runabout, a Queen Victoria, an inside-operated brougham and a two-seated surrey. The exhibit was one of the largest of electric automobiles and presented an attractive appearance.

The Royal Automobile Company of Chicago exhibited, under the charge of Mr. G. A. Berg, an inexpensive runabout for city use and a Royal "fit for a king" Victoria. What the company believes to be the strongest point about these machines is the Imperial motor, one of which is used for each of the back wheels. Each motor is independent and thus each wheel is "alive" and takes care of its own load.

As an example of heavy trucks the Vehicle Equipment Company of New York city exhibited one of two tons' capacity, which had been in constant use for 16 months.

Studebaker automobiles were well represented by the exhibition of nine vehicles, the majority of which were electric driven. Mr. T. W. Goodridge was in charge. The Studebaker people are the apostles of massive construction, with consequent longevity. The weight of the motors is all carried by the springs instead of being borne by the axles, which contributes much to the life of the motors and their efficient operation, since they are thus free from a large measure of the vibration.

Columbia carriages, trucks and touring cars manufactured by the Electric Vehicle Company of Hartford, Conn., were well represented at the show, including some very handsome broughams, phætons and landaus.

An interesting type of rotating gas engine for automobiles was exhibited by the Adams-Farwell Company of Dubuque, Ia. These engines have been developed by the company during the last four years, but have only been put on the market recently. There are three cylinders in the engine, situated at angles of 120 degrees, which rotate in a horizontal plane. The crank does not revolve, but the cylinders which are attached to the driving mechanism do revolve, it being possible to time the explosions in each cylinder so that the pistons successively impart to the mass comprising the three cylinders the necessary turning moment. The advantage of this construction is in the compactness, the whole engine being placed in a small space under the seat of the automobile; the accessibility of the parts, but above all, to the cooling effect on the cylinders, caused by the engine in its revolution, which circulates the air freely about the jackets of the cylinders, provided with fluted surfaces. The company makes automobiles, some of which were on exhibit. Attention was attracted to the exhibit by one of the engines, which was hung from the ceiling and covered with small incandescent lights of all colors, which, as the engine revolved, presented a striking appearance.

Accessories and sundries of all kinds for automobile use were exhibited, principally in the galleries and the ball room in the rear. The valuable products of the Joseph Dixon Crucible Company of Jersey City, N. J., were presented attractively to catch the attention of the [illegible] lubricating compound [illegible] graphite motor [illegible] turing for some time, [illegible] very [illegible] the [illegible]

The [illegible] Storage Battery Company [illegible] cago [illegible] a new type of [illegible] material. The grid is made with concentric circles as the main framework, which gives the greatest resistance to forces tending to make the plate "grow" during forming. Plates formed from this grid are of exactly the same size as the original grid.

Vesta ignition batteries were shown by the Vesta Accumulator Company of Chicago. Their strongest features are that the terminals are brought out on the side, reducing the liability of corrosion from acids, and there is placed in the top of the case a plate glass slide, closing in the batteries during charging and preventing the escape of fumes.

The new Columbia battery connector was exhibited among other things by the National Carbon Company of Cleveland. The connector is provided with a rubber gasket, which comes between the connector and the thumb screw, which gives virtually a spring contact when screw is firmly set. The company also showed a new type of cell, called the Navy type, used principally for gun firing and night-sighting lamps.

Following are other exhibitors handling apparatus of an electrical nature: Pittsfield Spark Coil Company, Pittsfield, Mass.; Chicago Battery Company, Chicago; Chicago Storage Battery Company, Chicago; Miller Signal Company, Chicago; Motor Car Equipment Company, New York city; Thurston Manufacturing Company, Chicago; Dow Port Electric Company, Braintree, Mass.; Howard Electric Novelty Company, New York and Chicago; American Electrical Novelty and Manufacturing Company, Chicago; Dayton Electrical Manufacturing Company, Dayton, Ohio; Remy Electric Company of Anderson, Ind., and the Electric Contract Company, New York city.

Reviewing the progress which has been made in automobile construction during the last year it may be noted that the average horsepower of all machines for 1905 is 18 as compared to 16 for 1904. Another is the 100-inch wheel base now used on many machines.

In nearly all the better makes of 1905 touring cars the entrance to the tonneau is on the side instead of in the rear, which is a decided advantage.

## Electric Drive in a Large Fashion-publishing Establishment.

The new Butterick Building, in which are produced in large numbers patterns and periodical publications for women, is an interesting type of the ultra modern skyscraper factory now gradually growing up in New York city. Electric power to a maximum of 2,500 horsepower is used in this building, and yet outwardly it resembles not a factory, but an office structure of 15 stories. It is especially noteworthy to observe how the fact of the predetermined employment of electricity simplified the problem of the architects. The necessity of planning the floor space to accommodate boilers and engines, belts and shafting, was entirely obviated, and when experience demonstrated that some particular piece of mechanism had not been originally placed in the most advantageous position, its removal to another part of the building has been accomplished with the minimum of labor and expense.

Excluding the local traction corporations, the Butterick company is perhaps the largest consumer of electricity for power purposes in New York city, and it is certainly the largest printing establishment whose plant is devoted to a single purpose, producing monthly publications and costume patterns by the hundred thousand. To this end there are already no less than 86 printing presses installed, each driven by an individual motor ranging from 25 horsepower downward. Nearly every kind of press is represented, and there are now in course of installation five newly imported French four-color presses from Éduard Lambert of Paris. These presses, it is anticipated, will produce, from halftone blocks, work equal if not superior to lithography. Each press is to be equipped with a motor of 10 horsepower. The manufacturer's specification calls for a 7½-horsepower motor, but experience has shown that press builders are apt to underestimate the energy required for the highest degree of efficiency.

Altogether, there are over 300 electric motors in the building, of various types—General Electric, Westinghouse, Crocker-Wheeler, Bullock, Sprague and others. Generally speaking, each machine is direct-coupled, or directly geared, and short belting has only been resorted to for temporary purposes. The motors are controlled by various methods, including General Electric, Westinghouse and Cutler-Hammer. The Cutler-Hammer controllers for web machines have been ingeniously suspended from [illegible]

[illegible]

are taken to a gathering machine, which automatic- [illegible] covers, are wire-stitched by means of 25 stitching machines, driven by Sprague motors. The stitched magazines are [illegible] other automatic machinery. The glue needed in this process is kept at a proper temperature by means of Hadaway electric heaters.

At present the company has no electrotype foundry, but the wood-engraving room, under the roof on the fifteenth story is in course of transformation into a foundry department, wherein all the latest appliances will be used. These will include a set of Boissier's "rapid depositing" tanks, which will produce an electrotype in 15 minutes, working at five volts and 500 amperes.

The mechanical equipment of the Butterick company is still in course of evolution. There is yet room for additional electrical and mechanical devices, and in the end the equipment will be so complete that the only supplies needed from the outside will be ink and paper. Paper is already used at the rate of 45 tons a day. There are 10 electric elevators in the building, about 5,000 lights, 90,000 feet of conduit, and 250,000 feet of wiring, not including the wiring for 120 telephones which have their own private exchange. On one side of the building is an enormous electric sign, visible at night for miles around, and illuminated with 1,200 incandescent lamps. This sign consists of the single word "Butterick," and the letter B is no less than 68 feet high.

D. W. W.

## Indiana Interurban Men Protest Against Proposed Legislation.

A number of Indiana interurban-railway men appeared before the Codification Commission last week and vigorously protested against certain provisions of the bill on municipal corporations. The traction men object to the enlargement of the powers of city councils, as proposed by the commission's bill. They oppose in particular the provision which grants a city council power to condemn city railways on the theory that this will permit the condemnation of interurban lines within city limits. They refrained from discussing the general principles of municipal ownership of public utilities and pointed out the predicament in which their systems would be left by the condemnation of their property in one or more cities. They argued that the 25-year limit to city franchises is unfair to interurban companies, because they are expected to compete with steam roads, which hold their right in perpetuity. They suggested that such provision would operate to defeat competition and work directly to the disadvantage of the public. The interurban men also oppose that provision of the bill which compels them to light every street crossing which they cross in towns and cities, 30 minutes before cars pass. Since interurban lines operate cars about every hour, this means, they say, that they must pay for the lighting of the streets on which they operate.

Those appearing before the commission were Charles L. Henry of the Indianapolis and Cincinnati Traction Company, A. W. Brady and Horace Stillwell of the Union Traction Company, S. B. Fleming of the Fort Wayne Traction Company, L. W. Taylor of the South Bend interests, J. F. Beasley of the Terre Haute interests and H. J. Peckinpaugh and H. D. Moran of the Evansville and Princeton interests.

A new obstacle to the immediate progress of the Newhouse railroad-commission bill in Indiana was made known by Arthur W. Brady, president of the Union Traction Company, who appeared before the legislative committee and complained that the amended bill, now about to become a law, contained no provision by which the proposed commission will have power to compel steam roads to turn over loaded freight cars to electric lines. Mr. Brady said that the traction interests would prefer to be left out of the railroad commission entirely. "Our business is now in a state of absolute experimentation, and we do not like to contemplate the possibility of having our development hampered by some rule of the commission without corresponding advantages," said he. "We do not ask for unconditional exchange of freight between steam and traction lines at this time. We are not ready for it. But there are times when we need loaded cars of the steam lines consigned to points on our lines, and at such times we believe the commission should have the power to compel it," said Mr. Brady.

## Acyclic (Homopolar) Dynamos.[1]

By J. E. Noeggerath.

Except for very low pressures, the so called homopolar dynamo has so far been a failure from a commercial point of view. This failure is principally due to two conditions: First, the uncertainty as to the magnetic and electrical conditions prevailing in this type of generator; secondly, the difficulties encountered in collecting large currents from a generator running at a high rate of speed. These conditions will be discussed in this paper, and in order that their import may be grasped there will be described in outline the design of, and some results obtained with, a 300-kilowatt 500-volt turbine-driven acyclic (homopolar) generator built in the shops of one

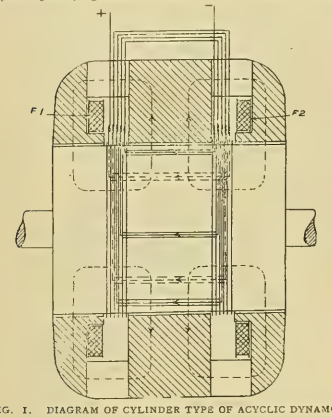



FIG. 1. DIAGRAM OF CYLINDER TYPE OF ACYCLIC DYNAMO.

of the large electrical-manufacturing companies. The question dealt with is a broad one, too broad to be discussed at length in this paper; the main points only will be taken up and a more thorough discussion left for a later date.

Classifying acyclic generators according to the position of the armature conductors we find two prevailing types:

1. The radial type; single disc and double disc.
2. The axial type; single cylinder and double cylinder.

The armature of the cylinder-type acyclic dynamo here under consideration (Fig. 1) consists chiefly of a solid cast-steel cylinder carrying a small number of straight conductors on its surface; these conductors are connected at both ends to sets of collector rings. The field consists chiefly of a cast-steel structure extending toward the shaft in three polar projections that enclose the armature in complete cylinders. Field coils (F1 and F2) are wound concentrically around the shaft. There are also mounted two sets of brushes and a number of stationary conductors (frame conductors). Eight openings give access to the brushes and field spools. The field spools set up two primary fluxes diverging radially.

As the armature revolves in this uniform field electromotive forces are generated in the armature

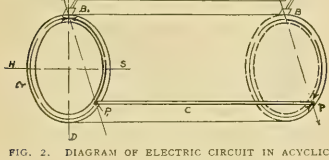



FIG. 2. DIAGRAM OF ELECTRIC CIRCUIT IN ACYCLIC DYNAMO.

conductors, constant as to magnitude and direction. Single conductors or groups are connected in series by means of collector rings or commutator segments and the frame conductors.

$$\text{The induced electromotive force} = \frac{\Phi\ N\ n\ 10^{-8}}{60}$$

$$= 1.66\ \Phi\ N\ n\ 10^{-10}$$

Where $\Phi$ = total flux,
N = revolutions per minute,
n = armature conductors in series.

Fig. 2 shows diagrammatically the simplest form of an electric circuit in a cylinder type of generator, (C) and (R) representing armature and frame conductors, (Cr) and (B) representing collector rings and brushes, respectively. The currents passing through this system set up secondary fields which affect the primary flux. Of these the ones created by the currents flowing in the collector rings (ring reactions) are of great interest from a practical point of view.

For a given time the connection point between armature conductors and collector ring passes through ($P_1$). At this moment currents flow from ($P_1$) to ($B_1$) through both sections of the ring, the currents being inversely proportional to the ohmic resistance of the ring sections. The currents set up fields in the magnetic material, in which they are completely embedded.

As the armature revolves, the connection point ($P_1$) moves on, changing magnitude and direction of the magnetomotive force. These periodical changes of magnetization create hysteresis and eddy losses in the solid material. They also weaken the primary flux, since, due to saturation, the increase in density is considerably smaller than the decrease. This means bad regulation.

There are various means of counteracting ring reactions. One consists of placing brushes all around the ring, practically covering its surface. For commercial pressures this method is out of consideration because of the great number of collector rings. It would be impracticable to adjust and watch the very large number of brushes required in this case. The question of friction losses also limits the number of contacts.

Satisfactory results were obtained with a method in which the rings, brushes, and connection points of the collecting system are on one side of the armature of one collector. The connection points form a spiral of one complete turn, while the contact points of the brushes form one or more turns of a spiral running in the opposite direction. The brushes are arranged in groups that can be inspected from the openings in the frame. In this case the summation of the magnetomotive force equals zero for each section of the collector periphery and for any position of the armature.

The medium between armature and frame conductors consists of non-magnetic material, air; that is, the conductors are mounted on the surface of the armature and frame, respectively.

The magnetic medium between the stationary and

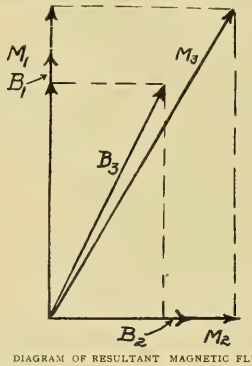



FIG. 3. DIAGRAM OF RESULTANT MAGNETIC FLUXES.

revolving parts of the winding consists of iron. Principally due to saturation, the density of the resulting flux will be considerably smaller than $\sqrt{B_2^2 + B^2_2}$ (Fig. 3), and its component in direction of the primary magnetization appreciably weaker than ($B_1$). But to restore the flux to its original value only so many ampere-turns have to be added as are required for the increase in density along that part of its path that is affected by the secondary magnetization. The influence of a given armature reaction or regulation is therefore determined by the relation between the reluctance of the primary magnetic circuit in that area and the total primary reluctance. It can be kept very low.

Tests on the 300-kilowatt generator show that the difference in pressure between full load and no load is only slightly higher than the drop, due to the total resistance of the armature circuit; that is, regulation is good.

While the armature windings of acyclic dynamos will not be discussed in detail, yet the points that have to be considered in laying out these windings would better be indicated here; they are:

1. Neutralization of ring reactions.
2. Magnetizing effect of end connections.
3. Minimum pressure between rings.
4. Assembling of brushes in groups for accessibility.
5. Equal resistance of armature circuits.
6. Minimum pressure between adjoining conductors.

Point five is to be considered if it is desired to run the machines at different pressures.

Accumulative or differential compounding of acyclic motors or generators can be effected either by means of a series coil, or by giving an angular displacement either between the contacts and the frame conductors or between the connection points and the armature conductors. For instance, the currents flowing in the leads that connect the frame conductors and brushes partly or totally enclose the armature. The circular component of the magnetomotive force of these currents acts in the same or opposite directions as the magnetomotive force of the field coils. By shifting the brushes it is possible to adjust the compounding. By moving them against the direction of rotation accumulative compounding is effected in generators; for motors, the result is the reverse.

It is obvious that series generators and motors can be built without field coils. In such generators the intensity and direction of magnetization can be changed by shifting the brushes and, consequently, the electromotive force of generators as to direction and magnitude, can be influenced as well as the speed, torque, and direction of rotation of motors. Acyclic generators are self-exciting.

The considerations of the electrical and magnetic quantities discussed above for an axial-type acyclic generator hold good also for the radial type, with the exception of a modification in regard to the armature reactions. The currents flowing in the armature of the radial type set up fields that enclose the conductors. These secondary magnetizations disturb the primary flux in a way similar to that discussed for the axial type, resulting in core loss and affecting regulation. By placing the conductors close together, that is, in conforming with the equation,

$$\frac{d\,i}{d\,l} = C,$$

the components $\alpha$ and $\beta$ are neutralized, leaving a resultant magnetization, which may consist of two circular fluxes. In this case i = current and $l^1$ = unit length of a circular section taken concentrically around the axis.

The secondary flux intersects at right angles with the primary. Their influence upon each other can be modified, as was discussed for the axial type.

The efficiency of a high-speed acyclic generator about equals that of a turbine-driven commutator-generator, but the distribution of the losses is very different. As windage and bearing friction depend on the mechanical design only, and not on the type, they can be made to have the same value for both machines.

The $I^2R$ field loss is somewhat smaller in acyclic machines, principally because the length of the air gap is limited by mechanical requirements and not by the armature reaction.

The $I^2R$ armature loss is almost negligible, on account of the small number of turns. In the generator under consideration there are 12 armature conductors and 12 frame conductors in series.

It is obvious that in a field of uniform and constant density there should be no hysteretic loss. As to eddy currents, reference is made to Fig. 17, where uniform distribution without stray fields is assumed. No electromotive forces are induced in the field. The arrows represent value and direction of the electromotive forces induced in the armature body. It is evident that summation of the electromotive forces equals zero for any closed circuit inside the armature, as well as in any circuit including armature, bearings and field.

In general, the distribution of the flux in acyclic dynamos that eliminates core loss is expressed by the equation

$$\frac{d\,B}{d\,L} = C,$$

where L = unit length of any circle concentric with the axis; that is, the flux must have a constant specific linear distribution in the direction of rotation.

The variation of the air-gap length and of permeability, the openings in frame and armature, as well as the secondary fields, disturb this ideal condition. In other words, the flux densities in symmetrical points are not actually equal.

One-half of this difference in density (B d) represents the (B) in the hysteresis and eddy-current formulas. Its value depends, except on the magnitude of the disturbing elements mentioned above, on the relation of the reluctance in and close to the air gap, to the total reluctance. It is possible to keep this B d and, consequently, the core loss very low. The main losses are encountered in the brush contacts.

### New York Discussion (in Abstract).

Prof. F. B. Crocker, New York: Farraday himself proposed to multiply the voltage by connecting disks in series, and he suggests revolving disks of separate construction in the same field, and connecting their peripheries, which would cause the current to flow outwardly in one machine and inwardly in the other, and the current could be taken from the two. There are other ways of multiplying besides the one which Mr. Noeggerath has used. Another way is to use concentric cylinders revolving in the same field, the current entering one end of the cylinder and passing out the other end, and entering the further end of the second cylinder and passing out at the end of that cylinder, etc., threading through the field repeatedly in the same general way as in Mr. Noeggerath's machine, but using concentric cylinders, instead of elements of cylinders.

Mr. Noeggerath has adopted the plan of splitting the cylinder longitudinally into strips, like the staves of a barrel, and connected these in series. As I understand, he has 12 of them, and 24 brushes, the one at each end corresponding to each of these elements of the cylinder. I might say that the limitation of this machine, of course, is the speed at which it can take current. At the speeds which Mr. Noeggerath uses, you see that if he had one element, it would be a plain cylinder of the old-fashioned unipolar type, so to speak,

1. Abstract of a paper presented at meeting of the American Institute of Electrical Engineers in New York, January 2nd, 1905. Mr. Noeggerath is an engineer of the General Electric Company.

and he would obtain one-twelfth of 300 volts, which is a very respectable voltage for a unipolar machine. I cling to the old term, although I think acyclic or non-acyclic, or homopolar, are good terms also. Unipolar is not a happy expression, because it is not really significant. There are two poles, the flux passing across an air gap from one pole to the other, so that the term unipolar is not particularly appropriate, but it is one which has been in use for the longest time. Acyclic or non-acyclic is a very good expression.

Dr. A. F. Kennelly, Cambridge, Mass.: I think a very interesting point has been brought out by this paper, and that is, that this is a field in which the direct current machine shows a distinct advantage. We have always regretted that we have not been able to get a magnetic material that could be cast, and which would conduct magnetically and not conduct electrically; that we had to go to the expense of laminating iron in order to destroy eddy currents in the mass of revolving armature. But in an arrangement of this kind we are led to expect that we can obtain a revolving, solid mass, in which there will be no sensible variation of eddy currents, and in which the desirable end we have all hoped for might be realized. The secret, of course, of the great success arrived at in a machine of the type described in the paper is the relatively enormous speed obtainable in comparison with machinery that existed before the advent of the steam turbine, and it is by reason of that enormous speed that this high electromotive force of 25 or 26 volts per foot can be obtained, and the result ought to be a great reduction in the weight of the really active parts, after the weight of the material which is purely structural has been deducted therefrom, owing to the favorable electromotive force produced per foot of active conductors, and accounting for the very small ohmic drop in the active conductors themselves. We have arrived, however, at a type of machine in which the surface which takes the part of the commutator is nearly double the surface of the armature core.

Mr. F. V. Henshaw, Ampere, N. J.: Any designer who has undertaken the problem of building a direct-current dynamo for connection to a steam turbine has always looked very longingly toward what we used to call the unipolar, but which is now the acyclic form, and there is one practical detail of construction here which I would like to ask Mr. Noeggerath about. The large size of the collector rings impresses one. Of course, in the case of a machine of this kind it is purely a mechanical question, there being no commutation, and what I am getting at is that the reduction of the surface speed would be of prime importance.

Then, again, if the brushes could be gotten outside of the frame, it would be extremely desirable. These things are so obvious that I presume they have been carefully gone into, and mechanical difficulties have presented themselves which have caused the designers to give up any attempt to place the contact rings outside of the frame and to reduce their diameter, which would have to be done in that case.

Mr. Noeggerath: Answering Mr. Henshaw's question, it is, for theoretical reasons, impossible to have the collector rings outside of the frame. While the C R drop arises appreciably with the increased speed, yet the friction losses decrease, so that the total losses remain practically constant for certain high speeds, so that the losses do not give any reason for decreasing the speed. The collector rings are not of hardened steel. They are ordinary cast steel, though it would, for mechanical reasons, be better to have them of nickel steel; you would be able to obtain higher speed than with the ordinary cast steel. There is, of course, wear on the brushes, but it is not any higher than on turbine commutators and machine. The wear is not more than the wear on carbon brushes on such high-speed machines. Of course, it is not more than the ordinary direct-current machines.

Edward P. Thompson, New York (written discussion): One serious point for consideration concerning Mr. Noeggerath's homopolar and a dynamo, as far as comparisons are concerned, seems to be the brushes. A longer experience will determine whether it is better to have a machine with two brushes and one commutator, or no commutator and many brushes. This sounds like an objection, and would appear so at first sight, but a close inspection of the author's paper discloses the valuable consideration that, in the dynamo, each commutator plate corresponds to a brush in the homopolar. In his homopolar the number of brushes is 24, while in a dynamo, of the same rating, there are 24 commutator plates. On top of this, should be pointed out the more excessive cost of a commutator, and the larger space occupied by the numerous rings and brushes. For comparatively low-voltage currents, the homopolar seems to be superior to the dynamo, on the whole, because of the absence of sparking, there being no succession of interruptions as in the dynamo, and only that sparking that is always due to a conductor loosely bearing upon a high-speed conductor. With the advent of high-speed engines, especially the steam turbine, Mr. Noeggerath's experiments are very timely, and more similar machines will doubtless soon spring up here and there.

Many an electrical inventor has tried his hand at solving the problem of making a homopolar like an alternator, except to obtain direct-cyclic or cyclic current instead of alternating. The solutions have generally ended in a case not that was not a homopolar, and not being either an alternator, a dynamo, or one that [illegible]. With single conductors, however, by which [illegible] conductors not having their return circuits in the magnetic field, the problem has often been solved, and in every conceivable manner, except possibly one. If the machine could be so designed that coils could be employed with their returns also in the magnetic field, and yet without using more than two collectors, then we would have the ideal machine, and the only question to be determined would be that of practicability of construction. It would be of interest, perhaps, to discuss running the returns (consisting of iron wires) through the center of a drum armature at or near the axis thereof, and therefore not moving, or moving but little, through the lines of force, magnetic poles being arranged substantially as in the Noeggerath homopolar. In this way the electromotive force could be anything desired. The lines of force could thus be caused to cut only those conductors on the outside of the armature. There would be waste wire, but so there is on drum armatures, and ring armatures in general.

[George H. Gibson, now of New York city, writes to the Western Electrician calling attention to a thesis which he prepared while at the University of Michigan in 1899 upon this subject in which he worked out the general theory of the machine and covered points which at that time appeared to be novel.]

## The Unipolar Dynamo.

The problem of the commercial application of unipolar dynamos is discussed in some detail by J. Seidener in a recent number of the Zeitschrift für Elektrotechnik, more especially with reference to their combination with steam turbines.

The writer points out (says the Electrical Review of London) that the great advantage of these machines is the sparklessness of the current collection, owing to the absence of a commutator, while at the same time one of the chief difficulties experienced with them in practice is connected with this very point of current collection. The high peripheral speeds demanded for the production of ordinary working voltages without an excessive expenditure on material involve a high friction loss at the collecting brushes, especially if the revolving surface is at all out of true, as that, naturally, necessitates a high-brush pressure in order to prevent vibration.

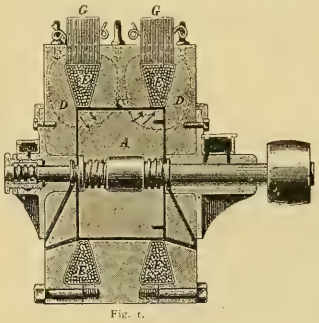


Fig. 1.

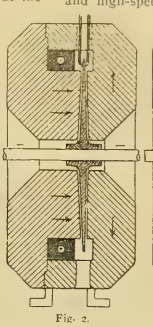


Fig. 2.

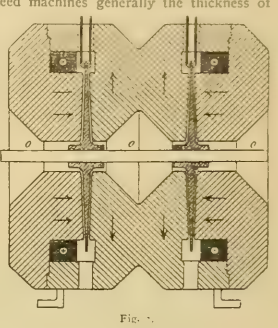


Fig. 3.

THE UNIPOLAR DYNAMO.

On this account the well-known Forbes unipolar machine (Fig. 1), with a solid cylindrical armature and the current collected at the two ends of the cylindrical surface, is especially difficult to deal with, as the exact balancing of a massive cylinder is almost impossible.

When the armature, however, takes the form of a thin disk (Fig. 2), this difficulty is much more readily overcome, chiefly because a thin disk can be more easily obtained of homogeneous quality throughout than a solid cylinder. Comparing Fig. 2 with Fig. 1, a little consideration will show that for the same number of revolutions per minute and the same external diameter of rotating part the disk machine will only develop half the electromotive force of the cylinder machine, though at the same time the weight of material in the disk machine is only half that in the cylinder machine. In order to obtain the same electromotive force in both cases it would be necessary to employ two disk machines in series. Now, in the cylinder machine current collection takes place at two points, both at the maximum peripheral speed. Two disk machines would together require four collecting points, of which two would be at the maximum peripheral speed and two at the minimum peripheral speed, i. e., on the spindle. The two latter collecting points may, however, be eliminated if the two spindles are electrically connected together, and the direction of excitation of the two field coils is arranged so that the two voltages act in series through the spindle. In this case (shown in Fig. 3), the disk machine has only two collecting points at the maximum peripheral speed, just as in the case of the cylinder machine, and the complete weight of material in the two types is the same. Such a two-disk machine [illegible] rial between the points of maximum [illegible] advantageously be built for small [illegible] especially suitable for comparatively [illegible] and large currents.

Armature reaction in the ordinary sense of the term is practically absent, partly because of the low value of the ampere per unit length of armature periphery and partly because from the arrangement of the machine actual armature reaction of the sort that exists in ordinary machines cannot occur.

The collection of the currents both in the cylinder and in the disk type of machine is greatly improved if in place of using the cylindrical outer periphery as the collecting surface part of the circular-end surface is used for this purpose.

Though there is great difficulty in obtaining a truly cylindrical surface (even if the final truing up is carried out at the actual working speed), yet the side faces of a disk made of homogeneous elastic material will approximate more and more to a perfectly flat surface the higher the speed at which the disk is rotated. With regard to strength the disk of a unipolar machine is even better off than a de Laval turbine wheel, as the former, when side-way-current collection is employed, need not even be thickened at the outer periphery, and so has no additional weight to carry there.

In the case of small moderate-speed machines the disks would usually be made of material of high electrical conductivity but bad magnetic quality, such as hard copper, bronze, etc. For large machines and high-speed machines generally the thickness of the disk near the spindle necessitated by mechanical considerations would be so great that the air-gap at the inner portions of the disk would become excessive and make these inner portions almost valueless as far as the production of electromotive force was concerned. If, however, steel or iron is employed as the disk material the only air-gap in the path of the flux is the sum of the clearances on the two sides of the disk, and this leads to a great saving in the weight of exciting, winding required, as compared with the non-magnetic disk type. Since all parts of the disk are at all times in a field of the same density, no hysteresis loss can occur.

There is, however, some danger of a one-sided magnetic drag on the disk, owing to the fact that some magnetic leakage occurs at the outer periphery of the disk, giving a higher flux density on one side of the disk than on the other. This difficulty can be avoided by replacing each of the exciting coils shown in Fig. 3 by two equal coils placed one on each side of each disk, thus making the arrangement about each disk symmetrical and preventing all peripheral leakage.

The employment of disks of magnetic material and the avoidance of all thickening of the disk at the outer periphery for collecting purposes (by collecting the current from the side faces) enables extremely high speeds to be utilized, and the writer is of the opinion that the introduction of machines of this double-disk unipolar type is likely to receive a considerable impetus in connection with the manufacture of steam turbines, both on account of the high speeds involved and also because the manufacture of steam turbines has led to increased experience in the construction of high-speed machine parts. In any case in view of the difficulties met with when constructing ordinary direct-current dynamos for coupling to steam turbines, both as regards commutation and the high centrifugal forces involved, a reconsideration of such unipolar machines would seem to be justified.

In order to show the sort of dimensions necessitated with this type of machine the results of a series of calculations on machines for five volts (plating dynamos), 115 and 230 volts (lighting dynamos), and

550 volts (traction dynamos), are shown in Fig 4. The magnets were in all cases assumed to be of cast steel, the flux density in the air and in the steel was taken as B = 15,000 C.G.S. lines per square centimeter, the voltage drop in the disk was neglected, the projecting part of the disk used for current collection was taken as 0.05 D where D= outer diameter of

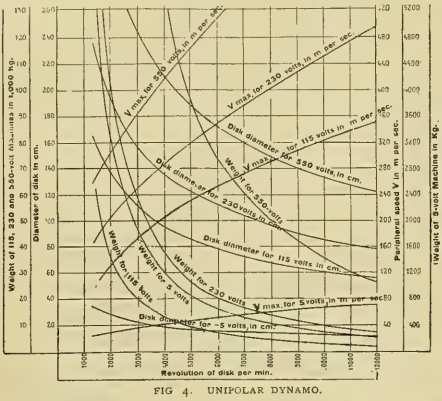



FIG 4. UNIPOLAR DYNAMO.

disk in centimeter, the air-gap was assumed to increase directly with the diameter of the disk, so that the section of the exciting coils also increased proportionately to the diameter. The inner diameter of the disk was taken as 0.15 D, so that the active radial length of pole face = l = 0.375 D, and the average peripheral speed in meters per second = v

$$= \frac{\pi \times 0.525\ D \times n}{60}, \text{ when } n = \text{number of revolutions per minute.}$$

The electromotive force induced in the two disks together is—

$$E = \frac{2 \cdot l \cdot v \cdot B}{10^8} = \frac{2 \times .375\ D \times \pi \times .525\ D \times n \times 15{,}000}{60 \times 10^8}$$

$$= 3.08\ D^2 \cdot n \cdot 10^{-6},$$

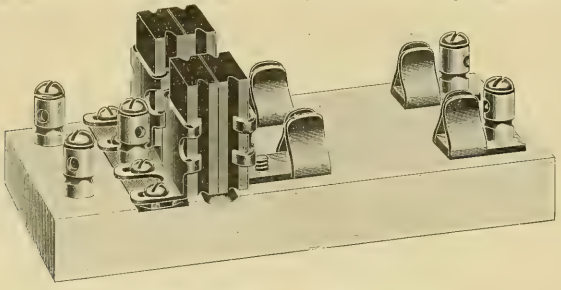
$$\text{or. } D = 570 \sqrt{\frac{E}{n}} \text{ in cm.}$$

The weights shown on the curve were obtained by proportion from a single complete working, assuming that the weight varied as the cube of the diameter of the disk—the expression being: Weight in kilograms = $0.0146 \times D^3$.

Machines of this type show a decidedly lower proportion of labor cost to cost of material than in the case of ordinary machines, principally because their massive build necessitates very little machining. The ratio of copper weight to steel weight is also very low. With a five-millimeter air-gap on each side of the disk and a disk about 100 centimeters in diameter this ratio worked out at only three to 3½ per cent.

## Lightning Arrester with Adjustable Carbons.

Lightning arresters which embody some desirable features are manufactured by the Appleton Electric Company of 224 Washington Street, Chicago, and are especially adapted for telegraph work. The accompanying picture illustrates a double-pole arrester complete; the device is also made in single-pole form. The arresters always come equipped with fuses. One good point about these blocks is that the carbons are adjustable from 1-64 to 1-16 of an inch, which makes it unnecessary to remove the carbons. After a lightning discharge or strong current has passed through, all that is required is simply to insert a card between the carbons to remove any dust. The open space between the carbons gives the entire surface of the carbons over which the discharge may take place.



LIGHTNING ARRESTER WITH ADJUSTABLE CARBONS.

## Troy Switchboard Instruments.

Switchboard voltmeters and ammeters first class in every respect and not of extremely delicate construction are always in demand. In designing an instrument to meet this want the principle first brought forward by Marcel Duprez has been adopted by the Troy Electrical Company of Troy, N. Y.

TROY VOLTMETER.

This instrument, as shown in the picture, is simple, the working elements consisting of a permanent magnet and two stationary coils, together with a pointer and its pivot, provided with a small steel vane. The lightest moving element is possible in this instrument, the steel vane being but 0.010 of an inch in thickness and three-fourths inch in diameter, and great torque is developed. This means both accuracy and long wear. The material in the steel vane is especially selected stock in reference to its magnetic permeability and its freedom from magnetic lag, no scale or oxide being allowed to remain on its surface. Vigilance in this respect gives an instrument reliability in its indications under any conditions, either ascending or descending.

The indications of the instrument are caused to be dead beat by a small aluminum damper, the moving element being extremely light; this device is very effective. The electrical losses are small, a 125-volt voltmeter having a resistance of over 3,000 ohms. The resistance is formed of an alloy having a very small heat coefficient, which renders the indications accurate, irrespective of changes in temperature. Insulation is of the best and all instruments are subjected to a rigid breakdown test before leaving the factory.

The permanency of the magnet is the vital point of all permanent-magnet instruments; it depends upon the length of the magnet relative to the air gap, the density of the magnetic flux, the process of magnetizing, the process of aging and the ingredients of the steel itself. Special tungsten steel is used. Tungsten introduced into the steel as an alloy aids the hardened steel and together they raise a mechanical barrier against the rearrangement of the molecules of steel and consequent loss of magnetism. The process of magnetizing is to subject the hardened steel blanks to a magnetic flux of maximum density, the idea being to affect the molecules most difficult of movement, and the theory being that actual movement takes place. Then, by reversing the direction of the magnetic flux and lessening it in density, the magnet is demagnetized until but 20 per cent. of the original charge remains. This 20 per cent. is then due to the molecules most difficult to move, and therefore most permanent. The final aging is done by subjecting the magnets to a long series of extreme temperature changes. The length of steel entering into these magnets is over 14 inches, the air gap being bridged by the steel vane of the moving element, is very short.

All the conditions necessary for permanent calibration are met. Instruments made under this plan and in constant and severe use are said to have shown no change whatever. The instrument is extremely sensitive, the scale being open throughout its length. By the popular arrangement, relatively, of the poles of the permanent magnet and of the stationary coils, the scale is caused to be more open in those portions most used, which is an important point in a switchboard instrument, that has to be read from a distance.

The iron base and carefully fitted iron cover form a first-class magnetic shield, errors due to proximity of bus bars or other conductors being thereby obliterated

## The Reflectric Electric Sign.

The new type of electric sign called the Reflectric, which is put on the market by the Western Display Company of St. Paul, Minn., is possessed of several novel features. The construction of this sign, as will be seen from the cuts, is such that the light is reflected directly onto the advertising spaces and downward, providing for a strong illumination on sidewalk and store front as well as on the sign.

Fig. 1. Sign in Place.

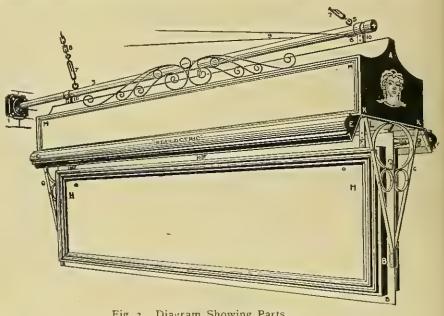


Fig. 2. Diagram Showing Parts.

THE REFLECTRIC ELECTRIC SIGN.

This sign is made entirely of metal and glass, the main display surface being made of porcelainized steel, and the glass transparencies of leaded cathedral glass, and the frame and hood of galvanized iron over steel skeleton. The glass transparencies and the main display panels are interchangeable and can be removed without taking down the sign or disconnecting the wires. Any desired color combinations can be used. The wiring is contained in galvanized-iron channel, which is part of the reflector, and is thoroughly protected from the weather. Only double-braid rubber-covered wire and weatherproof sockets are used. The corrugated frame and inside of reflectors are finished in white bicycle enamel and baked. The outside of reflectors, hood, scroolwork, hangers, etc., are thoroughly painted.

The company says that, while the sign consumes less current than other electric signs, it is thoroughly illuminated and can be read at a greater distance than the usual electric sign, both night and day. Many central stations are installing the Reflectric on lease in small weekly or monthly payments. The ownership of the signs remains with the lighting companies, and the advertisements, being interchangeable, the wording can be changed at will, and consequently the device remains a constant source of revenue. The experience of the Western Display Company, particularly in St. Paul, teaches that the installation of the Reflectric tends to increase the demand for more elaborate and costly electric signs for the larger concerns, so that instead of reducing current consumption for advertising purposes in other directions it has really been a benefit.

The Reflectric sign is covered by letters patent in the United States, England, Canada and France. Fig. 1 is a reproduction of a sign installed. Fig. 2 is a drawing showing parts. Referring to reference letters and figures, (1) is a flange block of wood, provided with four lag screws for attaching to building, (3) is crane of 1¼-inch black pipe, (7) (7) are turnbuckles on supporting chains—one only is used in small sizes, (9) one-fourth-inch galvanized-

iron guy cable, (A) hood, (B) galvanized iron frame for porcelain enamel signs, (C) (C) galvanized iron reflectors, (D) sliding plate to which electric parts are attached, (E) (E) removable ends of reflectors which release sliding plates, (H) sign, (L) back of glass transparency, (M) glass transparency.

## Some Recent Fixtures.

There is at the present day more attention given to correct and artistic designs in electric-lighting fixtures than at any time in the past. This may have been caused by the education received by a great many of the American people at the World's Fair at Chicago and later at the exposition in St. Louis. This demand has created among the public a desire for more of the beautiful and symmetrical in all lines, and the increasing wealth of the country has enabled many to consider as necessities what once they longed for as luxuries. Consequently the manufacturers have been led to put forth their best efforts to meet this demand, and they have spent much time and money in securing the best workmanship, patterns and material for producing the present fine effects that one can see on every hand in the way of decorative electric-lighting fixtures. In this worthy work of meeting and elevating the public taste the Beardslee Chandelier Manufacturing Company of Chicago has been among the foremost. Its product embraces a complete line of chandeliers, electroliers and combination fixtures, from the most ornate designs to simple brackets. The accompanying pictures illustrate some of the company's work. Fig. 1 shows a rather elaborate combination fixture, the candles being, of course, for the gas jets and the globes below for the incandescent electric lamps. The center is of art glass and the metal finishes are antique, brush and brass. This fixture is furnished in different sizes, and wired or not, as desired. It is an ornamental and rather expensive design. In Fig. 2 is shown a group of ceiling lights and brackets of simpler construction. These are all electric fixtures. The largest bracket at the bottom of the picture is an Empire design, and one globe is removed to show the backpiece. The one in the lower left corner is in Louis XVI. style, while the large ceiling light at the top is of classic design.

The Beardslee company issues large, handsome catalogues, cloth-bound and with many pleasing pictures, which are sent to dealers.

Fig. 1. Combination Fixture, Empire Design.

Fig. 2. Group of Ceiling and Bracket Lights.

SOME RECENT FIXTURES.

## Under-running Trolley Litigation.

Judge Wallace of the United States Circuit Court of Appeals for the Second District has handed down a decision in the case of the Thomson-Houston Electric Company, complainant and appellant, against the Black River Traction Company, defendant and appellee, concerning Vandepoele reissue patent No. 11,872 under litigation. The case was an appeal from a decree by the court below dismissing the bill of complaint in an action for the infringement of the reissued patent. It was decided by the court below that the reissue was void, among other reasons, because the invention described and claimed therein had been described and claimed by Vandepoele in letters patent No. 424,695, granted to him April 1, 1890, and previously to the patent of which the patent in suit is the reissue. The original patent, No. 495,443, was granted April 11, 1893, upon an application by Vandepoele filed March 12, 1887, and is for a "traveling contact for electric railways." Judge Wallace, however, reversed the decree of the lower court with costs.

## Chicago Street-railway Amalgamation and the Traction Situation.

The Chicago City Railway Company [illegible] the hands of new men, who propose [illegible] in some fashion with the Union Traction Company so as to bring the two systems under one control. The Union Traction [illegible] are the best [illegible] of the shares which will enter into the proposed combination, and its assets are practically limited to North and West Chicago stocks. It is regarded as unlikely that anything of a decisive nature can be accomplished in the way of purchasing North and West Chicago stocks until some basis of value can be arrived at, following a possible understanding with the city, though, even at this time, it is known in a general way what the securities should be worth.

In response to the offer of the syndicate which will engineer this unification, Chicago City stock to the amount of 124,000 shares has been deposited and payment for the same to the amount of $24,800,000 has been made. This gives the syndicate, composed of Morgan, Field, Mitchell, Valentine and others considerable more than half the shares.

The council committee on local transportation promises that before election day it will be ready to report an ordinance or ordinances covering the entire street-railway systems of Chicago. The annual meeting of the Chicago City company will be held on February 16th, when the reorganization will take place. By that time, also, it is declared, the new owners of the company will be able to make ordinance until after the people had expressed themselves on the referendum at the coming election." [illegible] seek the co-operation of the street-railway interests [illegible] cepted. The idea is to give the voters knowledge of what they are expected to pass upon in the marking of the ballots under the referendum, which will be ordered at the spring election.

## Crocker-Wheeler Convention.

The annual convention of officers and branch-office managers of the Crocker-Wheeler Company took place at Ampere, N. J., at the main office and works, January 26th, 27th and 28th. The most important topic for discussion at the convention was alternating-current practice. The Crocker-Wheeler Company has lately entered this field, and the branch-office managers from distant points were, of course, keenly interested in the lectures on this subject given by Chief Engineer Gano S. Dunn and Messrs. Edward Heitmann and H. Pikler of the engineering department. Mr. Dunn and Mr. Heitmann also informally told the selling men of their trip to San Francisco, where, a short time ago, an order was closed with the California Gas and Electric Corporation for three 4,000-kilovolt-ampere alternating-current generators, the largest gas-engine-driven generators in the world. Mr. Julian Roe, manager of the territory covered by the Chicago office, prophesied an even more lively business in electrical machinery this year than last. The question of selling agents for Crocker-Wheeler machines was thoroughly discussed by Mr. Roe and his fellow managers, a question of vital importance to the Chicago office, where the largest stock is carried, except at Ampere, N. J.

A banquet was given by the company on the evening of the 27th, at the Cafe Martin, in New York, at which President Schuyler Skaats Wheeler presided, and Secretary A. L. Doremus was toastmaster.

The men portrayed in the accompanying group illustration are (referring to the numbers in the picture): 1, J. R. Wilson; 2, Rodman Gilder; 3, R. B. Treat; 4, H. C. Baker; 5, H. C. Petty; 6, S. Russell, Jr.; 7, W. A. Doble; 8, Harold Lomas; 9, Hugh A. Brown; 10, F. B. Degress; 11, R. N. C. Barnes; 12, Leonard S. Horner; 13, H. S. Pikler; 14, C. W. Gearhart; 15, Louis M. Ward; 16, H. M. Sassman; 17, William F. Sullivan; 18, E. Heitmann; 19, Henry J. Sage; 20, W. L. Brownell (treasurer); 21, H. L. Patterson; 22, A. L. Doremus (secretary); 23, Dr. Schuyler Skaats Wheeler (president); 24, Gano S. Dunn (vice-president); 25, Julian Roe.

CROCKER-WHEELER OFFICERS AND SALES MANAGERS.

## Paralleling a 5,500-kilowatt Turbo-alternator.

In the latter part of December, 1904, a 5,500-kilowatt, 25 cycle turbo-generator was put in operation in the Seventy-fourth Street station of the Interborough Rapid Transit Company, New York. It was the first Westinghouse unit of this size to be put in service, although a number of similar machines are approaching completion. The next day after this machine was put in service, says a writer in The Electric Club Journal, it carried loads as high as 8,000 kilowatts, and for considerable periods loads between 7,000 and 8,000 kilowatts were of common occurrence. This turbo-generator is the largest now in service.

Within a few days after the machine was put in service, and while operating in parallel with six of the slow-speed, 5,000-kilowatt machines in the same station, a short-circuit occurred among the main leads at a point between the turbo-generator and the switchboard. This was a dead short-circuit, and it tripped the automatic switches on all the slow-speed machines, which were set at almost three times full-load current, but did not trip the safety switches on the turbo-generator on account of the fact that the arc was so violent that it burned off the leads to the safety devices for this particular machine, though these leads were in a separate conduit. It was necessary to cut the turbo circuits off by hand and the short circuit therefore continued on this machine some little time before it was cut out. Careful examination of the generator showed that it was absolutely uninjured in any way, as far as could be determined, and was ready for service immediately afterward, but could not be thrown in with the other machines on account of the main leads to the switchboard being burned off. The machine has been in service with heavy loads since these leads were replaced.

The 5,500-kilowatt turbo-generator is run in parallel with the other machines in the station, and the only notable difference in its operation and that of the slow-speed machines is due to the difference in the speed regulations of the two types of engines. The steam turbine was adjusted so that it regulated much more closely in speed than the low-speed engines, and, in consequence, the turbo-generator takes the fluctuations in load. It is noted that when the turbo-generator is operating in parallel with the slow-speed machines, that the latter machines carry a much steadier load than when the steam turbine is cut out, the turbine unit appearing to take all the fluctuations when it is in circuit. This unit, therefore, has something of the effect of a flywheel or a storage battery on the system. This effect, if considered undesirable, can be modified readily by adjusting the speed characteristics of the steam turbine.

On account of its uniform rotative velocity and its relatively large flywheel capacity, the turbo-generator is particularly suitable for operating rotary-converter systems, such as the Interborough. Such machines also operate extremely well in parallel, and the operation of a steam-turbine unit with a reciprocating unit is, in general, considerably better than reciprocating units with each other, due to the fact that the mean rotative velocity of the combined units is better than in the case of reciprocating units alone. In the case of the Interborough slow-speed generators, this effect is not noticeable, as there is no evidence of periodic speed fluctuations in the slow-speed units, due, to a large extent, to the heavy dampers on the machines, their large flywheel capacity, and the proportions of the engines, which are designed for very small angular variation.

Some months ago a series of tests was made to determine the paralleling qualities of turbo-generator units. At full voltage the machines ran perfectly in parallel. Fluctuations in speed were so slight that periods from one to 15 seconds could be obtained for synchronizing. When the voltage was reduced to 60 per cent. of the normal, the machines would carry the full current without any evidence of hunting. The voltage was further reduced, and tests were made, until about 15 per cent. of the rated voltage was obtained. Under these conditions the machines still remained in parallel when carrying full-load current, but the conditions of paralleling were not perfectly stable, the load being transferred from one machine to the other at an irregular but not rapid rate. As the synchronizing power varies approximately as the square of the voltage, it was extremely low in the last test cited. It is evident, therefore, that but small interaction is required between such machines to maintain parallel operation.

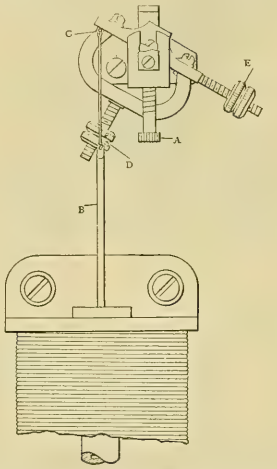
## Copper Market.

Production, exports and imports of copper during the year 1904 shot ahead of all previous records, and the year 1905 opened with a price for electrolytic wire bars fully 2½ cents a pound higher than the corresponding time a year ago. The most urgent demand comes from foreign markets and is attributable largely to the expansion of the electrical field. Conservative interests are led to expect a firm market for months to come, and it seems probable that European countries will continue to import heavily. Large quantities of copper are now under contract for exportation and delivery to domestic consumers, which will use up the output as fast as it comes from the refiners. Prices quoted for the latter part of January were 15⅝ cents a pound for electrolytic bars and 15½ cents for Lake. The total exports of copper for the year 1904 were 247,421 tons, the imports reaching 79,730 tons.

## Westinghouse Type K Instruments.

The Westinghouse Electric and Manufacturing Company offers a new line of instruments known as the type K for use upon either direct or alternating currents. This type is a development of one of the Lord Kelvin patents and the construction is strictly modern and fulfills the exacting requirements of present practice. In shape, size, finish and general appearance the instruments harmonize with the other round pattern switchboard types of the manufacturer. The face has a matted surface with raised letters and a pleasing ornamental design in low relief, the entire case being finished in black enamel.

The principal distinguishing characteristic is the simplicity of construction. There are but few parts, none of which is complicated, and the adjustments are easily made. In effect the mechanism consists of a stationary coil, through which the measured current flows, the voltmeter measuring the current which flows through a high resistance. This coil acts on a movable core or plunger, which is connected with a steel beam mounted upon knife bearings and carrying the indicating pointer. There are no springs, the action being controlled by gravity. The accompanying drawing shows the working parts of the instrument.



MECHANISM OF WESTINGHOUSE TYPE K INSTRUMENTS.

The core is so constructed that it is saturated with a very small amount of magnetic energy—that of one-twentieth full-scale deflection. Thus for any load the attraction upon the plunger is directly proportional to the current, making the error due to residual magnetism commercially negligible and the scale almost uniform, commencing with zero. On alternating currents its action is not appreciably affected by changes in frequency. External fields do not influence the performance and temperature errors are negligible.

The instruments are dead beat in their indications, the steadying effects of a dash pot being obtained by inserting the lower end of the plunger in a glass tube filled with oil. The opening in the solenoid is made small and the plunger is a piece of fine iron wire flexibly connected to the movement by means of a strong silk cord. The only point where friction could be looked for is at the two knife-edge bearings which support the beam, but in fact no frictional effects are perceptible, as the weight is exceedingly light and the controlling force very great. Movable weights shown at (D) and (E) afford a means for adjustment. The scale has large open divisions which are practically uniform in size. The sector illustrated at (A) corrects inequalities by keeping the leverage the same in all positions.

Ammeters are regularly made of capacities to and including 1,000 amperes and voltmeters to 750 volts for use without transformers. For larger capacities transformers are supplied. Switchboard builders find them of decided advantage in connection with moderate-priced panels where high accuracy is desired, such as combination panels for a single generator with its feeders and small boards for isolated plants.

In the contemplated improvements by the Birmingham (Ala.) Railway, Light and Power Company $200,000 is to be expended on the power house in Birmingham and about $35,000 for improving the systems in Bessemer.

## American Competition Profitable to Mexican Cities.

More than a year ago W. T. Thornton, ex-governor of New Mexico, representing a syndicate of Chicago men, made application to the Mexican government for a concession to establish a system of electric street railways in Guadalajara, Mexico, offering to pay the city of Guadalajara $400,000 for the use of the streets. Shortly after another American competitor for the valuable franchise appeared on the scene, represented by A. W. Geist and W. A. Rogers, who offered to pay a similar amount for the franchise. The owners of the existing system of street railway, known as the Bermejillo syndicate, were much disturbed by the prospect of competition, and in order to retain exclusive possession of the field offered to pay the city $100,000 for the franchise which they had been using for many years for nothing. This offer was rejected by the government with the assertion that unless the syndicate agreed to pay the amount which was offered by the Americans for the franchise it would be granted to one or the other of the competitors. After long deliberation this was agreed to and the Bermejillo people obtained the exclusive franchise, shutting out the two American bidders. In addition to the payment of $400,000 to the city the Bermejillo syndicate is required to convert all of its lines into electric traction and to extend the system to the suburbs of Guadalajara and to make other extensive improvements. The value of this street-railway franchise has attracted much attention in Mexico, and it is believed that other cities of Mexico will seek to obtain more compensation for the use of their streets by similar companies.

## Public Lighting Discussion in Detroit.

The Detroit Municipal Electric Lighting Commission wishes to be empowered to furnish electric light for residence purposes and also to do a commercial business. It asserts that electric light can be furnished to the former at six cents a kilowatt-hour and the city make money on the investment. It is estimated that it will take $2,000,000 to make the additions and improvements to the plant necessary to carry out this ambitious project. At present the plant is confined to supplying current for street lighting only.

Manager Alex Dow of the Detroit Edison Company has offered to pay $1,000 for the investigation of the municipal electric-lighting accounts. He expects to ascertain the exact cost to the city to manufacture electricity. He maintains that the city commissioners do not know how much current is being furnished in public places, and that the statement that they have supplied 1,000,000 kilowatt-hours at 3½ cents an hour is incorrect. The City Council is endeavoring to investigate the prices charged by the Edison company, and this is Mr. Dow's challenge to it. Mr. Dow further stated that if his company was granted a monopoly of the lighting the rate to the consumers would be much reduced. Before the meeting with the aldermen terminated a warm discussion ensued, and it has not been determined as yet whether Mr. Dow's offer will be accepted.

## Richard McCulloch on Street Transportation.

An interesting lecture on "The Evolution of Street-car Transportation," given under the auspices of the Washington University Association, was delivered last week in St. Louis by Richard McCulloch, assistant general manager of the United Railways Company of St. Louis. The speaker dealt at length upon the development of American street-railway systems, beginning with the old mule car and following the improvements up to the modern double-truck surface cars, the elevated trains and subway transportation. European tramways, he said, in most instances compare unfavorably with American systems. Returning tourists tell of two and three-cent fares, but they fail to mention the fact that one fare takes them only a short distance. The distance traveled by the average passenger in this country for five cents, he said, would cost eight cents in most European cities.

In response to the frequent query whether electricity would soon replace steam for railways, Mr. McCulloch said: "I have called attention to the fact that electricity is more economical than steam only under certain conditions, among them being that the distances must be short and through populous communities, where the traffic is heavy. Considering the fact that railways have so much invested in expensive steam equipment, I think they will be very slow in making any changes toward introducing electricity."

The British Columbia Electric Railway Company of Vancouver, B. C., has taken over the branch of the Canadian Pacific railroad, known as the Vancouver and Lulu Island railway, and will commence immediately to convert it into an electric system, hoping to have it ready by July 1st.

## Telephone News from the Northwest.

The People's Telephone Company of Superior, Wis., has been authorized to issue $100,000 bonds, and proposes to erect a fireproof exchange building and install a selective ringing apparatus. There is to be considerable new cable work and conduit extensions.

A bill has been offered in the Minnesota Legislature intended to empower Minnesota cities, towns and municipalities to own and operate telephone exchanges.

The North Star Telephone Company has been formed in the town of Irving, near New London, Minn., and the West Lake-New London Telephone Company has been formed to build from West Lake to New London.

The Northwestern Telephone Exchange Company of Minneapolis and St. Paul issues, with its February directory, a formula for disinfecting transmitters.

The Hallock (Minn.) telephone exchange has been sold to T. M. George.

The Tri-state Telephone Company has completed the gap in its long-distance system to Grand Forks, N. D. To get through Fargo, it is reported that arrangements have been made with the Western Union Telegraph Company to use its poles.

The Southern Minnesota Telephone and Telegraph Company of Winnebago City, Minn., has been incorporated with a capital stock of $100,000. A. W. Colvin is president.

J. H. Howe has transferred the local exchange at Zumbrota, Minn., to F. G. Marvin.

Barrett & Barrett of St. Paul have sought an injunction against the Northwestern Telephone Exchange Company of Minneapolis. The question for the court is whether the telephone company can regulate telephone numbers and the names used by subscribers.

The new code of the Minnesota tax laws is under consideration by the Minnesota Legislature. A change is suggested in the form of taxing telephone companies to a property valuation instead of a gross earnings. The revision now calls for a three-per cent. gross-earnings tax. Another bill introduced would increase the gross-earnings tax to five per cent.

George R. Farmer has applied to the council of Madison, S. D., for a franchise for a telephone exchange.

The Northwestern Telephone Exchange Company has received a carload of cables for the extension of its conduit system in Grand Forks, N. D. R.

## The Telephone in Mexico.

T. F. Maguire, general manager of the Mexican Telephone Company, which operates telephone systems in the City of Mexico, Guadalajara, Leon, Merida, Monterey, Motul, Progresso, Puebla, Queretaro, Saltillo, San Luis Potosi, Tacubaya, Tampico, Tlalpam, Uman, Vera Cruz and Zacatecas, says that bids will soon be asked for the laying of conduits for the underground system in the City of Mexico. There will be 240,000 lineal feet of conduit used in the construction of the underground system, and a 44-duct subway will leave the central station in Calle del Arco de San Agustin. These ducts will be gradually reduced in number until they number about four to the subway. They will be laid at a depth of 23½ inches from the surface of the street, and the total number of manholes will be 110. The ducts will be 3½ inches in diameter, and the cable within, which will contain 800 wires, will be 2½ inches in diameter.

The Minas Almeleya, S. A., which operates the Cerro Almeleya mine, is building a telephone line from its mine to Dorado station on the Mexican Central railroad. D. W. Shanks is general manager.

One of the largest private telephone systems to be constructed in Mexico is to be installed on the ranches of William Richardson, who is said to be the largest land owner in Northern Mexico. He has awarded the contract for building about 100 miles of telephone lines to connect his different properties to the firm of Van Vorhis Hños, of Monterey. The central office for this large private system will be at Carmen, the headquarters ranch of Mr. Richardson. H.

## Indiana Telephone Items.

The Sand Bank Telephone Company with a capital stock of $1,000 will establish and operate telephone lines and telephone exchanges in Tipton, Hamilton, Howard, Madison, Grant, Miami, Cass and Marion counties, with principal office in Tipton. J. M. Hoover, Harry C. Haskett and George A. Dickey are among the incorporators.

The Farmers' Union Telephone Company, just incorporated with a capital stock of $2,000, proposes to construct and operate telephone lines and exchanges in Jackson, Jennings and Scott counties. The principal office will be in Seymour. John M. Lewis, W. H. Boman and John Q. Foster are the incorporators.

The Sparta and Hogan Mutual Telephone Company has been incorporated and proposes to establish an exchange at Sparta and do a telephone business throughout Dearborn County. O. E. Canfield of Sparta heads the incorporators.

The Home Telephone Company of [illegible] has increased its capital stock from $200,000 to [illegible]. This was made necessary to provide [illegible] equipment and extensions to take care of [illegible] increasing business of the company. [illegible] is president and W. S. Stit secretary of the company.

## Ohio Telephone Notes.

The question of whether a municipality has the right to fix telephone rates was argued in the Supreme Court at Columbus on February 3d. The case is that against the Toledo Home Telephone Company, and the contention is that the company added $8 to the business rate and $6 to the residence rate in violation of the ordinance fixing its rates at a certain figure. Questions asked by one of the judges indicated that the contest might hinge on the authority of the Probate Court to fix rates. Telephone companies contend that no rate can be fixed legally by a municipality under which they shall operate, although this has been done in almost every franchise granted. In almost as many cases it has been found that the rate is too low and the companies have had to advance them in order to make the extensions and improvements demanded.

Word comes from Cincinnati to the effect that the Cincinnati and Suburban Telephone Company is negotiating with 15 or 20 small companies in the corners of Ohio, Indiana and Kentucky, which will give it an excellent outlet over this territory and at the same time add about 15,000 subscribers to its list. It is possible, however, that these negotiations may end in the Independent companies retaining present affiliations, as did those about Lima, over which there was such a stir some time ago. Officers of the United States Telephone Company and the Federal Telephone Company state that they will shortly have exchanges in Cincinnati and New York city, which will greatly strengthen their position. In connection with this it is reported that the Bell interests have taken over the Orange County Telephone Company of Middletown, N. Y., and the Glen Telephone Company of Gloversville and Johnstown.

It is reported that the Home Telephone Company of Hamilton is negotiating for the purchase of the Bell plant in that place. If this is done the plants will be consolidated.

The Erie Railroad Company has completed its telephone lines between Cleveland and Marion. Those between Galion and Marion have been completed several days. It is the intention to continue the lines to Cincinnati and Chicago.

The West Richfield Telephone Company of West Richfield has been incorporated with a capital stock of $10,000 by E. L. Carter, James B. Stouffer, J. B. Kennedy, M. L. Newton and Allen S. Prickett.

The Home Telephone Company of Toledo will install a private system of 130 telephones in the Boody House in Toledo. C.

## Michigan Telephone Matters.

The crew of the Michigan State Telephone Company is now at work on the construction of a line in Dickenson County, from Escanaba to Foster City, a distance of about 40 miles.

The farmers of Marion Township, Sanilac County, have organized a local telephone company, with branches, to run into other townships in that vicinity.

The farmers near Union City find many uses for their rural telephone line. One of the subscribers near Union City recently saw a horse running away with a surrey occupied by two women. He called up a neighbor about a mile further down the road, who, with the assistance of several others, stopped the horse without difficulty.

H. H. Hutchins, manager, and E. Hawley, secretary, of the Saugatuck and Ganges Telephone Company, recently paid a visit to Grand Rapids and called on the officers of the Citizens' Telephone Company and inspected the workings of their automatic plant. W.

## Telephone Profit Sharing Successful.

The amount of money to be distributed among the employes of the Cuyahoga Telephone Company of Cleveland, Ohio, for the latter half of 1904, under the profit-sharing plan, is $7,022.19, or 6½ per cent. of the salaries of all persons employed. The fund for this purpose has been gradually increasing and the employes, therefore, have been receiving a larger amount at each semi-annual distribution. The officials of the company are so well pleased with the results of giving the employes this extra amount of money that the system will probably be continued. The service has been greatly improved and the employes are zealous in their efforts to do their work as well as possible.

The Telephone Company of Warrensburg, Ill., has been incorporated by G. W. Claussen, J. A. Suerth and J. H. Rumsfeld. The company is capitalized at $2,500 and, it is stated, will manufacture electrical apparatus and supplies.

## TELEPHONE MEN.

[illegible] Kan.

[illegible]

[illegible] state.

W. [illegible] the People's Telephone Company at Spring Valley, Minn., and Charles H. Russell of Stewartville, Minn., succeeds him.

George W. Burnside retires as manager of the Citizens' Telephone Company of Sioux Falls, S. D., and has [illegible] manager will be installed shortly.

John [illegible] manager of the local telephone exchange, and goes to Crookston, Minn., with the same company. L. L. Smith becomes local manager at Ada.

Walter L. Haskell, general manager of the Minnesota Valley Telephone Company, Mankato, Minn., has resigned to go to Sioux Falls, S. D., where he becomes manager of the Citizens' Telephone Company.

M. D. Atwater, local manager of the Central Union Telephone Company at Indianapolis, has been promoted to be district superintendent. He will be succeeded by W. R. Hirst, former superintendent of the Cleveland Telephone Company.

## GENERAL TELEPHONE NEWS.

J. H. Barnes, R. M. Cavett and associates of Jett, Okla., have incorporated the Jett Rural Telephone Company with a capital of $5,000.

The Sulphur (I. T.) Telephone Company has been granted a franchise for 20 years, and an exchange will be put in at that place within 90 days.

The Northwest Texas Telephone Company of Canyon City, Texas, recently incorporated, contemplates increasing its capital to $20,000 and will build 300 miles of toll lines. John A. Wallace is in charge of the building plans.

The semi-annual report of the Home Telephone Company of Louisville, Ky., shows that the company has 6,600 subscribers. There are also about 2,000 telephones outside the city. The company has made excellent progress during the last six months.

J. T. Shaw, a government engineer, is at present superintending the construction of a telephone system along the line of the big irrigating canals in the vicinity of Reno, Nev. The line is being established to facilitate communication regarding canal conditions between owners of land and the office at the headgates.

In view of extensive improvements to be made by the Troy and Honey Creek (Wis.) Telephone Company in the spring, President Albert Walster of Troy has asked of the towns of Prairie du Sac and Sauk City that exclusive franchises be granted the company. Public opinion seems at present adverse to the granting of exclusive franchises.

At a recent meeting the directors of the Chicago Telephone Company re-elected the retiring officers for another year. No action was taken looking toward an issue of authorized new capital. The officers are: Chairman of board, John M. Clark; President, Arthur D. Wheeler; first vice-president, Byron L. Smith; second vice-president, A. S. Hibbard; secretary and treasurer, C. E. Mosley; auditor, A. W. Richards.

A new telephone directory just published, and compiled by F. C. Toepleman, general manager of the Home Telephone and Telegraph Company of Henderson, N. C., contains 240 pages and may be taken as an index to the marked growth and development of the telephone business in the Eastern Carolina and Virginia section of the Atlantic seaboard. The book covers 31 exchanges and 6,000 subscribers, which had their nucleus in an exchange of 45 subscribers built at Henderson in the fall of 1895 by Mr. Toepleman. The various exchanges and toll stations covered by the new directory are owned by the Home Telephone and Telegraph Company of Henderson, the Carolina Telephone and Telegraph Company of Tarboro, N. C., the Interstate Telephone and Telegraph Company of Durham, N. C., and the Southern Bell Telephone and Telegraph Company of Atlanta, Ga. Besides this interchange, connection is made with the long-distance lines of the American Telephone and Telegraph Company and the Southern Bell Telephone and Telegraph Company.

## Condensers for Steam Turbines.[1]

By George I. Rockwood.

Visitors to steam-turbine power stations generally notice, as a first impression, the relative inconspicuousness of the turbine itself in the midst of its numerous and large condenser auxiliaries. This prominence of the condenser equipment is especially noticeable in the case of the smaller turbine plants, where the floor space occupied by the condenser system far exceeds that required by the turbine.

There appear to be three accepted designs for these condenser systems: First, may be mentioned the combination consisting of a surface condenser, a centrifugal hot-well pump, an air cooler, a single-cylinder dry-vacuum pump, a centrifugal circulating-water pump, together with their connecting and drip piping and valves. Second, the foregoing arrangement may be varied by omitting the hot-well pump and also the air cooler and dry-vacuum pump, substituting the wet-vacuum pump—preferably of the Edwards type. The cost per kilowatt is about the same—$7 to $10—for either of these systems. The third system is like the first, except that an elevated jet condenser with barometric tube and hot well take the place of the surface condenser and hot-well pump. The advantage of this third type over the surface-condenser systems is that it may take up less floor space, while its cost is but $5 to $6 per kilowatt. The dry-vacuum pump used with barometric condensers must have a two-cylinder air pump, and the exhaust steam from the turbine cannot be used again in the boilers.

The whole cost of a condenser system, as intimated in the opening paragraph, is not, however, fully expressed in the contract with the condenser contractor. The turbine room is made a full third larger, and hence more expensive, by the provision of the necessary floor space; space, too, that is needed in the operation of the turbines. The smaller the turbine plant is, the greater this part of the cost becomes relative to that of the whole power plant.

There is, besides, a fourth type of condenser which may be used with steam turbines, and to which it is the object of this paper to direct attention; namely, the injector or ejector condenser.

Within the last year the Atlantic Mills, Providence, R. I., have installed a 400-kilowatt Westinghouse-Parsons turbine. A vacuum of 28 inches to 28½ inches is maintained on this turbine by means of the following condenser system: The exhaust steam is led, through 20 feet of vertical 16-inch cast-iron pipe and three short-turn elbows, into a 16-inch Bulkley injector condenser. The level of the ground floor is 34 feet below the condenser hulb, while the turbine lies on a concrete steel floor, the level of which is 12 feet and six inches above the ground floor.

The injection water comes 500 feet from the river to the power house, under a slight head—perhaps three feet—depending upon the state of the river. A six-inch belt-driven Lawrence centrifugal pump elevates the water into a vertical tank, 30 inches by 15 feet deep. The level of the water in this tank is maintained by the waste pipe six inches below the water-inlet nozzle on the condenser. From near the bottom of this vertical tank a seven-inch injection pipe rises up to the condenser.

A good deal of air along with the water is pumped into the top of the tank by the centrifugal pump, but apparently the depth of the tank acts efficiently as an air separator, and no air in the form of bubbles passes over into the condenser. At any rate, the vacuum shown by the mercury column is 28½ inches. The remarkable thing is that this is so, as nearly as the height of a mercury column can be measured, whether the column be attached to the bulb of the condenser or to the exhaust chest of the turbine.

To prove this absence of friction in the exhaust pipe a one-fourth-inch pipe was connected to the elbow above the condenser, then led down and attached to the turbine exhaust chamber. A branch horizontal pipe leads off to a mercury column. Two valves, one above and one below this horizontal pipe, enable either connection to be made at will. Starting with both valves open and the mercury quiescent, it was impossible to perceive any movement of the mercury, either up or down, after shutting either valve.

Not only is a 16-inch exhaust pipe thus proved ample, and more than ample, in size for a 400-kilowatt turbine, but the vacuum obtainable with this condenser is substantially the same, whether steam is passing through the turbine or not. The falling of the water through the "throat" is the air pump, and is the only air pump needed. The builders provided a 20-inch exhaust nozzle on the turbine, but Mr. Bulkley believes that, on the contrary, a 14-inch condenser would do as well as the 16-inch.

It may be of interest to relate here a rather unusual experience, encountered when this 16-inch condenser was first put into service.

It was convenient to have the injection pipe rise on that side of the 16-inch exhaust pipe farthest from the condenser. At the top a 45-degree bend connected to a long-radius elbow enabled the pipe to turn and pass the exhaust pipe, approaching the condenser horizontally, instead of vertically, as in the usual case. Upon starting up the turbine only 22 inches of vacuum could be obtained. The piping was, nevertheless, proved to be absolutely tight. After shutting the injection valve Saturday afternoon with the turbine blanked off at its nozzle, and with 22 inches vacuum on the exhaust pipe and condenser, one found 12 inches vacuum still left on the system Monday morning before removing the blank flange in preparation for starting. Still, only 22 inches was the maximum height of the mercury column while running.

Finally, at the suggestion of Mr. Bulkley to the effect that in his experience he had found it necessary to have the injection pipe to his condensers approach the condenser vertically rather than horizontally for the best results (although he had no explanation satisfactory to himself why this was so), a rearrangement of the injection piping was made, permitting this vertical approach. At once, upon starting up the turbine, the result was 28½ inches of vacuum, and this has been maintained without interruption since. With the present load—about 300 kilowatts to 350 kilowatts—the seven-inch injection valve is open only a few turns, the temperature of the hot well is from 80 degrees to 90 degrees, and water enough can be passed through this condenser to maintain the vacuum in summer weather. The highest degree of vacuum thus far recorded, as measured in the turbine exhaust chamber, is 28¾ inches, the lowest 27½ inches. The variation is caused partly by changes in the barometer, but more by variable leakages in drip-valve seats. Perhaps, also, the amount of air entrained by the injection water varies from time to time.

If water is not to be had in abundance, then the best way is to have two pumps, one of which returns to the condenser water taken from the hot well. In this way the highest theoretical temperature of the hot-well water may be reached. It takes 10 horsepower to supply water by means of the centrifugal pump in sufficient quantity to condense 400 kilowatts of steam.

The method of sealing the spindle of the Parsons turbine against air leak where it passes out to its journals from the low-pressure chambers, namely, by pumping water with centrifugal pumps formed in small recesses in the shaft cover, so as to keep a water pressure in these recesses in excess of that of the atmosphere, is a perfect success, as the experience with this condenser shows, although when but 22 inches could be obtained, owing to the fault in the injection-pipe design described, the efficacy of these seals was very seriously doubted.

It is interesting to note our experience that no drip pipe or drip pump, for removing the water of condensation or the leakage into the exhaust chamber from these air seals, is found to be necessary or desirable.

It is, indeed, necessary to exclude any accumulation of water in the exhaust pipe for fear that it will sway back and forth until it flushes up onto the large low-pressure blades of the turbine. Running as they do at a very high velocity, sudden contact with water from the exhaust pipe will strip the last row off clean if such contact is permitted. Any further damage, however, to the other rotating blades seems to be prevented by the presence of the fixed row, which, by dividing up the water into small streams, seems to protect the moving rows from contact with solid water, and therefore from injury.

The rate of accumulation of water leaking by the small centrifugal air-seal pumps into the exhaust pipe may be any amount up to over 950 pounds an hour. If, however, there is the least external load on the turbine, the flow of the steam up the exhaust pipe has the power to sweep the exhaust chamber dry. The method of starting the turbine at the Atlantic Mills is to first turn on the injection water. Then admit steam to the turbine without admitting water to the air seals. After the load begins to come on, as shown by the amperemeter, the drip pipe from the exhaust chamber to the atmosphere, which has been open all night and up to this point, is now closed, the water turned on to the air seals, and the vacuum immediately draws down to 28 inches. It is not found absolutely necessary to start in this way, as the turbine can be run hours before the water accumulates in quantity. The object is simply to drain the turbine up to the moment when the load begins to come on.

If the load is a "jumping" one, from nothing to full load, there is no danger of water accumulation. It is, of course, quite possible to provide a drain receiver and pump which will work under the vacuum if it is deemed desirable to do it. There is no exhaust steam "entrainer," or water trap or seal, provided at the Atlantic Mills turbine.

The injector condenser costs, fully installed, with centrifugal circulating water-pump, tank piping and valves, from $2 to $2.50 per kilowatt. This cost is much reduced if there is a natural head of water available. At the installation described the condenser, two elbows, one tee, 18 feet of cast-iron exhaust pipe and a 14-inch automatic relief valve cost, erected, $591.50. The room it occupies is practically none at all.

Theoretically considered, in its relation to turbines, the injector condenser would seem to bar out all other condenser systems in those situations where the water used in the boilers is pure in its natural state. Where it is absolutely essential to save the water of condensation for re-use as boiler-feed water, owing to the presence of salt, sulphate of lime, wool grease, acid from steel works, or other hurtful polution, then it pays to use one of the surface-condenser systems. If the city water is pure and costs about seven cents per 1,000 gallons, water enough for a 400-kilowatt machine at 100 per cent. load factor would cost per factory-year of 310 days, 10 hours a day, at 1,000 gallons per hour, about $217. With interest at five per cent. and fixed charges at eight per cent., this sum warrants the capital expenditure of not to exceed $1,670. It is thus clear that it does not pay to buy the surface-condenser system simply to save the cost of paying city rates for boiler-feed water.

Much talk has been made about the freedom of the condensed exhaust steam in turbines from cylinder oil, and the advantage which this purity gives to it as compared with the oily exhaust from reciprocating engines, where the condensed steam is returned to the boilers.

It should not be forgotten that great purity of feed water is not in itself a desirable thing, being only better than very impure water; for it pits the tubes and water-legs of steel boilers unless some lime is added.

Where the waste injection water from a jet condenser is used for washing in a dye house, this freedom from oil is of great advantage. Such is the aversion of dyers to using exhaust steam to heat water on account of the supposed presence of cylinder oil, no matter how careful one may be to provide and operate successfully oil eliminators, that this freedom of the turbine from the use of cylinder oil is sufficient cause to determine the purchase of turbines in place of engines for power in such places.

The Atlantic Mills turbine is, so far as the writer knows, the only instance on record of the use of injector condensers for large turbines either of the Parsons or Curtis type.

1. A paper presented at the New York meeting (December, 1904) of the American Society of Mechanical Engineers.

## Pacific Coast Waterpowers for Electrical Operation of Railroads.

"The Use of Pacific Coast Water Powers in the Electrical Operation of Railroads" was the title of a comprehensive and interesting paper read before the Pacific Coast Railway Club on January 21st in San Francisco. The paper was presented by Mr. Robert McF. Doble, consulting engineer of the Abner Doble Company of San Francisco, and was well illustrated with stereopticon views and diagrams of steam locomotives, electric cars and locomotives, track and rolling stock of California roads, hydro-electric plants, and a state map showing the location of power plants and transmission lines. Attention was called to the widespread consideration that is being given to the application of electricity as motive power to replace steam locomotives on railroads, reference being made to the large undertakings of this nature now being carried out by the New York Central and the Pennsylvania Railroad companies.

Under the advantages of a central power station, the author spoke of the present-day limitations of the steam station and of the self-evident possibilities of obtaining power from hydro-electric plants. Particular reference was made to the conditions on the Pacific Coast, where available waterpowers are distributed at frequent intervals all the way from Southern California up into British Columbia. While only a very small portion of these waterpowers have been developed, even with the stations now operating and the transmission systems now carrying power throughout the central portion of the state, the conditions would seem to make profitable the operation of at least some of the railroads by electricity. It was stated that the capacity of the steam locomotive has to be that of the maximum effort required from it, even though that effort be for a very short time, while, on the other hand, the load on the power station is only the sum of the loads on the different motors, which will average much less than the sum of their maximum powers. This materially reduces the cost of operating, especially with the conditions found on the Pacific Coast, where several power plants can feed into one network and supplement the power of each other. The possibility of recovering energy lost in braking was also referred to, the example of several European railways being cited to emphasize the fact that this has been practically accomplished. In such a system of distribution as is possible in California, considerable power might be generated by trains descending mountain grades, and thus fed back and utilized in the distribution network.

Reference was also made to the saving in the cost and maintenance of track, the possible increase in capacity of existing railroads, the saving of time and labor in the operation of an electric locomotive, its characteristic simplicity and the rapidity with which repairs can be made. The power which can be obtained from steam locomotives is rapidly approaching its limit, while the development of the electric locomotive has apparently only begun. The relative reliability of steam and electricity was held to be in favor of the latter, especially in consideration of the local conditions in California, where a number of waterpower plants feeding into the same distribution system would make exceedingly remote the possibility of breakdown of anything more than an individual locomotive.

Turning to the achievements of electric traction in California, particular reference was made to the Los Angeles and Redondo railway, the Pacific electric railway of Los Angeles, and the North Shore and Key Route systems of San Francisco. The North Shore railroad is of special interest by reason of its being the first and only third-rail line in California and because of its being operated from a sub-station which is the terminus of one of the longest transmission lines in the country. The Alto station referred to is 180 miles from the hydro-electric plant at Colgate and 250 miles from the new De Sabla power house. One of the features of the Key Route system which was given considerable attention was the Diamond trolley, which is successfully used on all of its trains. The possibilities of this collector for heavy railroad work were pointed out.

As to projected electric lines on the Pacific Coast, reference was made to improvements which the Southern Pacific company has under consideration for its suburban lines in Oakland, Berkeley and Alameda, to the rumored electrification of that company's San Jose and Port Costa lines and also to the possibility of operating its mountainous divisions by electricity.

## Electric Plant for Large Cotton Mill.

The Dwight Manufacturing Company of Chicopee, Mass., is one of the largest of its character in the country, manufacturing sheetings, shirtings and fine dress goods. It has an equipment of about 130,000 spindles, comprising both ring spindles and mule spindles, and about 3,500 looms. The machinery is, at the present time, driven by water and steam, the waterpower being supplied from the Chicopee River, on which the mill is located. The present power equipment consists of eight different waterwheels, situated in various parts of the plant, and connected to lines of shafting. To supplement this power in times of low water, and to add additional power which cannot be obtained from the waterpower, there are installed three separate steam engines. Owing to the increased development of the mill, the amount of power installed has been insufficient and it has been deemed advisable to increase the power plant by installing electric power, with the intention to operate a portion of the mill continuously by motors, and other parts by electric drive in case of low water.

The factory is divided into a number of buildings arranged in crescent form along the river. The advantages of electric drive are, therefore, especially marked. The electric power plant will be centrally located and the lines will extend in both directions to the various buildings.

The present contract provides for the following Westinghouse apparatus: One 440-volt, alternating-current generator, 900-kilowatt rated capacity, to supply three-phase current at a frequency of 60 cycles, this generator is to be direct connected to a C. & G. Cooper 26 by 52 by 48-inch cross-compound condensing engine; one 25-kilowatt exciter, direct connected to a Westinghouse engine, and one 22½-kilowatt motor-driven exciter. There will also be provided a four-panel switchboard to control generator, exciters and six feeders.

The electric power plant is to be placed in a new building to be built as an addition to one of the present engine houses, in this way putting the two engines under the supervision of one engineer. To utilize the current produced by this plant the following motors, wound for 60 cycles, three-phase, will be located in the various parts of the mill: Two 200-horsepower, 580 revolutions per minute, six 100-horsepower, 580 revolutions per minute; three 75-horsepower, 690 revolutions per minute; three 50-horsepower, 850 revolutions per minute, and two 40-horsepower, 850 revolutions per minute.

## New England Street Railway Club.

The New England Street Railway Club, comprising representative men identified with the management of leading street-railway companies throughout the New England states, held its fifth annual meeting and banquet on January 26th at the Hotel Brunswick in Boston. The club had an accession of 63 members to its membership during the year, making 560 on the rolls at present, nearly two-thirds of whom were present at the banquet. At the business meeting held before the dinner, the following-named officers were elected: President, E. E. Potter of New Bedford; vice-presidents, Paul Winsor of Boston, Norman McD. Crawford of Hartford, Conn., L. N. Wheelock of Claremont, N. H., A. J. Crosby of Springfield, Vt., J. E. Thielsen of Providence, George E. Macomber of Augusta, Me.; secretary, John J. Lane of Boston; treasurer, N. L. Wood of Boston.

The New York state association was represented by its president, Loomis Allen. Other special guests of the club were Calvert Townley of Hartford and Charles D. Wyman, Wallace D. Lovell, Gen. William A. Bancroft, C. S. Sergeant, James F. Shaw, George A. Butman, J. H. Goodspeed, D. D. Bartlett, C. F. Bancroft and Horace Rogers of Boston.

An ordinance has been introduced in the City Council of Seattle, Wash., for the appointment of a city electrician.

# CORRESPONDENCE.

## Great Britain.

London, January 28. [illegible] which took place in the United States and the St. Louis Exhibition by the members of the British engineering societies has resulted in a number of papers being read before the different institutions setting forth the members' views and impressions. The earliest of these papers are four, which were read last week before the Institution of Mechanical Engineers, two of which indirectly touch upon electrical matters. One of them, dealing with American workshops, stated that the very best of the general workshops, with possibly one exception, could be matched in equipment and in general methods of carrying out work by certain works in this country. In general, however, the organization of an American engineer's workshop struck the author as superior to that in similar works in England, while in some the organization was in every detail admirably administered. In fact, throughout the papers and discussions it was clear that everyone was struck by the amount of detail in the organization of American shops. But beyond this there was a disposition to complain of the usual impressions here of American and other works as being far too exaggerated. One or two speakers were especially severe, particularly with regard to the electrical pumping plant for the Cascades at the exhibition. In the official guide this plant was stated to be capable of setting in motion the largest volume of water ever moved by artificial means. When the plant was inspected it was found to consist only of three motor-driven pumps of a size which an Englishman would think of no consequence and unworthy of talking about for a moment. Furthermore, only one pump could be worked at a time for fear the vibration would result in the collapse of the structure in which the pumps were situated. Another speaker, in a little enthusiasm for the mother country, said that an American was proud of anything—even if it were bad—so long as there was enough of it; Americans were great at big things. In fact, as Americans "appreciated" themselves 50 per cent. and Englishmen depreciated themselves 25 per cent., he thought he had given a true idea of the proper comparison. From what I know of the men who made these utterances, I may say that they were made in no unfriendly spirit, but were simply candid expressions of opinions of their tour in the States. They certainly vary from the usual estimate of American engineering here.

Apropos of the breakdown upon the electric-lighting mains at Bradford, and which was recorded in these notes, the matter has been receiving the serious attention of the corporation and the electric-lighting committee. As usual, the electrical engineer has come in for a deal of criticism, although primarily he was not responsible for what happened, inasmuch as he has only been at Bradford a short time, and the trouble was the result of long-standing bad work. However, it has now been decided to call in an independent expert to report upon the undertaking generally as follows: (a) The condition of the whole of the electrical plant as it was in November, 1903; (b) whether the alterations and additions since sanctioned by the council were requisite and necessary; (c) if, generally, having regard to the whole of the circumstances, the engineer has adopted correct methods of surmounting any difficulties with which he may have had to contend; (d) whether the rearrangement made by the engineer in the organization of the electrical department is an improvement and will facilitate future working, taking into account the individuals concerned. It may be pointed out that the date, November, 1903, mentioned above, was the date at which the resident engineer took up his duties.

Captain Lionel James, who acted as the correspondent of the Times (London), working the De Forest space-telegraph outfit on board the steameer Haimun near Port Arthur in the early stages of the Russo-Japanese war, related his experiences at the Society of Arts a few days ago. Unfortunately it was in the nature of a popular lecture and little information for a technical paper was given. Most of what he said, too, has already appeared in the Times. One interesting paragraph in the lecture, however, referred to the loss of Admiral Makharoff's flagship. Captain James said that he witnessed most of the operations, and when the Japanese hoisted their fighting flags and steamed in to engage the fortress a brief message announcing the fact was sent to Wei-hai-Wei. That message was sent at express rate and consequently was in the Times office a couple of hours later, and making allowance for the difference of time the newspaper office knew that an engagement was taking place six hours before it began. Captain James also stated that he knew nothing of the scientific merits of the De Forest system, but claimed to have absolutely proved its practical utility. No disturbances were experienced from the many other naval systems in use there, except when they were within a mile of each other. He frequently worked the system at from 30 to 40 words a minute, whereas no other system that he knew of could transmit at a greater rate than 10 or 12 words per minute.

As an outcome of the grievances of the first-class passengers upon the electrified line of the North-

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ever.

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ized by Parliament last year, viz.,

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per mains. The use of overhead mains in North Wales was granted to the company in a manner and

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routes. This was overruled and all differences of

## New York.

New York, February 4. The New York [illegible] portation Company is a concern that makes a business of hiring out electric cabs and other vehicles. On Wednesday this company was before the Supreme Court as being subject to the city ordinance that prescribes the legal fares of hackmen, but Justice McCall decided that the company is a private concern that does not solicit the patronage of the public at large, and that the drivers are not at all in the position of public hackmen who have exclusive rights. Legal cab fares, therefore, do not apply to electric cabs.

Regarding the ever-growing demand for subway extensions, a proposition has been made to the Rapid Transit Commission by A. Stewart Walsh, who will guarantee to organize a company for the purpose of constructing a subway under Gates Avenue, Brooklyn, and to charge three-cent fares.

It would be tedious to record the history of the subway day by day. On Wednesday a passenger was injured, and yesterday a guard was killed. There was a fire in the Brooklyn section last Sunday and the water used to extinguish the flames gathered to such an extent that a boat had to be used in that part of the tunnel which is beneath the river. The Rapid Transit Commission yesterday made a definite order that if the advertisements and slot machines are not removed from the subway stations within 48 hours, they will be removed by force. Mr. Belmont has set men at work to remove some of the signs at an uptown station. On Wednesday there was an important conference between the employes of the Interborough company and Manager Frank Hedley. The men threatened to strike unless last year's agreement was fulfilled, but the dispute has been tided over for a few days at least, and it seems likely that the various little differences, relating mostly to the length of trips, will be adjusted.

Senator Cassidy of Schuyler County, N. Y., introduced a bill at Albany on Wednesday for the purpose of allowing any company producing light, heat or power, or distributing the same, to have condemnation powers in any place in the state of New York. This is an amplification of the defeated L'Hommedieu bill of last year.

The lighting controversy received a new impulse on Friday, when it was "discovered" that the city has been operating an electric-lighting plant since 1883 for supplying the lamps on Brooklyn Bridge. Advocates of municipal operation say that this plant costs only $30,000 a year, and supplies 209 enclosed arc lights and 1,800 incandescent lamps of 16 candlepower, or at the rate of $58 a year for arcs and $10 a year for incandescents. To supply these lamps at the central-station rates charged for street lighting would mean, it is said, a payment of $48,000 yearly. A reference to the civil list shows that the bridge plant is under the charge of Archibald McLean, who has a salary of $1,200, and who was appointed eight years ago. There are three dynamo engineers paid at the rate of from 43 to 47 cents an hour, a few linemen, and a "superintendent of lighting" receiving a salary of $2,200—a pretty fair staff for a small plant.

Cary T. Hutchinson, consulting electrical engineer, who was named as one of the committee of investigation to report on the project of municipal lighting, says it will take many months to prepare the "plans," and entail an outlay of $100,000, in addition to a fee of $5,000 which he would charge for his own services. This, on the surface of things, was not at all in the mind of the mayor, who was expecting a brief and speedy report based on existing conditions, and not a re-examination of the entire lighting situation.

The agitation in favor of cheaper or more equitable telephone rates is taking tangible form. The city is supporting a bill at Albany to this end, and Corporation Counsel Delany is initiating an investigation into the precise terms of the telephone franchises. The city is also suing the Empire City Subway Company for the repayment of a sum of $5,000,000 and the handing over of its underground conduits (used largely for telephone wires), on account of alleged failure to fulfill the terms of its franchise. Another movement, engineered by Borough President Ahearn of Manhattan, is designed

to compel the telephone companies to put all their wire underground.

D. A. Mackintyre, O. B. Goldsmith and A. L. Davis, all of this city, are the directors of the newly incorporated Kerr Electric Company, which has a recorded capital of $1,000. D. W. W.

## Dominion of Canada.

Ottawa, Ont., February 4.—The contract between the city of Sherbrooke, Que., and the Sherbrooke Power, Light and Heat Company for lighting the streets having expired, the company has made an offer to the city that if a contract for 10 years is entered into it will reduce the $60 rate for street lighting to $50 and give a discount of 10 per cent. on the meter rate.

The Montreal Terminal Railway Company is petitioning the Dominion Parliament for power to issue stock, to increase its bonding privilege and to construct branch lines operated by electricity in Hochelaga, Maisonneuve, Jacques Cartier, Chambly, Vercheres, Laprairie, St. Johns, Iberville and St. Hyacinthe; also to distribute electric power for lighting, heating and other purposes.

Because the cost of power is one-third greater in Montreal than it is in the city of Peterboro, Ont., is the official reason given by the Canadian General Electric Company in deciding to shut down its plant in Montreal and removing it to the latter city. It is further pointed out that lower factory costs follow the very low cost of power, and the company looks to effect an economy of fully 20 per cent. in these costs as compared with Montreal. The Montreal plant will be shut down about April 1st next.

Application has been made to the Dominion Parliament for a bill of incorporation of the Canada-Middlesex Railway Company, with power to construct an electric railway from Niagara Falls through the counties of Welland, Lincoln, Wentworth, Brant, Oxford and Middlesex, Ont., to a point near the city of London, Ont. The headquarters of the company are to be in Toronto. The capital stock is $500,000 and power is asked to issue debentures to the extent of $35,000 per mile.

The Toronto Street Railway Company has decided to equip every car on its system with air brakes at a cost of approximately $150,000.

Hon. C. D. Haines of New York, who has made arrangements for the building of the Ancaster and Brantford electric railway, has now made an offer to purchase the street railway of the city of Hamilton, Ont. His line was refused an entrance to the city on the streets applied for. The street railway is now owned by the Cataract Power Company and the franchise matures in 1928. The road has a bond issue of $500,000 and its receipts for the last year were $219,594.

Radial railways which, it is said, will be equal to the best in the world, will be in operation between Toronto and Oakville, 20 miles; Toronto and Jackson's Point, 50 miles, and Toronto and Whitby, 26 miles, at the close of the present year, according to the plans of the Toronto and York Radial Railway Company, otherwise known as the Toronto Railway Company.

The returns of electric railways in Canada show that there are 767 miles of such railways in operation in the Dominion. The capital invested in them, including Dominion and provincial subsidies and municipal aid, was $80,453,609, being an increase of $1,219,932 over 1903. Working expenses for 1904 were represented by the sum of $5,326,517, an increase of $853,659, when compared with the previous year. Net earnings were $3,125,092, or an increase of $366,273. There were 181,689,998 passengers carried, as against 155,662,812 for the preceding year. Ten passengers were killed, being 28 less than in the year previous.

It is understood that the Ottawa River Railway Company has awarded the contract for the construction of the proposed new railway between Montreal and the capital to Mr. M. P. McGrath of Easton, Pa. This new project is to be undertaken partly as a steam and partly as an electric road. City and suburban business will be conducted by electrical power, while the main line will be operated as a steam railway. The first section is to be built between Montreal and Hawkesbury, and the plans for this have been approved by the Dominion government. Ultimately the idea is to extend the line as far as Georgian Bay. Amalgamation is to take place with the company chartered by the Ontario Legislature. This will give the shortest route between the great lakes and Montreal. W.

## Mexico.

City of Mexico, February 1.—A company is being organized at Torreon, Mexico, with a capital stock of $500,000 to take over and operate the Torreon Electric Light Company and the Torreon Street Railway Company. The street-railway company has built two electric lines. It is stated that the new company proposes to make important enlargements and extensions. Joaquin Serrano is interested.

It is stated that a large electric generating plant is to be established in the vicinity of the City of Mexico by the Mexican-American Power Company, which was recently organized with a capital stock of $150,000. G. Stuart Simmons of New York is interested in the enterprise.

John J. Moylan of the City of Mexico is preparing to establish an electric power plant near San Cristobal. The proposed plant will afford power for operating hoists and other machinery at the Peder de Dies mine.

A company has been organized for the purpose of establishing an electric power plant on the Quebrada River, in the state of Durango. The electrical energy to be generated will be used to operate factories in that part of the state.

A syndicate of American and English capitalists has purchased the Cuicatla Waterfall, situated in the state of Michoacan. It is the intention to establish a large electric power plant at the waterfall, where, it is estimated by experts, that more than 8,000 horsepower can be obtained.

The state of Sinaloa has granted three important electrical concessions to the Culiacan Electric Company, composed of Americans, which was recently organized with a capital stock of $300,000. One of these concessions is for the establishment of an electric-light and power plant in the city of Culiacan; another is for the construction and operation of long-distance telephone lines throughout the state and the establishment of local telephone exchanges at Culiacan and Mazatlan, and the third is for the construction of an extensive system of electric railway in Culiacan and its suburbs. Culiacan has a population of about 20,000 people. Mazatlan is also a thriving city.

The Mexican government is establishing a space-telegraph station at Merida, state of Yucatan. Other stations will be established in that state.

Manuel Alonzo of Vera Cruz will establish an electric power plant on the Antigua River, at a point about 18 miles from Vera Cruz. He has obtained a concession from the Mexican government for the proposed enterprise.

The government of the state of Jalisco has granted a concession to Ramon Agraz Palomera to establish an electric power plant on the Mascota River, the electric current to be transmitted to the town of Mascota for light and power purposes.

The company recently organized for the purpose of constructing and operating an electric railway from the city of Guadalajara to the town of Patzcuaro, state of Michoacan, is composed of some of the wealthiest Mexicans in that part of Mexico. The only American interested is William V. Backus, president of the William V. Backus Company of the City of Mexico. The proposed road will be about 200 miles long, according to present plans, and the building of several branch lines is contemplated. The road will handle freight as well as passenger traffic. The company has a capital stock of $1,500,000. Following are the officers: President, Carlos Llagune del Hoyo of Zamora; vice-president, William V. Backus of the City of Mexico; treasurer, Jose R. Carral of Guadalajara; manager, J. M. Zermono of Guadalajara; secretary, Ignacio Carranza of Guadalajara; auditor, Jose Lopez Portillo y Rejas of Guadalajara. H.

## Ohio.

Cleveland, February 4.—The validity of the Rogers law, under which the Cincinnati Street Railway Company was granted a 50-year franchise, and of the curative act that was meant to correct any defect the law may have had, were argued in the Supreme Court at Columbus last week. The lower courts have decided that the franchise is not valid, because both the law and the curative act are invalid.

The receivers of the Appleyard roads have been authorized to make a loan of $8,000 for the purpose of paying the taxes due and issue receivers' certificates due in six months.

The net earnings of the Columbus, Buckeye Lake and Newark Traction Company for last year were $97,891. The operating expenses were 55 per cent. of the gross earnings.

The three-cent-fare test made by the Cleveland Electric Railway Company was stopped Saturday evening. It is known that it was not satisfactory to the company nor the patrons of the road. On Monday morning a test will begin of a four-cent fare without transfers, or five cents with transfers. The regular cars will be used and tickets will be good on any line and to any part of the city. The officials state that it is their belief that this will get rid of the fraudulent transfer scheme that was worked on the road when the test of six tickets for 25 cents was made. The results of the three-cent fare will be made public as soon as the records are completed.

Money is in the bank to pay off the last of the claims against the Everett-Moore syndicate and with this done the men who have formed this syndicate will be free to return to their original work of planning and building electric roads and telephone lines. This syndicate was the first to take advanced steps in the way of building or gathering together short roads into large systems, and to it the people owe the Lake Shore Electric, the Northern Ohio Traction and Light and other such systems, as well as the United States Telephone Company and the collection of smaller companies making up the Federal properties.

C. A. Alderman of Springfield has been appointed receiver for the depots of the Dayton, Springfield and Urbana and the Columbus, London and Springfield roads at Dayton, Springfield, Urbana, London and Columbus, under an attachment proceeding, issued in favor of the Maryland Casualty Company, which claims that these companies owe a large amount for premiums on liability policies.

As an example of the result of fighting electric lines under the hold-up system, the people of Perrysburg now walk a mile to Ft. Meigs when they want to take a car to Bowling Green or Toledo. They have asked the Kerper people to make more convenient arrangement and the reply was that the company would run a dinky car into the town if the people would make some arrangement with the Detwiler people, who own the track connecting their line with Perrysburg.

Attorneys representing the Cincinnati Traction Company have filed a protest with the City Council against the passage of an ordinance granting the Rapid Transit Company a franchise to operate an elevated road on Third Street. A warm fight is promised between these companies over the plan to build an elevated line in that city.

The new line of the Toledo Urban and Interurban Company was put into operation Thursday of this week and cars from Bowling Green were run into the city direct. A schedule of 2½ hours from Findlay to Toledo has been arranged.

The officials of Lorain are planning a small municipal light plant, which, it is expected, will later be enlarged to furnish lights for the streets. The officials assert that they are paying the local lighting company too much.

During the last year the Toledo and Western handled 5,000 freight cars and in this respect leads all other roads in Ohio and Michigan. Of these 3,500 were actual freight, while the remainder carried coal and other freight used by the road. A proposition has been submitted by the business men of Angola, Mich., to extend the line to that place, a distance of 25 miles. The old officers have all been re-elected, Luther Allen of Cleveland being president, and C. F. Franklin of Sylvania, manager. O. M. C.

## Indiana.

Indianapolis, February 4.—The commissioners of Wayne County have granted a franchise to the Indianapolis, Newcastle and Toledo Traction Company through the county. The road will have a private right-of-way and will run along the south side of the Richmond division of the Panhandle road, passing through Greenfork and Hagerstown. D. M. Parry of Indianapolis is interested in the road.

The Board of Public Works of Indianapolis has notified all the traction lines operating in and out of the city that they must carry freight to the end of their lines, complaints having been made that shipments have been refused for the more distant points. The traction companies are disposed to meet the demands, but question the board's jurisdiction outside the city.

The City Council of Warren has granted a franchise through the city to the Breed-Shideler interests, or the Marion and Wabash Traction Company. The grant provides that $10,000 worth of work must be completed on the line by July 1st, and that the line must be constructed within seven miles of Warren by that time. The Kokomo, Marion and Warren and the Interstate, both desiring to build from Marion to points in Ohio by way of Bluffton, are also applicants for franchises.

Huntington Township, in Huntington County, is reported to have voted a subsidy of $25,000 to the Huntington, Columbia City and Northwestern Traction Company. The company proposes to build a line from Huntington to Goshen. A similar election will be held in Clear Creek Township for a $5,000 subsidy.

The officials and directors of the Fort Wayne and Wabash Valley Traction Company held a meeting in Fort Wayne on the 3d inst., and it is reported that they decided to enlarge the power station at Huntington. A large power house is said to be contemplated for Fort Wayne in the near future.

The Fort Wayne and Wabash Valley Traction Company has begun work on its extension from Logansport to Lafayette. A new bridge will be constructed over the river south of the city. Grading has already begun at Clymers Station.

A bill to make it unlawful to vote a subsidy in aid of a railroad company, including electric lines, is likely to become a law. The bill was ordered advanced to engrossment, notwithstanding able argument and strong influence to let the people decide for themselves in such cases.

A bill has been introduced in the Legislature which provides that heat, light and power companies of small cities and towns may consolidate with electric-railroad companies in case three-fourths of the stockholders vote to perfect such a consolidation.

The building of the Vincennes and Jasper traction line has passed the uncertain stage. The surveys have been completed, and the contract for the power house to be erected in Petersburg has been awarded to the Cincinnati Construction Company, for $72,000. The power house is to be completed by May 1st. S. S

## Michigan.

Detroit, February 4.—The citizens of Union City, who are maintaining an expensive steam plant for the operation of their municipal electric-lighting and

waterworks plant, are considering the project of reducing the expense of operation by substituting waterpower instead. An engineer has been employed and options secured upon two properties. The estimated cost of transforming the plant runs from $10,000 to $15,000.

William H. Fitzhugh, superintendent of the municipal lighting system of Bay City, and A. L. Searles, district manager for the Fort Wayne Electric Works, paid a visit to Muskegon recently and were the guests of S. A. Freshney of the Muskegon Traction and Lighting Company.

The town of Spring Lake, situated on the Grand Rapids, Grand Haven and Muskegon electric line, has recently made an arrangement with that company whereby the town is to be lighted by the company. A two-year contract has been given.

The Hathaway Graphite Company, in which several Detroit capitalists have been interested, will now be controlled entirely by Detroit people. A better vein of graphite has been discovered, and electric-light carbon, stove polish, paint, pencils, etc., will be manufactured. The plant is situated at L'Anse, and it is the intention of the company to install a 150-horsepower turbine waterwheel to furnish power for operating the plant.

The Detroit, Monroe and Toledo electric railway has reduced the running time between Detroit and Toledo, as was promised some time ago. It now makes the trip in schedule time of 2½ hours, and the operation of the line upon the new time has proved a complete success.

The annual meeting of the stockholders of the Detroit, Ypsilanti, Ann Arbor and Jackson railway was held at Dearborn this week. A. L. C. Henry, for a number of years a trusted employe of F. S. Angus, president of the road, was appointed to succeed Secretary Hinchman, who resigned. A. E. Jennings of Detroit was added to the board of directors.

Prof. John R. Allen of the engineering department of the University of Michigan has been making a test of interurban lines and also of the Detroit United Railway to ascertain the efficiency of the electric lines running out of Detroit. Professor Allen has prepared tables of statistics based upon actual observation and includes among them a test of a steam engine of the Mogul type, as well as a simple passenger engine, as compared with electric cars from the Detroit, Ypsilanti, Ann Arbor and Jackson railway, and the Detroit United Railway. He is of the opinion that it is practical to operate electric cars at high speed. Some of the interurban lines have developed speed of 48 miles an hour, and, in his opinion, 70 miles an hour is not impossible.

The Common Council of Coldwater has accepted the deposit made by the Toledo and Michigan electric railway, with its acceptance of the franchise through Coldwater. It is expected that the road will be completed in two years. Considerable has been expended in grading between Coldwater and Adrian.

Detroit and Pontiac men have organized the Copper Range Gas Company, which will carry on the manufacture of gas and electricity for lighting, heating and other purposes at Houghton, Mich. C. A. Burr, trustee, of Rochester, Mich., owns the majority of stock. C. G. W.

## Northwestern States.

Minneapolis, February 4.—The Electric Development and Securities Company has applied for a franchise at Omaha, Neb. The company wants to furnish current for 1,200 street lights.

M. Donahue and P. G. Williams propose to establish an electric-light plant at Montrose, S. D., and to have it in operation within 60 days.

Plans are being prepared by Proudfoot & Bird, architects, of Des Moines, for a central light and heating plant at Iowa State College, Ames, Iowa.

The Grinnell (Iowa) Interurban Company has filed articles of incorporation. The company is headed by O. K. Cole and it proposes to construct an electric railway from Grinnell to Independence.

It is reported that A. G. Whitney will take steps to dissolve the receivership of the street-railway company at St. Cloud, Minn., and that the company will be consolidated with the Public Service Company of St. Cloud.

The power house of the Duluth, Missabe and Northern Railway Company at Proctor, Minn., was destroyed by fire at a loss of $6,000. A new power house was being built at the time.

N. U. Hord of Philadelphia has applied for a street-railway franchise at Excelsior, Minn., the plan being to construct a suburban line from Minneapolis to Excelsior. The Twin City Rapid Transit Company and the Minnesota Power and Trolley Company have each been planning such a line, and the matter will be brought to an immediate conclusion. R.

## Pacific Slope.

San Francisco, February 2.—Charles B. Kitch, who for many years was superintendent of the Mission electric lines of the United Railroads of San Francisco, has been appointed superintendent of the Eureka interurban electric railway, and will take up his new duties at once.

The Valley Counties Power Company has issued bonds valued at $2,500,000, bearing five per cent. interest, and has given the Mercantile Trust Company a mortgage on its Butte County properties.

The Schoenberg Electric Appliance Company has opened an office at 642 Sutter Street devoted to dental and medical appliances [illegible] small electric apparatus.

The Pelton Water Wheel Company [illegible] and works at 124 Main Street, San Francisco, reports a number of important sales of water wheels for hydro-electric work. A 700-horsepower Pelton wheel is being built for the Grande Ronde Electric Company of Oregon, to operate on about a 900-foot pressure. The Nanaimo Electric Light and Heating Company of British Columbia has ordered a 450-horsepower wheel, and the Silver Lake Mines of Colorado a 600-horsepower wheel. The government of Hawaii is having a 450-horsepower wheel built and the La Grande Water Storage Company of Oregon has ordered one of the 900-horsepower size.

The Westinghouse Electric and Manufacturing Company has contracted with the Truckee River General Electric Company for a 1,500-kilowatt generator to be installed at the new plant six miles from Floriston. Power will be supplied to the Comstock mines as well as in the Truckee River district.

The San Francisco Railway Company is attempting to secure possession of the Geary street line, which is now in the hands of the city, and establish an electric system from the ferries to Golden Gate Park. In the downtown district it is proposed to use underground electric conduits.

The United Railroads will soon entirely reconstruct the Sutter Street line in San Francisco and will ask permission to change it to an electric system. Property owners desire an underground trolley system, but the company's engineers have decided that this is impractical, owing to the imperfect system of sewers.

An electrical plant is proposed for the Lick Observatory on Mt. Hamilton.

The Standard Electrical Works has been incorporated with a capital stock of $100,000, by R. J. Davis, Harrison Dibblee, A. M. Tunke, A. S. Armstrong and H. C. Thaxter.

Grading and filling for the foundation of the new electric-light and water plant to be installed at Oxnard, Cal., by the Oxnard Light and Water Company, have been commenced. It is hoped to have the plant in working order by the first of April.

The National Park Electric Power Company has been incorporated at Sonora, Cal., by J. J. Inman, M. E. Page, J. H. Rucker and others. The capital stock is $250,000.

The San Joaquin Power Company has decided to begin at once the construction of another power plant in the mountains near the Crane Valley reservoir, east of Fresno, Cal. The plant will have a capacity of 3,500 horsepower.

At a recent meeting of the Broadway Boulevard Improvement Association of Los Angeles, Cal., the matter of installing an independent plant for electric street lighting was discussed and favored. Action will be taken at once towards installing the necessary machinery. The action on the part of the association is due to the electric-lighting companies of Los Angeles proposing to charge a higher price for electricity than agreed upon when the electric street lamps were put in.

The San Jose and Los Gatos Interurban Railway Company has applied to the council of San Jose, Cal., for a franchise for an electric railroad, to be constructed over Twelfth and San Carlos Streets. If granted this road will form part of the system which is to gridiron the eastern part of San Jose and the Santa Clara Valley.

Robert N. Frick of San Francisco has filed a petition for a franchise for a single-track standard-gauge electric railroad to run from the northwestern boundary line of San Jose, Cal., at the end of Twelfth Street, to Milpitas. It is said that the line is designed to connect with a through line from Oakland.

The Northwest Water and Light Company is to erect a building at North Yakima, Wash., to be used as an office building and electrical distributing plant for the lighting system of North Yakima.

O. M. Lacey of Hanford, Cal., inventor of the Lacey controller, has obtained a patent for an automatic voltage regulator. The object of the invention is to provide an apparatus by which the voltage can be constantly and automatically regulated at any desired spot. This is affected by a fluid pressure acting in opposite directions upon pistons of different areas, the flow being controlled by valves operated directly by the movements of the voltmeter, and the movements of the piston are transmitted directly to the rheostat or other controlling device. A.

## PERSONAL.

L. P. Sawyer, manager of the Buckeye Electric Company, visited Chicago last week. Mr. Sawyer was on a hurried trip, and left the same day for Cleveland.

C. C. Chesney of Pittsfield, Mass., has been suggested for the office of manager of the American Institute of Electrical Engineers by a number of friends, including H. W. Buck, W. C. L. Eglin, [illegible]

[illegible]

tric Light Association are very bright. An attend-

[illegible]

ment.

A. W. Wyckoff [illegible] ger for the National Electric Company for Pittsburg and the surrounding territory. Mr. Wyckoff is well known in that section, as he was previously district manager of the Bullock Electric Manufacturing Company, having been prior to his taking the Pittsburg office the general superintendent of the Bullock Works at Cincinnati. Mr. Wyckoff is a graduate of Cornell, and rounded out his engineering education in the Bethlehem Iron Works.

## ELECTRIC LIGHTING.

The city of Camden, Tenn., is preparing to build an electric-light plant.

The Lexington Gas and Electric Company of Lexington, Mo., has been incorporated.

The Royse (Texas) Milling and Light Company has been incorporated with a capital of $20,000 by E. E. Poynter and others.

John Harris and others have incorporated the Benton Electric Light Company at Fort Benton, Mont., with a capital of $15,000.

An electric plant is to be established in Savannah, Ga., by J. J. Cummings, Lawrence McNeil and associates to furnish electric light and power to industrial concerns.

The Lufkin (Texas) Electric Light and Power Company, with a capital stock of $30,000, has been incorporated by S. W. Henderson, G. A. Hackney and J. S. Henderson.

The Martin-Reynolds Electric Company of Little Rock, Ark., has been awarded the contract by the city of England, Ark., for the construction of an electric-light plant in the latter town.

The Andrews (N. C.) Light and Power Company has been incorporated with $100,000 capital to construct and operate waterworks, electric-light and power plant, telephone system, etc. J. Q. Barker and E. G. Henneman are interested.

J. H. Savage, M. Dick and V. M. Barber have incorporated as the Plaquemine Electric Light and Power Company of Plaquemine, La. The company is capitalized at $30,000 and proposes to construct and operate electric-light and power plants.

The Waycross Electric Light and Power Company of Waycross, Ga., is preparing to put on a day current for consumers. The company will move its office to the business district of the city, where it will carry a stock of fixtures, novelties, etc.

A bill introduced in the Illinois House of Representatives is aimed at electric-lighting companies. The bill would require such companies to maintain a set rate of charge for current, and provides heavy penalties for discriminations in favor of large users.

Preliminary estimates for the erection of the proposed $75,000 electric-light plant for the city of Covington, Ky., have been submitted by T. J. Creaghead of Cincinnati, Ohio. The proposed plant is to have a capacity of 400 arc lights and 2,000 incandescents.

The Central Heat and Power Company of Rockford, Ill., has petitioned the City Council for a permit to string overhead wires and extend its conduits for wires where possible, also for heating purposes. The company expects to make a bid for the city arc lighting in 1906.

The Merchants' Light and Power Company of Memphis, Tenn., recently organized with a capital of $500,000 to erect an electric-light and power plant and gas plants, has elected the following officers: President, L. Bry of St. Louis, Mo.; vice-president, Hugh Pettit; secretary and treasurer, R. W. Uhlman.

At the annual meeting of the Colorado Springs Electric Company in Colorado Springs, Colo., recently, these officers were elected: President, W. A. Otis of Colorado Springs; first vice-president, George R. Buckman of Colorado Springs; second vice-president, S. R. Bertron of New York city; secretary and treasurer, Irving W. Bonbright of Colorado Springs; assistant secretary and treasurers, F. W. Stehr of Colorado Springs and Murray

Dodge of New York city; general manager, George B. Tripp of Colorado Springs.

The sale of the St. Louis syndicate interests in the Union Electric Light and Power Company and the Laclede Gas Light Company to the North American Company has been officially confirmed by Julius S. Walsh, president of the Union company, following the return of the St. Louis capitalists from New York. It is announced that the syndicate got a little less than $3,000,000 worth of North American stock in exchange for its Laclede and Union stock of $6,000,000 par value. An adjustment concerning dividends on all the stocks figured in the deal, and this served to complicate any attempt at an accurate estimate of the prices commanded by the two stocks.

## ELECTRIC RAILWAYS.

Jeff Read and J. J. Freundlich are in New York for the purpose of financing the proposed electric railway between Paducah, Ky., and Cairo, Ill. The right-of-way has all been secured. The estimated cost of building the line is $600,000.

Several conferences have been held in Louisville, Ky., within the last week relative to the reorganization of the New Orleans Railway and Light Company, and it is said that a feasible plan has been devised to reduce the capital stock and yet leave everything fair and satisfactory for the stockholders. There are now outstanding stocks and bonds to the amount of $80,000,000.

It is announced by the Lawton, Wichita Mountain and Western Electric Railway Company that it expects to begin the construction of an electric railway from Lawton, Okla., to the Wichita Mountains, by way of Fort Sill, as soon as the game preserve has been established and Fort Sill has been made a regimental post, both of which have been recently provided for by Congress. The road will be about 25 miles in length, and will probably be extended northwest to Hobart.

The Northwestern, Metropolitan and Oak Park elevated railways of Chicago made traffic gains for January, compared with January, 1904, while the South Side Elevated had a loss. The total of the four lines is about 317,000 passengers daily. The daily average of passengers carried was as follows: January, 1905—Northwestern, 73,728; Metropolitan, 116,013; South Side, 84,659; Chicago and Oak Park, 42,842. January, 1904—Northwestern, 70,204; Metropolitan, 112,413; South Side, 87,601; Chicago and Oak Park, 41,334.

The first car, in charge of President Porter, over the new electric line in course of construction from Alton, Ill., to St. Louis was run a few days ago from Granite City to Alton. Cars will be run hourly, leaving Alton and Granite City simultaneously. Connection will be made at Granite City with cars running from there to the National Stock Yards, East St. Louis. Service to St. Louis via the Eads Bridge will not be started until the completion of the short line from Granite City. The fare between Alton and St. Louis will be 50 cents for a single trip and 80 cents for a round trip.

The New York and North New Jersey Rapid Transit Company, which has filed its charter at Trenton, N. J., proposes to run electric trains from Weehawken to Paterson in 15 minutes. It is proposed to tunnel through the Palisades and run the line on an elevated track part of the way. The incorporators include John W. Griggs, ex-United States attorney-general; Col. William Barbour, Malcolm R. McAdoo, a relative of W. T. McAdoo, who is building the Hudson River trolley tunnels; John R. Lee, Henry Parmelee, E. L. B. Gardiner and Howard Sprague. The terminus in Paterson is to be at Church and Ellison Streets. The power is to be by third rail.

An official statement from the offices of the New York, New Haven and Hartford railroad says that at a meeting of the board of directors of the Berkshire Street Railway Company, held in New Haven, Conn., the old board of directors resigned and the following were elected: C. S. Mellen, C. F. Brooker, D. Newton Barney, William Skinner, Arthur D. Osborne, H. M. Kochersperger, E. H. McHenry, Calvert Townley and James S. Hemingway. These men are directors of the Consolidated Railway Company, the corporate name of the concern through which the New York, New Haven and Hartford railroad has already taken over various electric lines in Connecticut.

The annual report of the president and directors of the Ottawa (Ont.) Electric Railway Company for the year ended December 31, 1904, has been published in booklet form and is being distributed by Secretary James D. Fraser. The gross receipts for the year amounted to $384,939.60, with net earnings of $139,097.70. The work of replacing light rails with 80-pound rails was continued during the year, and, owing to the increase in summer travel, 12 new cars have been ordered. A motor-generator set of a capacity of 1,300 horsepower was installed in a new power house. The roadbed and equipment, waterpower property and plant, real estate and buildings are valued at $1,718,759. Mr. T. Ahearn is president of the company.

## AUTOMOBILES.

Regulations governing the use of automobiles in Germany are made by the police and are always subject to change by simple order. On arrival, the owner of a machine must go to police headquarters, give his name, age, place of birth, etc., name of machine, where manufactured, weight, etc., and make formal application for a police number. After examination, if all regulations are complied with, a police number, a foot square and made of tin, will be brought to the owner of the machine, with a charge of 35 cents. The sign must be fastened to the rear of the car, and a lamp must be so adjusted as to throw light directly upon the number. The automobile must have two separate and hanging brakes. A plate, with name of the machine, where made, number of horsepower, and weight, must be in sight, and the machine must not appear on the streets or roads without a number. No one under the age of 18 years is permitted to drive an automobile. The duty upon a machine as a whole is $1 per 100 pounds; lamps and detachable fixings are subject to an additional specific duty. The insurance and freight on a machine from New York or Philadelphia to Germany is approximately $30 to $40. Customs duties can be paid subject to return, when the automobile leaves German soil within one year and the custom seal is not broken or off the machine.

## PUBLICATIONS.

Pass & Seymour of Solvay, N. Y., call attention, in a small pamphlet, to three of their sign receptacles—one type of which is weatherproof. Prompt shipment is guaranteed. Porcelain transformer cut-outs and solid-back fuseless rosettes and fuseless attachment plugs are other specialties, each described in a separate folder. The transformer cut-outs have been extensively used for five years.

Pleasing to the eye and carefully prepared as to the reading matter, the brochure recently issued by the Westinghouse Machine Company describing the Westinghouse-Parsons steam turbine is characteristic of the advertising literature which it is the company's custom to prepare. The principle of the Parsons turbine and the construction details of the present-day apparatus are thoroughly explained and illustrated with numerous pictures of the various parts. There are also pictures of a large number of actual installations given and a map of the eastern and central part of the United States upon which is indicated the location and capacity of the Westinghouse steam-turbine power plants to date. Inserts to the brochure contain complete data on a few typical tests made upon turbines ranging from 400 to 1,250 kilowatts in capacity.

The National Electric Company of Milwaukee has hit upon a method of advertising which is unique in itself and at the same time promises to be the source of considerable information to those who will follow carefully the series of leaflets containing the "Electrical Catechism," as it is called. No. 1, Volume 1, of the "catechism" contains, as a starter for the course, two diagrams explaining the analogy between electric current in a circuit and water under pressure flowing in a system of pipes, which analogy, although criticized as inexact, nevertheless is readily applied and a useful method of gaining a concrete conception of the phenomena of electric circuits. Besides the diagrams, there are seven question, with short but concise and accurate answers. The questions in catechism No. 1 have to do with the units of electrical pressure, current, resistance and power. Future numbers of the catechism will be anticipated with interest, and as the series progresses questions and answers of much value not only to the layman but to engineers as well will be given.

## SOCIETIES AND SCHOOLS.

The Southern Supply and Machinery Dealers' Association will hold its annual convention at the De Soto Hotel, Savannah, Ga., on April 25th to 28th. Mr. Denney, of the Georgia Supply Company, Savannah, heads the entertainment committee.

The Electrical Contractors' Association of Minnesota held its semi-annual meeting in St. Paul recently. William Burger of Duluth presided. A discussion of the law regarding the necessity of requiring that licenses be given to electrical inspectors and master electricians was the chief topic of the meeting.

## MISCELLANEOUS.

The Manitoba Legislature, which closed its session on February 1st, among other legislation passed an act empowering towns and villages to establish and operate electric-light, gas and telephone systems. The act has received the royal assent and become law.

Experiments are being made at El Paso, Texas, with a process for the electrical purification of the water supply, which in that city contains much alkali. The electro-aluminum process was tried and appears to work satisfactorily. The salts formed by the process are precipitated to the bottom in solid form and the purified water is said to be apparently soft, will lather freely, and the hands do not have that "dry" feeling when taken out, as is the case when alkali water is used for washing.

Largely on account of the presence of the great works of the General Electric Company, Schenectady, N. Y., the "Electric City" has increased from a population of 19,902 in 1890 to 31,682 in 1900 and over 55,000 at present. Once known as the sleepiest town in the state, Schenectady is now a bustling city.

The secretary of the treasury has submitted to Congress a draft of a bill authorizing the installation of electric burglar-alarm devices in connection with vaults and safes in buildings under control of the Treasury Department, and making an appropriation of $60,000 therefor during the fiscal year ending June 30, 1906. This bill provides for protection additional to that authorized by the sundry civil act of March 3, 1903.

After many years of trials the cultivation of rubber in a commercial sense has been established in Hawaii. Six years ago a rubber plantation was started at Nahiku, but little has been heard of the matter until recently. Now the trees have been found in a condition to produce rubber, and the work of gathering it probably will soon begin. Those interested are among the wealthiest Hawaiians. More than 5,000 saplings have been planted.

It has been discovered recently that the slime or residuum of the thermal springs at Baden-Baden, Germany, contains a comparatively high percentage of radium, and the residuum, previously considered worthless, is now sent to laboratories as fast as it can be collected. For hundreds of years, in fact, ever since the Roman occupancy, the springs have been thought by the people at large to possess healing qualities, though the belief has been looked upon by scientists as superstition.

A floating repair shop is almost completed for the United States navy, which is said to be the first of its kind ever built, and with it second-class cruisers, gunboats and torpedo boats may be repaired while at anchor. The craft is 120 feet long and 40 feet wide, built of steel. It is fitted with a 20-ton crane, air-compressor outfit, dynamos for lighting and other electrical apparatus. The boat is practically unsinkable, but has no propelling means and must be towed. The apparatus will be capable of taking off the smaller guns on battleships and armored cruisers and of making minor repairs to the superstructure and interior of large ships. There is nothing pertaining to the smallest craft, except a hole below the water line that cannot be repaired.

The people in the business portion of Chicago were enabled to see clearly the large sun-spot which appeared on February 5th, with the naked eye, owing to the canopy of smoke which hung over that portion of the city for several hours. The smoke was thick enough to allow of the observer looking directly at the sun, but did not shut out the spot, which, in the opinion of many individuals who witnessed the phenomenon, ranged in size from that of a pencil point to the size of a fly, comparatively speaking. Professor Cox of the Weather Bureau said that it was a most unusual occurrence to be able to see a spot of this character without the aid of smoked glass. According to astronomical observations made at Lake Geneva the spot actually measured 30,000 miles across and was one of the largest ever observed. The spots come, it is said, in unusual numbers once in 11 years, often accompanied by remarkable electrical disturbances on the earth.

## TRADE NEWS.

John C. Fries and E. J. Theobald are among those interested in the Home Electric Company, recently organized at Louisville, Ky. The company will conduct a general electrical business at 205 West Market Street, Louisville.

George A. Clyde, late of the firm of Clyde & Dyett, wire manufacturers of Rome, N. Y., has organized a stock company with a capital of $40,000 for the manufacture of insulated electrical wire, machinery and apparatus, the new company to be known as the Fort Stanwix Electrical Works. The directors are Newton H. Jones, George A. Clyde, W. R. Huntington, W. W. Parry and Dr. Thomas G. Nock. The plant will be located in Rome.

Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until 3 o'clock p. m. on March 3d, for the installation of a conduit and electric wiring system for the United States marine hospital at Savannah, Ga., in accordance with the drawings and specification, copies of which may be obtained at the above address, or at the office of the superintendent of construction at Savannah.

Negotiations have been concluded between the St. Louis and Belleville Electric Railway Company and the American Carbon and Battery Company of St. Louis, by which the latter company has purchased the old power plant of the Suburban road on the bluffs just east of East St. Louis, with five acres of ground, on which it will build a $200,000 plant for the manufacture of carbons, insulators and electrical

supplies. The company is now located in St. Louis in somewhat cramped quarters. The plant will employ about 200 men.

The Navy Department has just called attention to the fact that bidders who submit proposals to the Bureau of Supplies and Accounts should be careful to send them in duplicate. Failure to meet this requirement will be regarded as sufficient reason for declaring the bids informal, and bidders will run the risk of the loss of the contract. Attention is also invited to the fact that bidders who find they have made mistakes in their proposals will run the risk of being required to pay a penalty if they do not execute the contract when it is awarded.

Following some changes in the organization of the sales offices of the Allis-Chalmers Company, a district sales office has been opened in St. Louis in the Chemical Building. Mr. H. P. Hill, formerly district manager for the Bullock company, is the manager. A district sales office has been established in Cleveland, in the New England Building. Mr. Franklin Wharton, the manager, was formerly the district manager for the Bullock company. A Bullock office has been opened in the Frick Building in Pittsburg, Pa., and consolidated with the Allis-Chalmers office, under the management of Mr. H. Wrodeman Murray. A new office has been established in Kansas City in the Dwight Building, with Mr. George W. Mattison in charge. An office, with temporary headquarters in the Elliott Square Building, has been opened in Buffalo, under the management of Mr. George W. Pulver.

In order to handle its largely increased business to better advantage, the Holophane Glass Company has consolidated its Chicago and New York offices, and all business will hereafter be taken care of from New York. Mr. R. V. Lansingh, who has had charge of the western office, is now general manager of the company and will have charge of the selling end of the business. Mr. O. A. Mygatt, president of the company, will devote his time to the manufacturing end. Mr. Lansingh's many western friends wish him a full measure of success. The New York offices of the Holophane company are located in the Gladner Building.

## BUSINESS.

Quality, accuracy and reliability are the characteristics claimed by the Appleton Electric Company of Chicago for its electrical supplies, of which it manufactures an extensive line. The various devices

[illegible] pany and are too numerous t[illegible]

[illegible]

Company has closed a contract with the United Rail[illegible] kilowatts. It will be of the flywheel type, with 32 poles, and will run at 94 revolutions per minute. The generator will be wound for 13,000 volts, three-phase, with a frequency of 25 cycles. The 5,000-kilowatt generator now on order is to have the same characteristics and to run in parallel with the five 2,000-kilowatt generators which the company just finished installing in the Pratt Street station in Baltimore. The company has also just sold to the La Belle Iron Works at Steubenville, Ohio, a direct-current engine-type generator, to be rated at 1,000 kilowatts, the [illegible]

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued (United States Patent Office) January 31, 1905.*

780,977. Trolley. George J. Cook, Pittsburg, Pa. Application filed August 3, 1904.

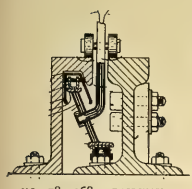
Retaining arms are mounted upon the pin carrying the trolley wheel, the upper edges of the arms being adapted to lie over the wheel.

780,997. Apparatus for Producing Oscillatory Currents. Peter C. Hewitt, New York, N. Y., assignor to the Cooper Hewitt Electric Company, New York, N. Y. Application filed February 9, 1903.

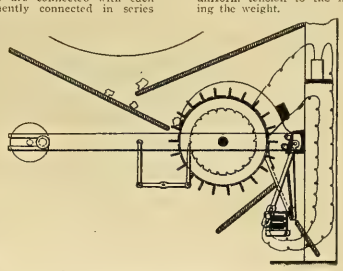
A condenser or its equivalent and a discharge device are connected in shunt upon the source of current. An inductance in the discharge circuit of the condenser, a condenser in shunt upon the inductance, and an emitting circuit, a portion of which is in inductive relation to the inductance are other factors in the invention.

780,998. Apparatus and Circuits for Starting Electric Lamps. Peter C. Hewitt, New York, N. Y., assignor to the Cooper Hewitt Electric Company, New York, N. Y. Application filed April 5, 1900.

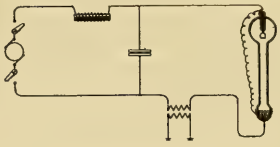
Two coils of a transformer are connected with each other, one coil being permanently connected in series with the translating device and the other in shunt upon the source. Means close and open the circuit of the second coil for inducing a higher potential in the series coil. An electromagnet in series with the translating device and the last-named coil is provided with an armature, the armature being normally included in the circuit of the shunt coil, whereby on the passage of current through the translating device the circuit of the shunt coil will be opened and will remain open during the operation of the device.



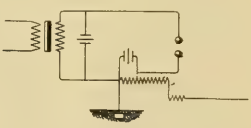
NO. 781,268.—RAILWAY CONDUIT SYSTEM.



NO. 781,437.—APPARATUS FOR SEPARATING COKE FROM CINDERS.



NO. 781,603.—MERCURY-VAPOR TRANSFORMER.



NO. 781,606.—OSCILLATOR FOR SPACE TELEGRAPH.

780,999. Method of Transforming Electrical Energy. Peter C. Hewitt, New York, N. Y., assignor to the Cooper Hewitt Electric Company, New York N. Y. Application filed April 25, 1902.

The method of producing a periodic flow of electric current through a medium consists in first applying to the terminals of the medium a potential of a high value, thereby starting the flow of current, opposing to the flow a predetermined resistance so low as to render the energy loss practically negligible, thereby causing a sudden drop of potential below the lower value and interrupting the flow of current, and successively repeating this operation.

781,000. Apparatus for Transforming Electrical Energy. Peter C. Hewitt, New York, N. Y., assignor to the Cooper Hewitt Electric Company, New York, N. Y. Application filed April 25, 1902.

A condenser is connected with the source and means retard the charge of the condenser. A discharging circuit comprises a composite resistance, one element being of relatively low value and the other of relatively high value, the relations being such that the high-value portion will be broken down by each successive condenser discharge, and the remaining portion of the resistance will act practically as the sole resistance to the passing current.

781,001 and 781,002. Means for Amplifying Electrical Variations. Peter C. Hewitt, New York, N. Y., assignor to the Cooper Hewitt Electric Company, New York, N. Y. Application filed May 16, 1902.

These two patents apply to apparatus embodying a method of amplifying energy variations caused in an electric circuit including an inclosed conducting gas or vapor and electrodes. The method consists in affecting the conducting gas or vapor by variations of current, and thereby transforming such variations into corresponding amplified variations of current.

781,008. Electric Motor. Michel Koener, Chicago, Ill. Application filed May 18, 1904.

A motor is described which has a vertical shaft and a cylindrical casing of non-magnetic metal receiving the motor. The casing is open at its upper end and adapted to be closed by a cover. A step-bearing carried by the casing receives the vertical shaft.

781,016. Incandescent Lamp. Almon D. Page, Newark, N. J., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 18, 1904.

Combined with a tube or container is a filament supported at one end from the tube, a weight attached to the opposite end of the filament and serving to apply a uniform tension to the filament, and a guide surrounding the weight.

781,025. Process of Insulating Coils. George H. Rupley, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 13, 1903.

The process of insulating a coil of edge-wound conductor ribbon consists in opening the coil so that adjacent turns do not touch, immersing one side of the coil in insulating material several times to different depths, hardening the film after each immersion, and immersing the other side of the coil and hardening the film in a similar manner.

781,035. Commutation of Electric Currents. Elihu Thomson, Swampscott, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 17, 1903.

Connected to the commutator are a condenser, a circuit terminal and means for connecting a number of the conductors to the terminal and inserting a condenser between the conductors so connected.

781,048. Signal-recording Mechanism. Arthur E. Colgate, New York, N. Y., assignor to the Signal and Control Company, Brooklyn, N. Y. Application filed November 9, 1896.

Combined with a steam whistle is a blast recorder, the time stamp of which is operated by an electromagnet; another electromagnet controls the pressure to the whistle.

781,062. Electrical Tool. David J. Hauss and Casper W. Miles, Cincinnati, Ohio, assignors to the Cincinnati Electrical Tool Company, Cincinnati, Ohio. Application filed April 24, 1903.

A portable drill driven by a motor is described.

781,072. Self-winding Electric Clock. Robert L. Hight, Decatur, Ill. Application filed January 7, 1904.

Electromagnets form the means by which the clock is wound, step by step, as the circuit is made and broken by the escapement wheel.

781,074. Carrier-stopping Mechanism for Telephone Apparatus. Charles M. Johnson, Chester, Ill. Application filed April 27, 1904.

An electric circuit is [illegible] closed by the carrier on its travel. M[illegible] by the electric circuit stop the [illegible] of a magnetic field.

781,077. Electromagnetic Ore Separator. Erich Langguth, Euskirchen, Germany. Application filed February 1, 1904.

An armature rotating between the pole pieces [illegible] a shield of magnetic material mounted directly upon it and rotating with it. Other means feed the material to be separated to the armature and collect the separated material.

781,131. Time Indicator. Jesse Childs, Hites, Pa. Application filed February 18, 1904.

An apparatus for reminding a patient when and what medicine to take is described. The medicines are arranged in a casing with incandescent lamps to indicate each. An alarm circuit connected to a clock rings a bell and lights the proper light when a certain medicine is to be taken.

781,154. Method of Controlling the Running of Reciprocating Engines or Turbines Driving Alternators in Parallel. Charles A. Parsons, Newcastle-upon-Tyne, and James Swinburne, London, England, said Swinburne assignor to said Parsons. Application filed March 30, 1903.

Several alternators are driven in two sets, steam tur[illegible] bines driving one set and reciprocating engines driving the other set. Means are provided for admitting to each of the turbines puffs simultaneous with the maximum turning moments of the reciprocating engines. Governing means independent of the means employed for securing such simultaneity are also supplied.

781,161. Railway Signaling System. William G. Roome, Jersey City, N. J., assignor to the Union Switch and Signal Company, Swissvale, Pa. Original application filed March 3, 1902. Divided and this application filed November 17, 1903.

In a signaling system are combined a series of insulated track sections, a signal for each section and a relay provided at each end of each section, the relays being adapted when a train is in a section to break the circuit of a track relay in the rear and to close a circuit for the signal of the track section in advance.

781,194. Automatic Code Ringer for Magneto Signal Bells. Larkin V. Elliott, Indianapolis, Ind. Application filed February 20, 1904.

In an automatic code ringer for magneto signal bells, a rotatable drum is provided with a series of parallel circumferentially disposed concave channels. Circuit-breakers are embedded in the periphery of the drum and lie within the concave channels, a bar being mounted adjacent and parallel to the drum. A needle slidably mounted on the bar is supplied, means on the needle operating to hold it in contact with the drum. Other means in the surface of the drum engage the needle and operate as a barrier for limiting the rotation of the drum.

781,207. Telephone Relay. William W. Jacques, Boston, Mass. Application filed November 3, 1904.

A compound telephone relay consists of a magnifying relay and a correcting relay, the magnifying relay consisting of a receiving telephone in circuit with one section of the line and a microphone adjusted to light normal pressure. The correcting relay consists of a receiving telephone in circuit electrically with the microphone of the magnifying relay and a microphone ad-

justed to heavy normal pressure and having its circuit connected electrically to the other section of the line.

781,225. Rent-collecting Means for Telephone Service. Joseph L. Peavey, Meridian, Miss. Application filed January 15, 1904.

A switch in the service line is located at the subscriber's station and normally held to its circuit-closing position. An electromagnet-controlled means shifts the switch to an open position, the switch including a supplemental contact maker for closing in the service line. Manually operated devices at the subscriber's station actuate the supplemental contact maker to move it to a circuit-closing position.

781,237. Telephone System. Charles B. Smith, New York N. Y. Application filed February 23, 1901. Renewed October 22, 1902.

A series of calling instruments are normally in circuit with the telephone lines and two series of calling instruments are normally out of circuit. Means are supplied for cutting out of circuit the first series of instruments and simultaneously cutting in circuit either of the second series of instruments. Ringing keys are adapted to cause current of different signs to pass from the generator over the telephone lines.

781,268. Underground or Conduit System for Electric Railways. William Cope, Birmingham, England. Application filed May 24, 1904.

In conduit for electric tramways is a T-rail provided with the usual bolts for holding it in position, the ends of the bolts being wedge shaped. A U-shaped electric conductor is arranged over and on the bolts and insulating material is placed between the conductor and the bolts. (See cut on preceding page.)

781,287. Electrical Stop Motion. Ulysses G. Lee, Madison, Ohio, assignor to the George D. Whitcomb Company. Application filed February 28, 1902.

Controlling an electric circuit is a thread-controlled circuit controller. A bracket carries an oscillatable spindle. A thread guide is fixed to the spindle and guides the thread across the path of the circuit controller. A spring is coiled about the spindle and has its ends anchored to the bracket and the guide, a knot detector being located between the source of yarn supply and the guide.

781,288, 781,289 and 781,290. Thermoelectric Element. Albert L. Marsh, Lake Bluff, Ill., assignor to William A. Spinks & Co., Chicago, Ill. Application filed October 18, 1904.

These three patents refer to a thermo-electric couple one element of which may consist of an alloy of chromium and another metal, an alloy of molybdenum and another metal or an alloy of tungsten and another metal. The other metal is preferably nickel.

781,299. Switch System for Electric Vehicles. Ferdinand Porsche and Ludwig Lohner, Vienna, Austria-Hungary. Application filed August 5, 1902.

An open electric circuit comprising dynamo elements and a motor contains a variable resistance and a common means for making the circuit and for switching the resistance parallel with the dynamo field and varying the latter during the maintenance of the circuit.

781,316. Guard and Finder for Trolley Poles. William P. Underhill, Brooklyn, N. Y. Application filed May 21, 1904.

Guard plates are loosely mounted on each side of the trolley wheel and recessed finders extend transversely of the guard plates, the latter received in the recesses formed in the finders.

781,319, 781,320 and 781,321. Signal System. Claude White, St. Louis, Mo., assignor of one-half to Charles T. Noland, St. Louis, Mo. Application filed February 2, 1904.

In the three systems are series of posts arranged along a railway between stations. An electric wire strung on the posts between two stations has a light at each end. Lights on the posts are connected to the wire and grounded. A generator is situated at each station so that the lights may be illuminated from either end.

781,322. Signal System. Claude White, St. Louis, Mo., assignor of one-half to Charles T. Noland, St. Louis, Mo. Application filed August 27, 1904.

Each station of a system is paired with each adjacent station. Three series of lights of contrasting colors are arranged between the stations. A live wire connects the stations and switches are arranged so that either series of lights may be illuminated from either end or at any desired point between the stations.

781,339. Electric Time Switch. Jacob Helmstadter, Jr., McKeesport, Pa. Application filed December 11, 1903.

An alarm winding shaft in an alarm clock carries an arm. A spring piece extends over the switch in its raised position, and a lever is connected to the spring piece and engages with the arm. The lever has an angular portion for holding the spring piece in its raised position and for releasing it to automatically drop the switch at a predetermined time in making an electric circuit.

781,340. Transformer Cut-out. John P. Hetherington and Lewis E. Grubbs, Logansport, Ind.; said Grubbs assignor to said Hetherington. Application filed December 28, 1903.

The transformer embodies a motor, an electromagnet and armature, primary coils, a resistance for each of the primary wires, switches operatively connected with the motor, a secondary wire connected with the motor and connections between the transformer and magnet.

781,347. Safety Fuse for Electric Circuits. Christian Krämer, New Isenburg, Germany, assignor to the Society of Elektrizitats-Aktien-Gesellschaft vorm. W. Lahmeyer & Co., Frankfort-on-the-Main, Germany. Application filed January 5, 1904.

Combined with an insulating bath is a container forming an electrode, the container opening beneath the surface of the bath but being otherwise closed. An insulating lining for the container is provided and also a contact piece engaging with the interior of the container. A fuse is mounted within the container and is connected to the contact piece.

781,351. Electric Lamp Socket. Mortimer Norden, New York, N. Y., assignor to Joseph Norden, New York, N. Y. Application filed March 9, 1904.

Details are described.

781,353. Conduit for Electric Wires. Stephen Palmer, Troy, N. Y., assignor to Marcus M. Waterman, James K. P. Pine, James J. Child, Herbert E. Northrup and George W. Daw, Troy, N. Y. Application filed November 17, 1903.

Conduit for electric wires comprises an inner tube of woven fireproofed fabric having an inner coating of refractory material, an open braiding inclosing the fabric tube, waterproof adhesive material inclosing the open braiding and entering the interstices, a closely woven braided fabric inclosing the adhesive material, and a coating of adhesive material inclosing the closely woven braided fabric.

781,359. Trolley. Leonard O. Pullen, Augusta, Me., assignor of one-half to Thomas J. Lynch, Augusta, Me. Application filed March 26, 1904.

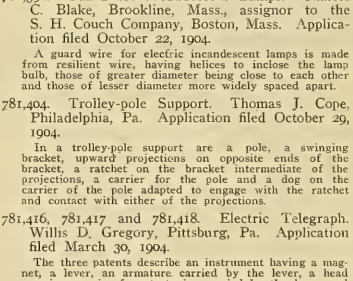
A trolley stand has a segmental ratchet and a pole socket pivotally mounted. A pawl is slidably mounted in the socket and has a reduced portion. The pole is secured in the socket.

781,366. Safety Appliance for Elevators. August A. Roth, Baltimore, Md. Application filed August 20, 1904.

Means are supplied on the car for ordinarily operating the motor mechanism to start and stop the car. An emergency device independent of the motor operates only in cases of emergency to render the motor inoperative. Other means coact between the emergency device and the operating means on the car so that the premature operation of the latter will cause the emergency device to be operated.

781,385. Sanitary Attachment for Telephone Transmitters. Simon E. Williams, Boston, Mass. Application filed May 9, 1904.

An attachment for telephone transmitters consists of an annular supporting member which projects inward across the face of the transmitter. An antiseptic cone-shaped member closed at the inner end projects into the transmitter and is supported by the inwardly projecting edge of the annular supporting member.



NO. 781,434.—AUTOMATIC SIZING MECHANISM FOR GRINDERS.

781,391. Guard for Incandescent Lamps. Charles C. Blake, Brookline, Mass., assignor to the S. H. Couch Company, Boston, Mass. Application filed October 22, 1904.

A guard wire for electric incandescent lamps is made from resilient wire, having helices to inclose the lamp bulb, those of greater diameter being close to each other and those of lesser diameter more widely spaced apart.

781,404. Trolley-pole Support. Thomas J. Cope, Philadelphia, Pa. Application filed October 29, 1904.

In a trolley-pole support are a pole, a swinging bracket, upward projections on opposite ends of the bracket, a ratchet on the bracket intermediate of the projections, a carrier for the pole and a dog on the carrier of the pole adapted to engage with the ratchet and contact with either of the projections.

781,416, 781,417 and 781,418. Electric Telegraph. Willis D. Gregory, Pittsburg, Pa. Application filed March 30, 1904.

The three patents describe an instrument having a magnet, a lever, an armature carried by the lever, a head carrying a pair of contact pins carried by the lever and movable independent of the armature and a pair of contact pins or points arranged opposite the pins on the head.

781,431. Electric-railway System. Frank E. Kinsman, Plainfield N. J. Application filed December 8, 1903.

One of the track rails is divided into insulated sections electrically isolated from the remainder of the system. A return conductor is electrically connected with the other track rail and forms therewith and with the working conductor and the source of energy a metallic circuit.

781,434. Automatic Sizing Mechanism for Grinding Machines. Abraham B. Landis, Waynesboro, Pa. Application filed March 30, 1904.

An automatic sizing mechanism for grinding machines comprises a feed wheel having ratchet teeth in its periphery. A rim is mounted on the wheel having a pawl lever adapted to engage with the teeth. A cam or trip mounted in the periphery of the rim engages the operating device and throws it out of operation. An electrically operated plunger is arranged to engage the pawl lever and operate it to turn back the rim and cam out of engagement with the operating device until the work has reached a predetermined size. (See cut.)

781,437. Electrical Apparatus for Separating Coke from Cinders, Etc. Henri Lelarge, Liege, Belgium. Application filed April 13, 1904.

Apparatus for separating coke from cinders and other substances comprises a rotary drum provided upon its surface with channels or receptacles for receiving the material to be separated. Electrical conductors contiguous to the channels or receptacles are connected to electromagnets. A stationary chute delivers material from the drum and a gravity-positioned chute is pivoted in proximity to the stationary chute for deflecting coke and other conductors of electricity from the latter. (See cut on preceding page.)

781,444. Automatic Alarm for Grain Bins. Hans L. Moebeck, Ulen, Minn., assignor of one-half to N. O. Henricks, Fargo, N. D. Application filed March 10, 1904.

When the bin is filled to a certain point a lever is pushed over by the grain which in turn closes an electric bell circuit.

781,448. Electromagnetic Apparatus. John McIntyre, Jersey City, N. J. Application filed October 29, 1904.

A frequency source of electrical energy has a primary circuit connected with it. A secondary circuit induced by the primary circuit is provided conducting cables arranged in coils for surrounding a person or object for the purpose of generating around the person a field of force, used principally as a therapeutic agent.

781,451. Suspension Device for Street Lamps. August Niemeyer, Berlin, Germany, assignor to Deutsche Waffen und Munitions-Fabriken, Berlin, Germany. Application filed April 5, 1904.

Mechanical features are described.

781,603. Apparatus for Transforming Electrical Energy. Peter C. Hewitt, New York, N. Y., assignor to the Cooper Hewitt Electric Company, New York, N. Y. Original application filed April 25, 1902. Divided and this application filed September 24, 1902.

Means are employed for periodically applying to the terminals of a mercury-vapor lamp differences of potential varying from the higher potential to a value less than the lesser potential. (See cut on preceding page.)

781,605. Method of Producing Light. Peter C. Hewitt, New York, N. Y., assignor to the Cooper Hewitt Electric Company, New York, N. Y. Original application filed April 25, 1902. Divided and this application filed July 1, 1904.

Energy from a source of electric potential of a given value is applied to the terminals of a gas or vapor path in successive electrical impulses varying in potential from a value above the normal resisting power of the vapor path to a potential insufficient to cause a continuance of the flow of current therethrough for the purpose of producing light.

781,606. Method of Producing Oscillatory Currents. Peter C. Hewitt, New York N. Y., assignor to the Cooper Hewitt Electric Company, New York, N. Y. Original application filed February 9, 1903. Divided and this application filed July 28, 1904.

The method of producing oscillatory effects in an emitting circuit of a wireless-telegraph system consists in generating electric currents, producing primary oscillations therefrom in an oscillatory circuit including a discharge device and reinforcing the oscillations by subsidiary intervening synchronous oscillations independently of the discharge device. (See cut on preceding page.)

781,622. Electric Motor. Barney Samuels, Leavenworth, Kan., assignor of one-half to David Samuels, Leavenworth, Kan. Application filed May 31, 1904.

A motor is made up of an electromagnet, poles secured to the opposite ends of the magnet terminating at their inner ends in obtuse angles, and an armature pivotally mounted between the poles.

781,625. Method of Protecting Telephone Circuits from the Action of Electromagnetic Waves. John S. Stone, Cambridge, Mass. Application filed June 29, 1904.

Protecting telephone circuits against the effects of the electromagnetic waves developed by wireless-telegraph and telephone systems is accomplished by diverting the currents induced in the telephone circuit by the electromagnetic waves to earth through a circuit or circuits of impedance low for the induced currents, but high for currents of the frequencies employed in telephony.

## EXPIRING PATENTS.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on February 7, 1905:

377,374. Telegraphy. T. A. Edison, Menlo Park, N. J.
377,383. Electromagnetic Grain-weighing Scale. W. A. Holley and U. Malin, Holland, Mich.
377,397. Electric Railway. W. I. Ludlow, Cleveland, Ohio.
377,414. Electrical Apparatus for Effecting Mechanical Movements. R. T. Smith, Nashua, N. H.
377,441. Transfer Switch and Circuit for Telephone Exchanges. C. E. Scribner, Chicago, Ill.
377,473. Telephone Transmitter. J. E. Bahr, Jersey City, N. J.
377,487. Process of Electrolyzing Copper. E. S. Hayden, Waterbury, Conn.
377,488. System of Electrical Distribution. J. W. Howell, New Brunswick, N. J.
377,505. Electric Gas-lighting Burner. LeRoy S. White, Waterbury, Conn.
377,518. Magnetic Separator. T. A. Edison, Llewellyn Park, N. J.
377,538. Electric Circuit Closer. W. F. Stocker, Eureka, Kan.
377,539. Electric Bell. W. F. Stocker, Eureka, Kan.
377,553. Electric Gas Lighter. J. Finck, San Francisco, Cal.
377,634. Telephone Transmitter. H. V. Hayes, Cambridge, Mass.
377,615. Electric Arc Lamp. E. E. Higgins and J. James, St. Johnsbury, Vt.
377,622. Electric Motor Car. W. H. Knight, New York, N. Y.
377,626. Electromechanical Signal Apparatus. W. W. La Grande, Louisville, Ky.
377,634. Railway Signal. T. S. Nicholson, Mount Washington, Ohio.
377,642. Secondary Battery. J. S. Sellon, Hatton Gardens, County of Middlesex, England.
377,683. Armature for Dynamo-electric Machines. R. H. Mather, Windsor, Conn.
377,684. Electromechanical Movement. R. H. Mather, Windsor, Conn.

# WESTERN ELECTRICIAN

**EVERY SATURDAY**

Vol. XXXVI. CHICAGO, FEBRUARY 18, 1905 No. 7

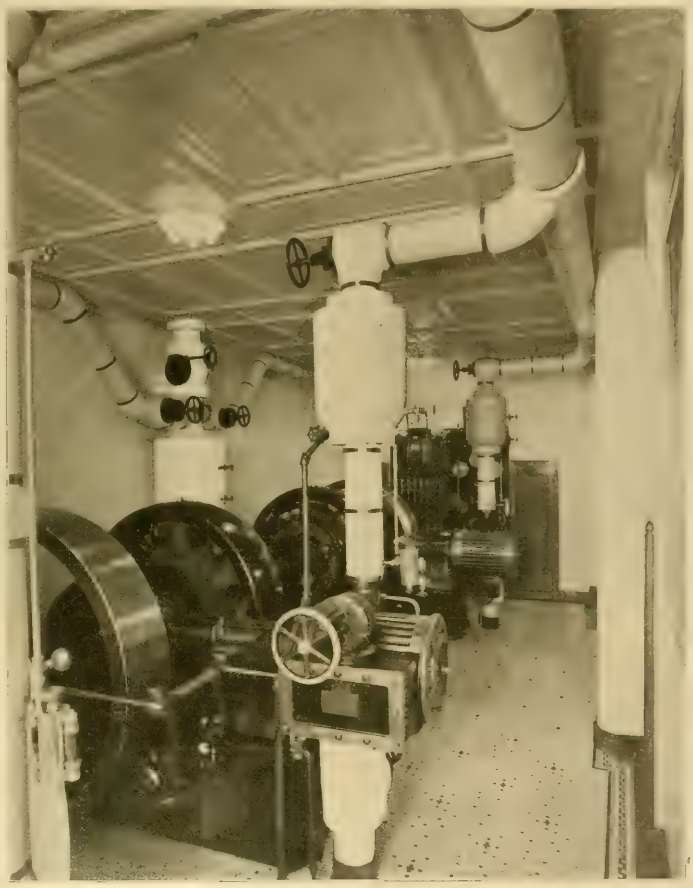
## Pleasing Department-store Plant In Worcester, Mass.

An interesting electric plant has recently been installed at the Barnard, Sumner & Putnam Company's department store in Worcester, Mass., located on Main Street just south of Mechanics' Hall. The plant supplies all the current for operating motors and lights throughout the building and also furnishes a supply of exhaust steam for heating purposes in cold weather. It is installed in the basement of the store just a few steps from the artistic tea room maintained by the company and in itself constitutes a working exhibit of attractiveness. The engine room is finished handsomely with light-colored walls, a white steel panel ceiling and a floor laid with different-colored tiles designed to neutralize the appearance of oil drops in case any are thrown from the machinery. The accompanying picture shows the interior of the generator room and illustrates admirably the neat and attractive appearance of the plant.

The load upon the plant at present connected to the bus bars consists of five motors, aggregating 23 horsepower, 87 enclosed arc lamps and 800 16-candle-power incandescents. The distribution system is direct-current, two-wire, 115 volts throughout, the circuits being run in iron-armored conduits. The arc lamps are of the five-ampere size, 72 of them being Helios-Upton and 15 General Electric make.

Although but a small number of motors is installed in the store at present, their use illustrates the great variety of purposes to which the electric motor can be adapted in department-store service. All but one of the motors are shunt-wound and each one is wound for 115 volts. The largest motor is a 15-horsepower Sprague machine of the semi-enclosed type, running 1,000 revolutions per minute, compound-wound and belted to a triplex single-acting plunger pump for elevator service. The Lamson pneumatic cash system in the store is operated by a three-horsepower semi-enclosed Sprague belted motor, making 1,480 revolutions per minute. There is also a Lamson cord cash system installed, this being run by a 511-revolution-per-minute, direct-connected, two-horsepower Lundell open-type motor. In the main vestibule of the store is a customer's standing space and passageway, which is supplied with warm air from the store by a blower direct connected to a one-horsepower Lundell motor. This motor has eight speeds, ranging from 50 to about 600 revolutions per minute, so that the volume of warm air admitted to the vestibule inside the storm doors can be regulated at will. On the upper floor of the store is a shop in which various sewing machines, lathes, grinders, etc., are driven by a two-horsepower belted Sprague motor making 1,140 revolutions per minute. Besides there are two one-sixteenth-horsepower motors in use in the hair-picking room, and in the summer season fan motors can of course be connected to the system as occasion serves.

The boilers and steam auxiliary apparatus of the plant are those previously in use in the building. There are two 54-inch by 17-foot Stewart horizontal return-tubular boilers capable of operating continuously at 125 pounds pressure, although the present working pressure is 110 pounds. Soft coal is used, the present consumption being about 6,000 pounds per day. All the coal burned is weighed in the boiler room and a storage bin is built beneath the street floor adjoining the boiler room. The feed water is heated by a Warren heater of the open type and pumped into the boilers by a four by four by six-inch Warren duplex pump.



PLEASING DEPARTMENT-STORE PLANT AT WORCESTER, MASS.

The generating units are two in number, each being composed of a 14 by 12-inch horizontal high-speed non-condensing American Ball engine direct coupled to a six-pole, 75-kilowatt, 115-volt, compound-wound Sprague direct-current generator making 275 revolutions per minute. The guaranteed steam consumption of each engine is a maximum of 29 pounds per indicated horsepower-hour at full load. The exhaust steam is discharged in cold weather into the heating system and in warm weather through an atmospheric exhaust in accordance with standard practice.

The store is heated mainly by air which is forced over three banks of heating coils, aggregating over a mile of three-quarter-inch pipe. Two banks take the fan, forcing the air through the system. This fan engine is a seven by 10-inch Sturtevant ma-

pipes of the engines being five inches in diameter

inches in diameter and they are carried under the floor to a point midway between the two engines, where they join in a nine-inch pipe which rises vertically from the floor along the south wall and terminates in a Cochrane oil separator. Into this separator are tapped the pipes to the heating system and the exhaust pipe. Cochrane steam separators are used in connection with the high-pressure engines.

The switchboard, composed of two panels of black enameled slate, is set into the wall at the west end of the engine room. Each panel is eight feet high and three feet wide. One carries a Thomson recording wattmeter of 1,200 amperes capacity and 12 double-pole single-throw switches, with enclosed fuses for the feeder circuits. The other panel carries two triple-pole generator switches, two 1,000-ampere Weston ammeters, a 150-volt voltmeter, two rheostats and a voltmeter switch with ground-testing lamps.

The present daily output of the plant is about 600 kilowatt-hours ordinarily and 840 kilowatt-hours on Saturdays. The store building is six stories in height and has an area in floors of 85,000 square feet. The approximate height of each story from floor to ceiling is 12 feet six inches. The coal-storage capacity of the plant is 25 tons. The engine room is 47 feet long, 14 feet wide and 15 feet high, and figures 4.3 square feet per kilowatt, or 65.8 cubic feet per kilowatt of generating capacity. Mr. S. J. Blatchford is chief engineer, with Mr. F. Alberty assistant.

## Electrical Section of the Western Society of Engineers.

A well-attended and profitable meeting of the Electrical Section of the Western Society of Engineers was held on February 10th. There was no business to come before the meeting, and the whole of the time was devoted to the paper of Prof. Charles F. Burgess of the University of Wisconsin upon the "Present Status of Electric-furnace Working." Professor Burgess, without going into detail, gave an excellent idea of the progress which electric-furnace working has made, its advantages and its efficiency as compared with direct reduction processes. Much original work along this line, and in the general field of electrochemistry, has been done at the University of Wisconsin under the direction of Professor Burgess, and in recognition of this work he was recently presented $2,500 by Andrew

Carnegie, the money to be used for further research work. (An abstract of the paper is on page 134.)

The next meeting of the Electrical Section is scheduled for March 10th, when Mr. W. T. Banalek, formerly state inspector of electrical wiring for Michigan, will present a paper on the "Relation of Electrical Wiring to Fire Risik."

## Indianapolis and Cincinnati Traction Company's Single-phase Railway.

An electric railway 120 miles in length operated from a single power house would have been regarded a short time ago as impracticable by even the most progressive engineers, and would have been said to be commercially impossible without the use of rotary converter sub-stations. Nevertheless, the opening of the year 1905 finds the construction of such a line well advanced and a portion of the road in actual operation.

This epoch-making engineering achievement is accomplished by the use of the alternating-current single-phase railway motor recently perfected by the Westinghouse Electric and Manufacturing Company. The first to adopt and put in operation this system is the Indianapolis and Cincinnati Traction Company of Indianapolis, Ind., of which Mr. Charles L. Henry is president and general manager.

Starting from Indianapolis, the road will pass through the towns of Irvington, Julietta, New Palestine, Reedville, Fountaintown, Morristown, Gwynnville, Arlington, Rushville, Glenwood, Connorsville, Dunlapsville, Oxford, Hamilton and Cincinnati. It has already been constructed as far as Rushville, Ind., and, in the course of the present year, will be extended to Connorsville. It is the intention of the company to push through to Cincinnati at the earliest possible date. At the present time about 20 miles of road are in operation, and the new system has been shown to be a complete success and thoroughly to justify the wisdom of President Henry and his consulting engineers, Sargent & Lundy of Chicago, in adopting the alternating current for this important operation.

The central station from which this railway will be operated is located at Rushville, Ind., adjacent to the tracks of the Cincinnati, Hamilton and Dayton railroad and distant about 41 miles from Indianapolis. The building is a fireproof structure of brick, concrete and steel, with well-lighted interior and skilfully arranged for future enlargement as the operations of the company are extended. The present equipment includes three 350-horsepower Babcock & Wilcox boilers, which are at present fired by natural gas. Provision is made, however, for the burning of coal if, at any time, the supply of gas becomes insufficient, and arrangements have been made for the future installation of coal-crushing and automatic coal-handling machinery, with overhead bumpers which will feed directly to the boiler grates. The boiler room occupies one-half of the present building. The remainder is divided into two parts, the larger room being known as the main engine room while the eastern portion of the building is set apart as a high-tension chamber.

The generating equipment consists of two 500-kilowatt, 2,300-volt Westinghouse alternators of the revolving-field type, wound for three-phase, 25-cycle current, and direct connected to cross-compound Fulton Iron Works Corliss engines. The operating speed is 94 revolutions per minute. The engines are of the double-cylinder vertical type. Both engines and generators are designed for an overload capacity of 50 per cent. Each engine is equipped with a Dean independent jet condenser. Water for condensing purposes is supplied by a large millrace through an underground tunnel running under the basement floor.

The 2,300-volt, three-phase, 25-cycle current from the generators is led direct to two pairs of 250-kilowatt, air-blast transformers which are connected according to the Scott three-phase two-phase system. The secondary windings are arranged for two-phase operation at 33,000 volts, at which potential the current is delivered to the transmission lines. A pair of motor-driven Sturtevant fans provide the air necessary to ventilate these transformers.

The generators are separately excited by direct current at 125 volts. Duplicate exciter generators have been installed, one of which is direct connected to a Westinghouse engine, the other to a Westinghouse induction motor.

The switchboard controlling panels are located in the main engine room, but the switches, transformers and other similar apparatus have been installed either in the basement or in the high-tension chamber. The main bus bars are located in the basement and are supported upon a masonry structure of most approved design and construction. Live bars are separated by barriers of alberine stone.

A pair of 300-kilowatt transformers of the Westinghouse oil-insulated self-cooling type located in the power house reduces the 33,000-volt current from the main transformers to a potential of 550 volts, and feeds that portion of the trolley line which is located within the limits of the city of Rushville. Other portions of the trolley are fed at a potential of 3,300 volts, obtained from the 33,000-volt transmission lines through reducing transformers which are installed in transformer stations conveniently located along the roadway at intervals of from 10 to 12 miles. At the present time three of these transformer stations have been constructed, one located near Indianapolis, another at Reedville and a third at Gwynnville. The houses are very small and compact, measuring but 21 by 23 feet, but their construction is thoroughly substantial and is fireproof throughout. The walls are of brick laid in cement mortar and mounted upon foundations of concrete; the floors are of concrete laid upon steel beams. The doors and windows are protected by steel shutters. The equipment of each of the transformer stations so far installed consists of two 300-kilowatt oil-insulated step-down transformers of the Westinghouse self-cooling type, 33,000 to 3,300 volts, together with disconnecting switches and suitable lightning-protecting apparatus, including low-equivalent lightning arresters and static interrupters. Provision has been made in each station for a third similar unit when required. The transformer stations contain no automatic switches of any type but are controlled altogether from the main central station. They, therefore, require no attendance and need be inspected only occasionally when in operation.

As has been stated, the main section of the trolley will be fed at a potential of 3,300 volts, while in the city of Rushville 550 volts alternating current will be used. As, however, within the city of Indianapolis the cars must operate over the already existing lines, which are equipped with direct current at 550 volts, provision had to be made for operation with both direct and alternating current and at a trolley potential of both 550 and 3,300 volts. The system, therefore, serves to exemplify the adaptability of the new type of motor for operation upon both direct and alternating-current circuits and to illustrate the flexibility of the system in regard to voltage.

The diagram (Fig. 1) indicates the general arrangement of the alternating-current transmission circuits and the connection of apparatus in the power house and the transformer stations. It will be noted that a two-phase four-wire circuit is shown in this diagram, in addition to the single-phase circuits which connect the power house with the transformer stations. This power circuit illustrates an arrangement whereby it is proposed in the future to operate the electric railway now running between Indianapolis and Shelbyville from the Rushville station. The Indianapolis and Shelbyville line is owned by the Indianapolis and Cincinnati Traction Company and is at present operated from its own power house through rotary converter sub-stations and direct-current railway motors.

At the present time the Indianapolis and Cincinnati Traction Company is giving an hourly service between Rushville and the neighboring towns toward Indianapolis, and the work is being completed rapidly with a view to running through cars into the larger city. They have at present 10 cars which were built by the St. Louis Car Company, each of which measures 55 feet over all. The cars are divided into three compartments; one arranged to carry baggage, the center compartment being fixed up as a smoker, while the main compartment at the other end has a seating capacity for 38 people. The cars are handsomely finished in fine mahogany with plate-glass windows and art glass in the ventilators. The trucks are of the M. C. B. type, made by the Baldwin Locomotive Works, and are mounted upon steel-tired wheels 36 inches in diameter and provided with six-inch axles and five by nine-inch journals.

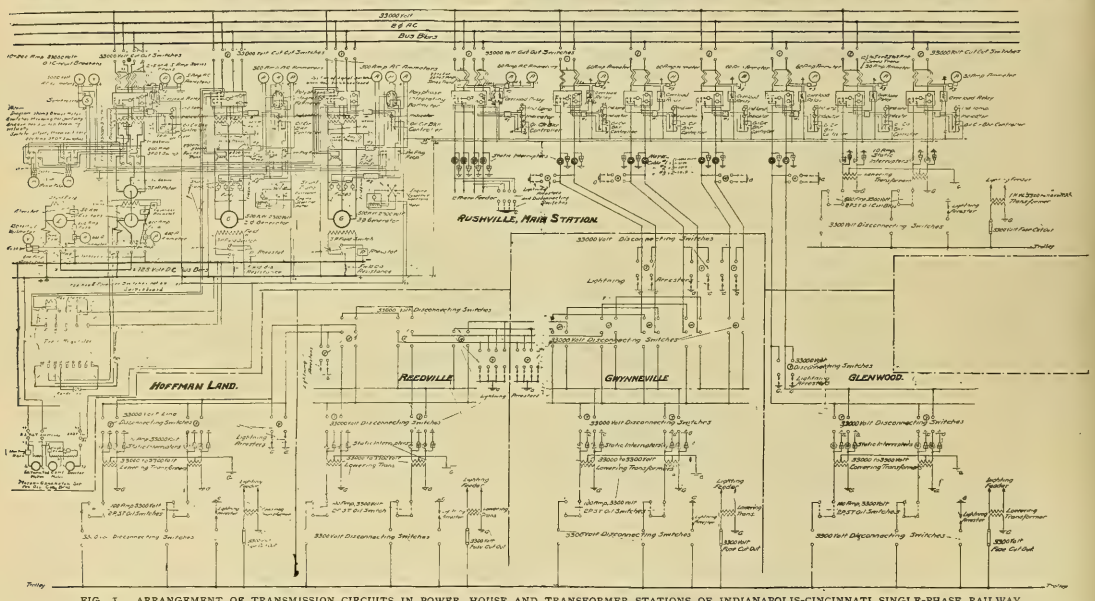



FIG. 1. ARRANGEMENT OF TRANSMISSION CIRCUITS IN POWER HOUSE AND TRANSFORMER STATIONS OF INDIANAPOLIS-CINCINNATI SINGLE-PHASE RAILWAY.

The electrical equipment consists of four 75-horse-power single-phase alternating-current motors of the commutator, series wound type, mounted two to the truck. The equipment includes the unit-switch system of multiple control, so that the cars may be operated either singly or in trains.

In view of the fact that these cars are to be operated by both direct and alternating current, the rheostatic system of control was adopted. The motors are geared for a maximum speed of 45 miles an hour and are arranged for a schedule speed of 30 miles an hour, which has been adopted for local service. Stops will be made at all of the cities and towns and at the principal crossings of the country. To properly take care of the through service, additional "limited" cars will be run at an early date. These limited cars will be equipped with four 150-horse-power motors and will be arranged for a schedule speed of from 50 to 60 miles an hour, as, under the provisions of the various franchises under which the company operates, they will not have to make stops in the country or in the smaller towns and will be required to make only one stop at each of the larger intervening cities. It is expected that when the road is completed from Indianapolis to Cincinnati these limited cars will be able to make the through trip from the center of one city to the center of the other in three hours time.

The road has been built with a view to handling heavy freight even to the extent of carrying it in long trains, and it is confidently expected that the use of a high voltage on the trolley wire and the sliding contact bow trolley will make such a service possible without experiencing the difficulties which have heretofore been encountered when a heavy

Fig. 2. Bridge over Blue River near Morristown.

Fig. 3. Track Construction—Laying Rails.

INDIANAPOLIS-CINCINNATI SINGLE-PHASE RAILWAY.

freight service has been attempted with direct-current operation.

Each car is equipped with two trolleys—one of the bow type designed for high-potential service, the other a modified form of the union standard trolley, intended for use on the direct-current line in Indianapolis and the low-voltage alternating-current line in Rushville.

The roadway is said to be equal to that of any line in the country. The track is graded in accordance with the best practice for steam roads, cuts and fills having been made wherever necessary to avoid excessive or frequent grades. For a distance of nearly 50 miles from Indianapolis there is no grade in the line to exceed 1½ per cent., and, while from that point on toward Cincinnati the country is less level and in some cases straight lines have been preferred, even at the expense of slightly increased grade, it is confidently expected that, with the true alignment secured and the low grades encountered, greater speed can be maintained with comfort and safety to passengers than on any steam road now operating in that vicinity. So far as has been yet determined, the heaviest grade will be four per cent.

The road-bed is graded 28 feet wide on top for a double track, with slopes on fills and in cuts of 1½ to one, and upon a grade line that puts the track in most instances above the level of adjacent lands, so as to avoid trouble on account of snow. In the construction of the roadway, bridges, etc., provision has been made in every case for double track, though but one track has been laid at the present time. The bridges across all streams are constructed in the most approved manner, either with concrete steel arches or with steel girders and stone abutments, as shown in Fig. 2, which depicts a bridge over the Blue River near Morristown. The upper structures have been built [illegible] struction by the [illegible] Bridge [illegible] Muncie, Ind., and are made [illegible] carry trains of car [illegible] tons per car. Though all abutments [illegible] for double track, the superstructures at the present time are arranged for one track only. It will be noted that provision has been made for the heaviest demand in respect to size of cars and length of trains likely to be experienced in the near future.

Wherever possible, the track has been laid upon the company's own private right-of-way. Where the land is level and there are no considerable fills or cuts, a right-of-way four rods wide has been secured, but, wherever peculiarities of construction made it desirable, a wider right-of-way has been obtained. In all of the smaller towns the private right-of-way has been continued through, and the road has been constructed upon streets or highways only in cities of such size as to make it necessary. Wherever possible, curves have been avoided and such an alignment has been secured between cities and towns as will permit of very rapid running with entire safety to passengers and equipment. In most instances the right-of-way has been protected by a woven-wire fence erected under an agreement with the landowner whereby he maintains the fence and keeps all gates closed. Wherever such agreements have not been secured, the right-of-way has been fenced with barbed wire. In most cases the company has also been granted the right to cut and keep out any timber on adjacent lands which might interfere with its wires and fences or with the operation of the road.

The track is laid with 70-pound T-rail in 60-foot lengths, connected with Weber rail joints and bonded with No. 0000 10-inch copper bonds, with seven-eighths-inch terminals under the plates so as not to be exposed. Fig. 3 shows the work of laying rails as the construction of the line progresses. Cross bonds are put in every half-mile and long bonds under all special construction. All switches and other special devices have been furnished by the Buda Manufacturing Company of Harvey, Ill., the construction throughout following steam-railway standards. Turn-outs and cross-overs are constructed so as to avoid danger of open switches. The ties are mostly of first-class white oak or burr oak, though a few chestnuts have been used. They all measure six inches by eight inches by eight feet long, and are laid 3,280 feet to the mile. The bridge ties are of long leaf yellow pine. Gravel ballast has been used throughout the whole line. It is generally laid eight inches under the ties and level with the top of the rail. In the streets of Rushville an eight-inch layer of broken stone has been placed under the ties.

The high-tension transmission lines are composed of No. 4 bare copper wire. A single-phase circuit leads to each transformer station. The high-tension wires are supported on large porcelain insulators, held by iron pins to strongly constructed cross-arms, mounted upon a separate line of poles which are set near the edge of the right-of-way.

Along the private right-of-way the trolley wire is suspended from poles set in the center of the grade 100 feet apart, with a bracket made of angle iron looped at the end so as to carry a large flat insulator, from the top of which is run a seven-sixteenths-inch steel strand cable or messenger wire. The trolley is formed of No. 000 copper wire and is carried eight inches under the messenger cable, to [illegible] the steel cable every 10 feet, break [illegible] catenary construction provides a practically level trol- [illegible] point is of particular advantage in high-speed service. [illegible] track.

Where the track [illegible] set on the sides of the streets and the trolley suspended from span wires. Otherwise, the construction is the same as along the private right-of-way.

The entire system is provided with two metallic circuit telephone lines, one of which is reserved exclusively for the train dispatcher; the other line is intended for general company business. Each car carries a telephone, so that communication can be had with the train dispatcher at intervals of 2,000 feet. Telephone wires are carried on porcelain insulators on cross-arms near the tops of the trolley poles. The wires are transposed every 500 feet in order to avoid disturbance by the current in the transmission lines.

The poles are all of selected white cedar—those for the center trolley construction are 40 feet long with seven-inch tops. The side poles for the high-tension lines are 35 feet long with seven-inch tops. All are set six feet in the ground and are carefully tamped. Thirty-foot poles are used for the streets in the cities where there are no feed wires and the poles are used only to support the span wires; while on the other side, where the high-tension lines run, the poles vary in height from 40 feet to 60 feet so as to carry the transmission lines above the shade trees. All the side poles along the streets are neatly shaved and painted and are set in concrete. The tall 60-foot poles are of Idaho cedar, beautiful, smooth and straight as if turned in a lathe. The entire pole line was constructed under the direction of A. A. Anderson, general superintendent of the Indianapolis and Cincinnati Traction Company, and under the immediate supervision of Oscar D. Emery. The work is of an excellent character and attracts the attention of the most casual observer.

The Indianapolis and Cincinnati Traction Company, which will operate this new line, was organized on February 4, 1903, under the laws of Indiana. It is managed by a board of seven directors constituted as follows: Charles L. Henry, Indianapolis, president and general manager; Ephraim Marsh, Greenfield, Ind., vice-president; William L. Taylor, Indianapolis, secretary; Endorus M. Johnson, Indianapolis, treasurer; James W. Fesler, Indianapolis; Theodore F. Rose, Muncie, Ind.; Wm. M. Frazee, Rushville, Ind.

The general office of the company is located at Rushville. It is a three-story frame building, as shown by Fig. 5, with a slate roof and was constructed from a residence which was purchased in the first instance to enable the company to make an easy curve around the corner. The building is now equipped with fireproof vaults, is heated with steam, is lighted from the company's own power station

and is arranged with ample accommodation for the general officers of the company. Waiting rooms and baggage rooms are also provided. The executive officers of the company are located in the Traction Terminal Building of Indianapolis.

Under the provisions of the franchises of the Indianapolis Traction Terminal Company, interurban lines are allowed to enter the city over the tracks of the city company by such roads as the city designates, upon payment to the city company of an agreed or ascertained compensation. The Traction Terminal Company has made a uniform agreement with interurban roads for entrance into the city over its tracks whereby the interurban road pays four cents for each passenger carried while on the city lines. This agreement entitles the interurban line to all of the privileges of the Terminal Station where all the interurban roads of Indianapolis center.

The Indianapolis and Cincinnati Traction Company has franchises of a most favorable character in all of the cities and towns through which the line passes. They uniformly run for a period of 50 years and contain no objectionable features regarding the pavement of streets, the erection of iron poles or the payment of a franchise tax to the state or town. The franchises of the cities of Rushville and Connersville permit the company to run "limited" cars making only one stop in each city. In all of the smaller towns the franchises specially provide that "limited" cars need not stop at all. The franchises also provide for the carrying of freight, express and mail matter under reasonable regulations of the various cities and towns. All private rights-of-way and franchises outside of cities and towns run in perpetuity.

The most interesting feature of the new installation, made possible by the use of the alternating-current system throughout, is the absence of the rotary transformer sub-station and the consequent small amount of feeder copper required. The No. 0000 copper trolley wire is supplemented by no feeder and the only lines required are the No. 4 high-potential transmission lines which connect the main power house to the transformer stations. The system, therefore, makes possible a considerable saving over former methods of operation and does away entirely with the expense usually incident to the operation of the sub-station and which may be regarded on an average as amounting to the wages of three men, aggregating not less than $6 a day for each sub-station. The adoption of the alternating-current system makes possible for the three transformer stations already installed between Indianapolis and Rushville, a saving in wages amounting to $6,570 per annum. It is estimated that for the 10 stations which will be installed between Indianapolis and Cincinnati a total annual saving of $22,000 is thus made possible in wages alone.

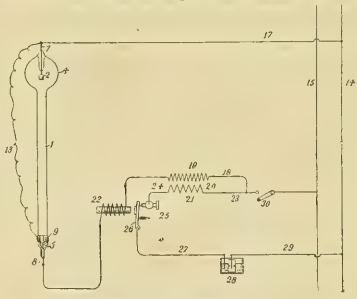
The entire construction of this road is a high testimonial to the progressiveness and skill of Sargent & Lundy of Chicago, the consulting electrical engineers. President Henry, whose wise foresight and commercial courage made possible the trial of the alternating-current railway motor in so large an operation, is one of the strong pioneers in the development of modern electric traction. In 1897 he built the first interurban line in Indiana, and under his management the Union Traction Company in 1900 united a line of roads running from Indianapolis via Anderson to Muncie, from Anderson via Alexandria to Marion, and from Alexandria to Elwood, with an approximate total mileage of 100. This was one of the early large electric-railway systems.

## Starting Device for Mercury-vapor Lamps.

In the operation of mercury-vapor electric lamps of moderate voltages it is found desirable in some instances to start the lamp by the application of currents of higher potential than those employed for the continued operation of the lamp. It is convenient in some instances to use interrupted currents derived from the same source as the currents employed for running the lamp and to induce, by the interrupted currents, the electric currents of the higher potential. It is usually desirable to cut out of circuit the apparatus employed for producing the higher potential starting current when it has performed its function of starting the lamp. The accompanying diagram illustrates an apparatus for starting the lamp under such conditions, which was recently patented by Peter Cooper Hewitt of New York.

A lamp is represented as having an enlargement at its upper end constituting a cooling and impurity-containing chamber. At or near the upper end of the lamp there is placed an electrode connected with a leading-in wire (7). An electrode at or near the other end of the lamp is connected with a leading-in wire (8). A conductor—such, for instance, as a band of foil (9)—is shown as being placed around the lamp near the lower electrode and connected by a conductor with the upper leading-in wire.

A conductor at the upper end leads from the main to the leading-in wire. A conductor (18) leads from a conductor (23) through the secondary coil of a converter and also through the coils of an electromagnet, to the leading-in wire (8). The conductor (23) leads from the other main to one terminal of the primary coil of the transformer. The remaining terminal of this coil is connected by the conductor with the back contact stop of the armature of the



STARTING DEVICE FOR MERCURY-VAPOR LAMPS.

electromagnet. A conductor (27) leads from the armature to one terminal of a suitable circuit interrupter (28). The other terminal of the circuit interrupter is connected by the conductor with the main. Assuming that the switch (30) is closed, current will pass through the interrupter and the primary coil of the converter, the interrupter serving to make and break the circuit with the proper rapidity. The higher-potential current will then be produced in the secondary coil, and this higher potential acting upon the vapor or gas path within the lamp creates the proper condition for permitting the passage through the lamp of currents supplied by the main circuit (14) (15). When the lamp commences to operate, the magnet will be energized, drawing forward the armature, and thus opening the circuit of the primary coil. The lamp will then continue to operate under the influence of the currents supplied directly from the main circuit. The lamp may be turned off by opening the switch.

## The Appleyard Properties in Ohio.

Plans are now being formed for the organization of three companies to handle the Appleyard electric-railway properties in Ohio. The Central Market street railway of Columbus and the Dayton, Lebanon and Cincinnati will each be operated under separate companies and all the other properties will be merged into one corporation. This will include the Dayton, Springfield and Urbana, the Columbus, London and Springfield, the Urbana, Bellefontaine and Northern (which connects with the Kenton and Southern), the Springfield and Western from Springfield to New Carlisle and the Columbus, Grove City and Southwestern.

According to this report the combined bond issue of the new companies is to be $8,500,000 and the capital stock about the same. The Dayton, Lebanon and Cincinnati, still a steam road, has a bond issue of $2,000,000 outstanding. A new issue of $1,000,000 will be made to retire these, with the necessary capital that will be furnished for it. The first mortgage bonds of the Central Market road are to be left intact, but a new issue of $1,000,000 consolidated bonds will be made to cover the indebtedness, together with the capital which will be arranged. The other companies are to be merged into the Ohio Union Railway Company, which will be authorized to issue $6,500,000 five-per cent. 40-year bonds. Half of this will be held by trustees to be named in the mortgage to retire the underlying first-mortgage bonds, and of the remainder the trustees will certify as many as necessary to pay off the debts. What is left is to be used in extensions and improvements. The stock issue will be the same in amount as the bonds and present holders in the various companies will receive it pro rata.

The management is to be vested for five years in a board of trustees consisting of nine members. Of these one is to be named by each of the four largest creditors, one each by the four largest roads included in the merger and one by the party to the agreement who has charge of the reorganization, Guy Mcrison Walker of New York. A. E. Appleyard, who built these roads, has promised to aid the trustees in the management of the roads and do all he can to bring them out of the trouble which overtook them.

The McKinley syndicate of Champaign, Ill., has also been looking into the condition of the properties with the intention of reorganization if matters are satisfactory. Congressman W. B. McKinley of Champaign and F. L. Nelson and R. D. Smith of Fort Wayne, Ind., have visited Columbus, Springfield and Dayton within the last few days and consulted with persons who know something of the properties, among them being General Manager Theodore Stebbins and C. A. Alderman of the Dayton, Springfield and Urbana. It is said that the men expressed the belief that the reorganization of the companies would not be a difficult matter, and in the event that this proves true they are willing to pay cash for the properties.

Arthur E. Appleyard was arrested in Boston a few days ago on a warrant in connection with the failure of the German-American Bank at Buffalo, but was at once released on bail, Harold P. Williams of Brookline signing a bond for $15,000. Mr. Appleyard will resist extradition, it is said, and will not go back to Buffalo to plead to the indictment against him without a fight.

Fig. 4. Catenary Trolley Construction and Elevated Crossing.

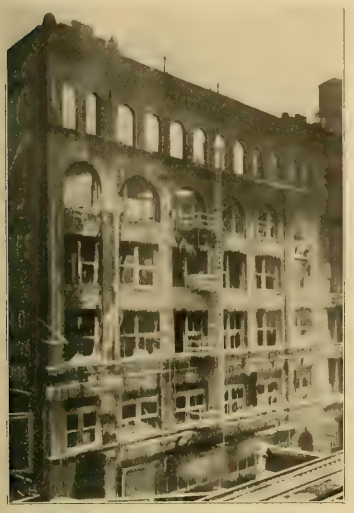
Fig. 5. Three-story Office Building.

INDIANAPOLIS-CINCINNATI SINGLE-PHASE RAILWAY.

## Chicago Electrical Houses Suffer by Fire.

The offices and warehouse of the Central Electric Company, together with the entire stock of electrical supplies, was destroyed by fire early on the morning of February 11th. The company occupied the lower floors of the six-story building at 264-70 Fifth Avenue. Several other concerns used the upper floors of the building and all suffered total loss. The building was completely ruined, only part of the outer wall remaining intact.

The fire, which is supposed to have originated on one of the upper floors at about four o'clock in the morning, gained considerable headway before it was discovered, and the firemen had a hard fight



CENTRAL ELECTRIC BUILDING AFTER THE FIRE.

to save adjoining property. When the flames were finally subdued the building presented a spectacular appearance from the ice which formed on the wall. The picture herewith was taken by the Western Electrician from the roof of a building across the street. Just before the picture was taken the large sign "Okonite," projecting from the roof of the burned building, fell to the pavement, and soon after the top of the wall fell. The structure of the elevated railway loop is shown in the foreground.

The Central Electric Company is undoubtedly the oldest electrical supply house of the country. It was established in 1887 and enjoys a large patronage. Showing characteristic enterprise, in less than one hour after the usual office-opening hour the company had established new headquarters at 209 East Jackson Boulevard. Before noon the office was completely equipped, including typewriters, desks and new stationery, and by 10 o'clock at night 10,000 circulars had been sent out to the trade announcing the fact of the fire and that arrangements had been made to take care of all orders promptly. At this time the force of nearly 100 employes is busy as ever, and within a few days a full new stock of supplies will be on hand at the new headquarters.

President George A. McKinlock when notified of the fire was at his home in Lake Forest. With him was Charles E. Brown, secretary of the company. They arrived at the scene of the fire at eight o'clock in the morning, noted the complete destruction and within an hour were at their desks in new headquarters. Mr. McKinlock, through the columns of the Western Electrician, wishes to express his appreciation of the kindness of competitors in offering to the Central Electric Company their facilities in the emergency. The loss of the Central Electric Company was large but covered by insurance. It is learned that before long the company will occupy a new building of its own near the site of the building just burned.

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On the night of February 13th another fire broke out, this time in the building at 133-139 South Clinton Street, Chicago, in which the Crouse-Hinds Company (western office) and J. L. Schureman & Co. suffered loss. Just before going to press Mr. F. F. Skeel, western sales agent of the Crouse-Hinds Company, informs the Western Electrician that the stock of switches, switchboard, etc., has not been entirely destroyed, as the company occupied the north end of the building, which was saved. Mr. Skeel has opened a temporary office with the Electric Appliance Company and will be located at 42 West Van Buren Street until new quarters can be secured. J. L. Schureman & Co., manufacturers of automatic motor-controlling devices, were in the same building, and the company's loss is estimated at $35,000. Mr. S. M. McFedries, secretary and treasurer of the concern, has opened a temporary office with the Guarantee Electric Company, corner of Adams and Clinton Streets.

## New Inventions in Single-phase Work.

Two patents of some significance in the field of single-phase motors have recently been granted, one to Benjamin G. Lamme and the other to Paul M. Lincoln, both residing in Pittsburg.

The apparatus devised by Mr. Lamme is a single-phase motor of the general class of alternating-current multipolar machine, provided with a commutator, and the invention has for its object the equalization of the potential between the brushes of like polarity.

Unequal division of the current between brushes of like polarity in multipolar motors having parallel-wound armatures may be due to a variety of causes, such as differences in brush resistances and unequal magnetization of the field-magnet pole pieces. Such unequal division of current is avoided in direct-current motors by connecting together points in the armature windings which at any instant occupy corresponding positions with reference to the field-magnet pole pieces or which are normally of equal potential.

Mr. Lamme's invention provides simple means for equalizing the potential between brushes of like polarity in alternating-current motors, which operate satisfactorily regardless of the exact equality of potentials in the windings or the resistances of the brushes. The device is illustrated in Fig. 1, which is a diagrammatic view of a motor so constructed.

The motor is in most respects similar to ordinary direct-current motors, but certain parts are so proportioned and arranged that the motor is adapted for satisfactory operation by means of alternating currents. The armature is provided with parallel windings of a well-known type, and the proper points in the winding are connected in the usual manner to the bars of a commutator cylinder. Brushes (4) and (5) are of like polarity, and brushes (6) and (7) are also of like polarity, but

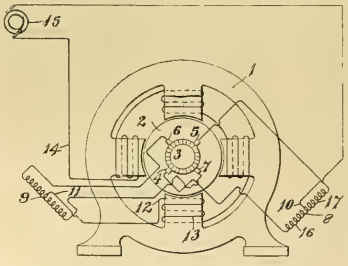


FIG. 1. LAMME SINGLE-PHASE MOTOR.

at any instant are of opposite polarity to brushes (4) and (5).

The terminals of a suitable inductive winding (8), such as a transformer or choke-coil winding, are connected, respectively, to brushes (4) and (5), and the terminals of a similar winding (9) are connected, respectively, to the brushes (6) and (7). Leads (10) and (11) are connected, respectively, to the middle points of the windings (8) and (9) and constitute the armature terminal leads, which may be connected to any suitable source of alternating current or to other windings of the motor as may be desired.

In the normal operation of the motor equal amounts of current would be supplied to the brushes (4) and (5) through the halves of the winding (8), the portion supplied to the brush (4) passing through the portion (16) and the current supplied to the brush (5) passing through the portion (17). If, however, the resistance of the brush (5) is greater than that of the brush (4), a greater current will pass through the portion (16) of the winding (8), which acts inductively upon the portion (17) and tends to cause that portion to carry the same amount of current that is carried by the

[redacted]

direct-current motors, and various systems have been devised for transmitting energy at high voltage and supplying it at [redacted] motors at the points of consumption. For instance, one plan [redacted] ence of potential between one terminal of the motors and the grounded conductor the same as the potential difference between the motor terminals. In the system of Mr. Lincoln the differences of potential between the respective motor terminals and the grounded conductor are only one-half that between the motor terminals. With this arrangement the stresses on the insulation and the dangers incident to the operation or repair of the motors are materially reduced.

The system comprises a main transformer-wind-

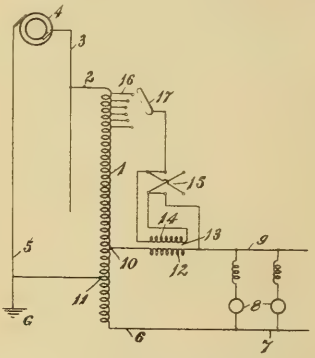


FIG. 2. LINCOLN SINGLE-PHASE DISTRIBUTION SYSTEM.

ing (1) (Fig. 2), having one end terminal connected by means of a conductor (3) to one terminal of an alternating-current generator, the other terminal of which is shown as connected to ground. The other end terminal of the transformer is connected to one conductor (7) of the circuit for supplying the motors (8), the other conductor of the motor circuit being connected to a point (10) in the winding, which will insure the desired difference of potential between the motor terminals. A point (11) in the winding between the points (6) and (10) is connected to the grounded conductor. If the system is employed for the operation of railway motors, the conductor (5) might be the track or the grounded portion of the circuit.

The conductor (9) of the motor circuit includes the secondary winding of a series transformer. The terminals of the primary winding of the series transformer may be respectively and reversibly connected to the terminal of the secondary winding that is adjacent to the motors and to a desired point in the main transformer winding by means of a reversing switch (15). The transformer winding may be provided with a number of spaced leads (16) and a switch-arm be employed in connection therewith to vary the point of connection of the winding (14) with the transformer winding.

In order to reduce the potential difference between the terminals of the motors and the grounded conductor to approximately one-half the maximum difference of potential between the terminals of the motors, the point (11) in the main transformer winding, which is connected with the conductor (5), will generally be located somewhat nearer the point (10) to which the secondary winding of the series transformer is connected than to the terminal (6), though it is obviously practicable to vary the location of the point (11) from what is shown in the drawing. The point (10) is so chosen that when the voltage in the winding (12) is added to the voltage supplied to the motors by the portion of the main transformer winding between the terminal (6) and the point (10) the full potential is supplied to the motors, and so that when the current in the winding (12) is subtracted from that supplied by the portion of the winding between the terminal (6) and the point (10) of the main transformer winding the lowest starting voltage is supplied to the motors.

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## DATES AHEAD.

Iowa Telephone Association (annual meeting), Des Moines, March 13th and 14th.

Ohio Independent Telephone Association (annual meeting), Columbus, March 30th.

Iowa Electrical Association (annual meeting), Hotel Julien, Dubuque, Iowa, April 19th and 20th.

National Electric Light Association (annual convention), Denver, June 6th, 7th and 8th, and Colorado Springs, June 9th and 10th.

International Association of Municipal Electricians (annual convention), Erie, Pa., August.

Ohio Electric Light Association (annual convention), Hotel Victory, Put-in-Bay, August 16th to 18th.

American Electrotherapeutic Association (annual meeting), Academy of Medicine, New York city, September 19th, 20th and 21st.

TRACTION, in various electrical aspects, is given much attention in this issue of the Western Electrician. The interesting Indianapolis-Cincinnati single-phase road is described at some length; new single-phase-railway inventions are given attention; the annual dinner of the American Institute of Electrical Engineers, which was a glorification of electric traction, is reported; editorial consideration is given to the political aspects of street-railway ownership in Chicago; and in addition there is a report of the meeting of the Indiana Electric Railway Association and news items relating to the Appleyard properties in Ohio and various other matters. Verily, the insistent, constantly growing electric railway is not to be denied.

KRUPP is a name of world-wide fame in connection with ordnance, armor plate and iron and steel-construction work, but it has not been generally connected with electrical manufacturing. It is now reported in Paris, however, that the great Krupp establishment at Essen, Germany, has gone into the manufacture of electrical apparatus. Whether the appliances made are intended only as a part of the company's equipment in various classes of machinery or whether the line of electrical manufactures is offered direct to consumers as a separate and distinct department of the company's business does not appear. If the latter assumption turns out to be correct, the fact will be of much importance to the electrical trade in Germany and on the Continent and of interest elsewhere.

WHY is it eminently proper for the grocer, the baker and the candlestick maker to sell their products in large quantities at wholesale rates while it is all wrong for the electric-light company to do the same thing? There is no equity in such a distinction, and yet a representative from Cook County in the Illinois Legislature has introduced a bill which, if it becomes a law, will work this injustice. The bill fixes heavy penalties for electric-light and heating companies making differences in their rates in favor of large users. The bill requires such companies to maintain a set rate for all persons regardless of the amount used. A violation subjects the corporation to a fine of from $1,000 to $5,000. On the fourth offense this fine is fixed at $20,000, and, in addition, the aggrieved person may collect three times the amount of damages sustained through rate difference. This bill is so unfair and the proposed penalties are so grotesque that it will probably fail to secure a place on the statute book. It will be observed that the bill prohibits the making of wholesale rates to wholesale consumers, and is not confined to possible discrimination between customers of the same grade. There can be no need of such a law, which contravenes all accepted ideas of good public policy and fair dealing.

SOUTH DAKOTA is the scene of a curious controversy which throws an unexpected light on the value of electrical education. The University of South Dakota is located in Vermilion, while Brookings is the seat of the South Dakota Agricultural College. As is the case in some other states, there is considerable rivalry between these two state institutions. Engineering in various branches is taught at the Brookings school, and the mechanic arts are given a prominent place in the curriculum. In fact, it appears that the Agricultural College is the only institution in the state conferring a special degree in electrical engineering. With the modern demand for technical education this fact seems to have aroused apprehension among the friends of the state university. Some of them declare that there is on foot a movement to remove the university to Brookings. This is denied by the Agricultural College people, who, however, see in the charge a possible attack on the prerogatives of their own school, which they are eager to defend. "If," says the Brookings Register, "time has changed the order of things—if the young men of this state have found it more to their liking or to their advantage to learn scientific agriculture, scientific electrical or mechanical engineering and are heading toward the state Agricultural College rather than attend the state university, that is the misfortune of the university." But it was not always thus, for, to quote again: "Is it not a fact that until very recently the S. D. A. C. students have been dubbed as being 'barnyard cadets' and 'steam whistlers' by the faculty and the students of the 'U'?" However, the value of the engineering department of the college is well recognized at Brookings. The Register says that "the friends of the Agricultural College will defend to the last what rightfully belongs to it, and if the Register mistakes not there will be 'something doing' before her rights are stolen by Vermilion."

To the unprejudiced bystander this unusual controversy, while not without its amusing side, is of considerable interest. It is entirely characteristic of the intense local pride of western towns in the United States and it also shows the importance attached to the study of electrical engineering, even amid the wheat fields of Dakota. It is well for the South Dakota Agricultural College to be proud of its electrical engineering course, while it is natural that the intimation of the Vermilion Republican that "the only thing that will keep the [state] university alive and make it prosper is a school of electrical engineering" should cause it some disquietude, which will turn out, however, we hope, to be entirely unfounded.

"IMMEDIATE" as a word qualifying municipal ownership bids fair to play an important part in the mayoralty campaign in Chicago this spring. Judge Dunne, who will probably be the candidate of the Democratic party, has written a letter to say that he will accept the nomination and setting forth his views on municipal ownership, of which he is a strong advocate. The following paragraph from this letter seems to give the gist of the judge's "platform:"

"Immediate municipal ownership, in the sense of immediate proceedings leading to early success, is entirely feasible. Such proceedings should be vigorously prosecuted. Whether municipal ownership should be followed, as I think it should, by municipal operation under a rigidly enforced civil-service law, is a distinct question which must be decided as such under the provisions of the Mueller bill by the people themselves on referendum. The issue at the present crisis in our city government is the issue of ownership solely. Regarding that issue I hold the true, the practicable and the only safe and wise policy to be municipal ownership without reservation or procrastination."

It will be noted that Judge Dunne makes a distinction between municipal ownership and municipal operation and that what he proposes are "immediate proceedings" to get municipal ownership of the street railways. Mayor Harrison, the present incumbent, says that immediate municipal ownership of the traction properties in Chicago is simply out of the question. To say nothing of other legal difficulties, the city has no means of raising the money. Judge Dunne does not say in what manner he will undertake to solve the problem if elected mayor, but speaks vaguely of "immediate proceedings." During the campaign he will no doubt be pressed to state exactly what these "proceedings" should be.

Mr. John M. Harlan, the probable Republican candidate, has not as yet declared himself as to his present attitude on the overshadowing traction issue. It is perhaps a fair assumption from his record to say that he, like Mr. Harrison, regards as futile any attempt to secure immediate municipalization and favors a short-time (20-year or less) franchise with the private owners, with stringent provisions as to compensation and service. But it is to be remembered that the citizens of Chicago have already voted by an overwhelming majority in favor of municipal ownership of street railways; furthermore, the existing surface-railway transportation is very poor (for the "question" has been unsettled for a number of years) and the mixed-up management of at least one of the companies is decidedly unpopular. These are considerations that appeal strongly to a man preparing to run for public office. Boiled down, the situation is that, with all his zeal, the pro-municipal man can only promise, as yet, "immediate proceedings," while his probable opponent is simply doing a "heap of thinking." Even the most enthusiastic municipal-ownership advocates don't see just how they are going to get it, while, on the other side, politicians who probably really believe that private ownership is inevitable for a term at least are put to their wits' end to see how they can avoid publicly espousing immediate municipalization. It is truly an interesting situation.

## Traction Dinner of the Institute.

Over 300 members and guests of the American Institute of Electrical Engineers attended the annual dinner of February 8th in the Waldorf-Astoria, New York city, the "motif" of which was a celebration of the triumphs of electric traction. The electrical decorations were elaborate and effective. By the co-operation of the New York Edison Company each of the 50 tables was decorated with miniature incandescent lights placed amid smilax and ferns. Elblight cables about the walls and boxes of the room carried about 1,000 other incandescent lights, entwined with festoons of living green. Cooper Hewitt lamps were also used to take a "flashlight" photograph. The iced dessert course was borne in by a procession headed by a Goddess of Electricity bearing an electric light and standing on a globe ablaze with electric radiation. The effect was brilliant.

Prior to the dinner there was a reception, and those present inspected the Gilbert painting presented to the Institute by the British Institution and the bust of Ferraris presented by the Turin Museum. There was also an excellent display of moving pictures relating to railway subjects.

Telegrams of regret were read from T. A. Edison, George Westinghouse and W. B. Potter. The first-named said: "Our efforts must not cease until electricity has made the whole art of transportation fully and forever its own." Mr. John W. Lieb, Jr., president of the Institute, presided, and made the opening address. He briefly reviewed the history of electric traction. Of Sprague he said: "It required indeed a rare combination of those qualities which are characteristic of American engineers and American engineering methods—audacity, skill, perseverance and a strongly developed commercial sense—to have undertaken in 1887 the contract to 'electrify' a complete railroad system of 13 miles of track and 20 cars, with the natural difficulties which the Richmond road presented." Mr. Lieb closed by introducing "our past-president and traditional toastmaster," Mr. T. C. Martin, who thereupon assumed the duties of his office. Mr. Martin introduced Lieut. Frank J. Sprague as a naval officer who, "finding that he could make no tracks upon the boundless sea, determined to try another vocation," becoming "the Edison of electric traction."

Mr. Sprague's response was to the toast, "The Art and the Men." After a graceful reference to Mr. Martin and an outline history of the electric railway, the speaker said:

"Looking back these nearly 20 years, I am reminded of the cry of the prophet, 'O, ye of little faith,' and yet I, for one, and I think I may speak for most of the others, would not have had it otherwise, for, let me tell you, my younger brethren, whether it be on the battlefield or in civil pursuits, there is no victory so sweet as that wrung from almost certain defeat, and if you need encouragement in present or future struggles, let me bid you ask of the living and the dead the record of 1879 to 1888. They will tell you of cynicism, ridicule and unbelief, of unremitting labor and disappointment, of poverty, sickness, wreck and ruin, but they will also tell you of their inspirations, of exalted moments, of hopes realized, of victories won.

"Richmond's story is an old one, and typical, but it offered greater possibilities because of its greater extent. It was a new confederacy to be assaulted, a confederacy of physical difficulties, adverse conditions, and all the ills of a new and untried system. But Richmond fell again, and the mule was freed."

Some interesting anecdotes of the work in Richmond were given by Lieutenant Sprague, who then traced the development of the art down to the present day, concluding as follows:

"We face the solution of grave and complicated problems, incident to the demands of our local situation. Terminal improvements on the New York Central, Pennsylvania and Long Island railroads, costing nearly eighty millions of dollars, and made possible chiefly because of electric traction—supplementing the equipment of the surface, elevated and underground railways—may well dazzle the mind, and lead to hasty conclusions, forgetting that, in so far as these problems are out of the ordinary, they are many of them special in character.

"Our esteemed senator, Mr. Depew, has been quoted recently as saying that in 10 years the only place for a steam locomotive would be a museum. Is the wish father to the thought, or does it mean the awakening of our railway officials to the possibilities of the future? If so, then we indeed have reason to congratulate ourselves, for there is much work ahead. But, gentlemen, let us be in no hurry to build museums, for, in spite of any development which may take place, our old friend the steam locomotive will be on deck and doing business at the end of another decade, although his younger brother will be giving him an interesting tussle. We have indeed 30,000 miles of line to the credit of the electric railway in this country alone, but the character of the traffic and the service performed by these lines is absolutely distinct from that pertaining to trunk-line operation. Two hundred thousand miles of road, and over half a million miles of track are in the steam locomotive's grasp—a prize worth fighting for, but not easily won. Understand, I do not for one moment [illegible] that a railroad, no matter how large, cannot be operated electrically. It can be done, if any amount can be [illegible] for the [illegible] commercially required. Motors of large power can be aggregated into combination of capacity greater than that of any steam locomotive can be [illegible] and perfectly controlled.

"And with great power there is, of course, the possibility of high speeds, but a well-ballasted track, free from curves, grades and grade crossings, a reserved right-of-way, perfect brakes and signals, infrequent stops, and favoring outward conditions are equally essential to steam or electric traction of the first order. It is sustained, not extraordinary maximum speed, which is required in practical service, and sustained speed is a matter of finance.

"What, then, will determine the future? Solely this financial factor, as it must the future of any other great industrial problem. When savings in operation and the increased returns from traffic on any road will more than pay a fair dividend on money invested for electrical equipment, then, and then only, will trunk lines, great or small, be operated electrically. As I have often stated, the problem resolves itself into a question of relative density and the character of load factor, and these essentials are, of course, vitally connected with the allowed working potential on a trolley line. There is a tendency to assume that the limitation of operations by continuous-current motors has been reached, and that the only possible large development is with alternating-current motors. I say, God speed the alternating-current motor, and every mile it adds to the radius of action is a mile to the good, but speed also its sister, which has as yet by no means reached the limit of its usefulness.

"And now a closing work to the Institute. Someone has said that he who adds to means for transportation and the transmission of intelligence is one of the greatest benefactors of the human race. Measured by this rule alone, irrespective of any other, and considering all its ramifications, the members of the American Institute of Electrical Engineers have in its short span of life contributed more to the well-being of the world than any similar body of men. You are no longer only electrical, but electric engineers, comprising in the equipment necessary for highest success the knowledge and training of the civil, mechanical and hydraulic engineer. The future of this Institute is indeed a bright one, for because of the magnitude and variety of the works to be performed, the diversity of training required, and the constant acquisition of the brightest minds from unequaled universities, it must of necessity become the greatest of engineering societies.

"Thirteen years ago I had the honor to preside over your meetings as president, and to address you on the 'Future Development of the Electric Railway.' The first purely social dinner was held in that year, when 65 members and guests, unabashed by the presence of the gentler sex, formed the company; and it is interesting to contrast that occasion with the present magnificent dinner and assemblage. As I look around me tonight, I cannot but feel a pardonable pride that I have in some degree been an instrument in the progress of electric traction, and I am doubly honored that you should have coupled my name so significantly with it."

"These Twenty Years" was the subject assigned to Leo Daft, who, as Mr. Martin said, "did splendid work in the traction field before this Institute came into existence." Mr. Daft gave interesting reminiscences of the early days. Among other things, he said:

"Looking backward over these 20 years, perhaps the fact which stands out in boldest relief is the almost unique attitude of this keen, eminently progressive business community toward the new development. There was an almost total absence of that deadly neglect or active opposition which characterized the public attitude toward inventors or pioneers from the time of Palissy the potter to that of Bessemer, or, even later. On the contrary, after the first shock, so to speak, the inventor was met with an amount of cheerful encouragement and material support which alike honored the country and the men who tendered it, and perhaps the best feature of this substantial aid was the fact that it was accompanied by the good-natured restraint which keen business judgment imposed upon the often dangerous enthusiasm of the inventors themselves. And, while the invaluable sagacity of this body of the ablest business men the world has yet produced prevented undue haste, they kept pace with all real improvements, for though actual development followed the first attempts with a celerity which has no parallel in the history of applied science, the capitalists were on hand to give full commercial effect to the perfected systems."

H. H. Vreeland, president of the New York City Railway Company, spoke of "The Broomstick Train." This was the peroration of his speech: "Ministering to every want of the body, while freeing the mind from the fetters of distance and time and joining the utmost region of the earth in a common brotherhood and in the common possession of every thought of genius and every product of art and science, you are steadily bringing nearer the dawn of the day of universal peace by uniting all men in class intercommunion with one another, and thus breaking down the barriers of caste and prejudice which [illegible] universal law.

[illegible] numbers that the rails are fairly greasy and the [illegible] H.S; there is practically no oxygen present. It is so noisy that even the loudest advertisements that [illegible] with the architects in decorating the stations) cannot be heard when trains are passing. It is infested by myriad [illegible] ous subterranean channel of communication, make their way in droves from one part of the city to the other, carrying with them pestilence and famine. We all know that the deadly third rail is employed, and I may as well admit right here and now that the company's engineers have obstinately refused to adopt and utilize scores of plans for rendering the third rail innocuous. The weight and speed of the trains are such that people standing upon the tracks are liable to be seriously hurt; and the dangers of flood and fire are so imminent that the company should be compelled to issue an accident policy with every ticket. The electrical equipment is all wrong. Nothing, not even ignorance, will excuse this, for some of our most popular inventors at high frequency during the last decade or so have announced, even in the columns of the daily press, inventions which they were about to make which would have made it possible to avoid all these mistakes. It is only natural, of course, that in high-frequency invention, while announcements are positive, results are chiefly negative, and in these days no one should be afraid of high frequency in any form. The engineers of the Interborough company, however, have failed to avail themselves of their glorious opportunity to burn money. They have not adopted the obvious and simple expedient of utilizing refrigeration to reduce the conductor loss in a wireless system. They have refused to wait even a few months for promised inventions which will startle the world, and they have shown a dastardly tendency to avoid irresistible forces."

Becoming serious, Mr. Stillwell said that as a railway, the subway demonstrates the value of the four-track system with island platforms. This system makes it practically possible to double the speed which can be attained if two tracks are used. "As regards equipment, the subway has demonstrated in the sight of all men the fact that trains weighing 320 tons can be driven by electric power at a speed of 45 miles an hour between stations, and that electric equipment can develop a tractive effort of 45,000 pounds, which is far more than double the drawbar pull of the average passenger locomotive. Electrification of the elevated lines in New York has increased their capacity by one-third and has decreased by one-fifth the time spent on trains by the average passenger. It has demonstrated that the cost of maintenance of electrical equipment of rolling stock is materially less than that of steam equipment. It has proved that electricity can render more reliable service than steam, the aggregate delays due to all causes on the Manhattan lines now being less than one-half per car-mile what they were when steam was used as a motive power. It has eliminated smoke, steam and cinders, formerly the cause of so much annoyance."

Gen. A. W. Greely, chief signal officer of the United States Army, responded to the toast, "Other Uses of Electricity." His speech was a very interesting one, but, as it referred only incidentally to traction, it is reserved for future publication.

General Greely's was the last toast of the evening. Among those present who have not been mentioned were Nikola Tesla, W. J. Wilgus, H. H. Westinghouse, C. F. Scott, Prof. F. B. Crocker, C. G. Curtis, Dr. S. S. Wheeler, Gen. Eugene Griffin, C. A. Coffin, Frank Hedley, B. J. Arnold, H. Ward Leonard, E. A. Sperry, R. W. Pope, W. C. Kerr, J. G. White, C. O. Mailloux, A. H. Armstrong, G. H. Condict, H. McL. Harding, O. T. Crosby, Charles Blizard, Robert Lundell, J. R. Lovejoy, C. H. Wilmerding and A. H. Armstrong.

## The St. Louis Situation.

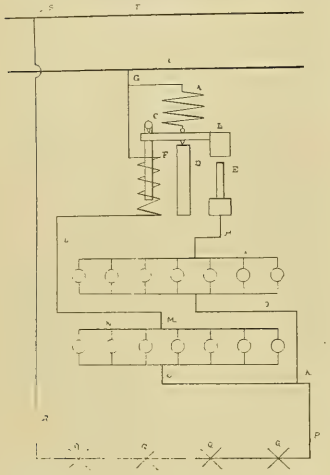
According to a Milwaukee dispatch in the St. Louis Globe-Democrat, John I. Beggs, president of the Milwaukee Electric Railway and Light Company, recently made this interesting statement: "All the electric-lighting and gas-lighting systems of St. Louis are in our control, and our administration has been so successful that we have been asked to take over the street-railway system—even the general public joining in the requests—and administer and operate it as we are operating the Milwaukee system. I made a careful investigation of the properties about a month ago and was so well pleased with what I learned that a discussion of ways and means to bring it about is now under way."

## COMMUNICATION.

### Distribution of Current from Constant-potential Circuits Without Dead Resistance.

To the Editor of the Western Electrician.

How to distribute current from constant-potential power or railway circuits without the employment of dead resistance or undue loss for lighting purposes has always been a question of no small



DISTRIBUTION OF CURRENT FROM CONSTANT POTENTIAL CIRCUITS WITHOUT DEAD RESISTANCE.

moment. The remedy will be found in the accompanying diagram.

Power or railway lines, presumably of 500 volts, are designated by (T) and (U). The local circuit is shown by (S), (R), (Q), (P), (O), (N), (M), (L), (F) and (G), and the shunt circuit by (G), (A), (B), (E), (H), (I), (J), (K). The component parts of a series cut-out are shown in percircuit would be left open unless means were provided for closing it and at the same to compensate for the loss of resistance due to the loss of the lamps out of the circuit (N).

The means provided in this instance to compensate for the loss of resistance and the closing of the open circuit is shown in the diagram by letters (A), (B), (C), (D), (E) and (F), representing an automatic cut-out. The functions of this cut-out are such that when the local circuit is complete the shunt circuit is open within the cut-out between (B) and (E). However, if the local circuit is opened plunger (C) is released from the influence of electromagnet (F), when (B) and (E) come in contact and so close the shunt circuit from (G) to (K), which completes the circuit, and the lamps in group (I) come into service. The group of lamps represented by (I) may be substituted by dead resistance, since they are not protected by the device against opening the circuit. This latter method is, of course, a matter of choice.

The fundamental principle in wiring this system of distribution is simple. The cut-out is placed across the leads or loops of the arc lamp—in this case across the leads of the group (N). The cut-out is designed to be adjusted so that when half of the lamps in group (N) give out the cut-out will close the circuit through the shunt circuit, and in that way may save part of the first group from burning out wholly.

The cut-out may also be employed across the loops of the arc lamps, so that in the event that either one of them gives out there will be thrown into the circuit resistance equal to that of the lamp out. This resistance may consist of dead resistance or a cluster of incandescent lamps. This cluster of lamps should be of such number that the resistance will assure long life as a precaution against open circuit.

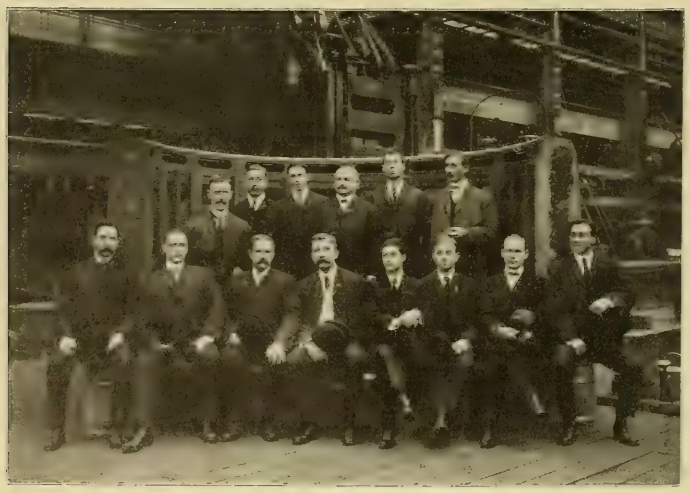
By the means shown in the diagram a continuous service is assured and the arc lamps are protected against abnormal current. At the same time eight or 10 incandescent lamps are connected for use at any convenient point instead of a dead resistance.

A. F. Hamacek.

Chicago, February 11, 1905.

### Directors of National Electrical Contractors' Association in Pittsburg.

On February 6th and 7th the board of directors of the National Electrical Contractors' Association, comprising 26 delegates from the electrical contractors' associations from the various states, met at the Hotel Schenley, Pittsburg, Pa. Plans for the annual convention to be held this year and the busi-



DIRECTORS OF NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION IN PITTSBURG.

spective. Arc lamps of 110 volts each are designated by (Q), which equal, combined, 450 volts of the 500-volt-line pressure, leaving a remainder of 60 volts to be made up of either dead resistance or resistance utilized in some useful manner. In the diagram the group of incandescent lamps represented by (N) makes up this remainder, the lamps being of 60 volts and an amperage such that their combined carrying capacity will equal the current required for the arc lamps. However, as is well known, the life of the entire group of lamps in (N) is that of only one of them—that is to say, when one or two burn out the remaining ones would also go, since they could not carry the entire current which was intended for the whole group; still worse, in case the group of the lamps did burn out, the

ness outlook for 1905 were discussed. Owing to the large amount of business transacted, little opportunity was afforded the delegates to visit the many industries for which Pittsburg is noted, but a party of 12, accompanied by Mr. E. McCleary of the McCleary Electric Company, Detroit, Mich., and president of the National Electrical Contractors' Association, spent a day in the works of the Westinghouse Electric and Manufacturing Company at the end of the convention. They found the trip interesting and enjoyable and only regretted that lack of time prevented a more thorough investigation of the works. A group of the delegates as they appeared in the works of the Westinghouse company is shown herewith, Mr. McCleary appearing as the fourth gentleman from the left in the row sitting.

### Notes on Induction Integrating Wattmeters.[1]

By A. A. Serva.

In the induction wattmeter we have a combination of series and shunt elements (Fig. 1) establishing a rotating field which produces opposing fields by inducing current in a movable closed secondary, causing the rotation of the same. It is, of course, obvious that the speed must be proportional to the wattage to be measured. In order for this to hold true the combination of elements must produce a torque or turning moment directly proportional to the load or wattage. This is accomplished by causing the rotating element, which is constructed of non-magnetic material, to pass between the poles of per-

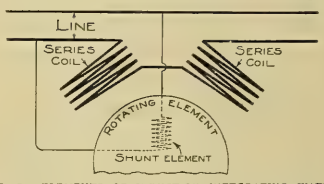



FIG. 1. ELEMENTS OF INDUCTION INTEGRATING WATTMETER.

manent magnets which generate Foucault currents in it directly proportional to the speed.

In regard to wave form, most modern meters are practically accurate within the required limits for the wave forms that are usually met in standard practice. One of the most important features in connection with wattmeter work, however, is accuracy on inductive loads. With the introduction of this element the problem becomes more complicated for the reason that the impressed electromotive force and current in the circuit are no longer in phase, and the formula

$$W = E\,I$$

where W equals watts, E the impressed electromotive force and I the current in circuit, no longer holds true.

Instead the conditions are as represented in Fig. 2, where (A) equals impressed electromotive force, (B) the effective electromotive force or the energy

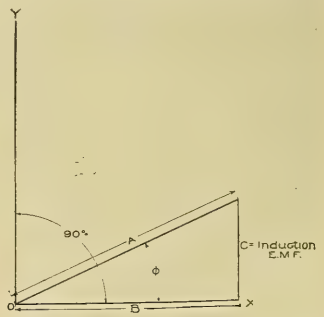



FIG. 2. CONDITIONS IN WATTMETER CIRCUIT, IMPRESSED E. M. F. AND CURRENT OUT OF PHASE.

component of the impressed electromotive force, and ($\Phi$) the angle of lag or phase displacement between the impressed electromotive force and current.

When there is no phase displacement between the impressed electromotive force and current

the angle $\Phi = 0$

and $\frac{B}{A} = 1$

or cos. $\Phi = 1$

Assuming a phase displacement of 90° between the impressed electromotive force and current

the angle $\Phi = 90°$

and $\frac{B}{A} = 0$

or cos. $\Phi = 0$

From this it will be seen that the true energy in any alternating-current circuit varies directly as the cosine of the angle of displacement between the electromotive force and current; hence we have the true energy in the circuit expressed by the equation

$$W = E\,I \cos.\ \Phi$$

If $\Phi$ should equal 90°, true energy would equal 0, and when $\Phi$ equals 0°, the apparent and true energy are equal.

It is evident, therefore, a meter must be constructed to account for this variation. This is accomplished by what is commonly termed in practice "lagging." As previously explained, the principal parts of a meter are the series and shunt elements acting upon a rotating part in the form of a closed secondary, producing a torque; hence a speed proportional to the load or wattage. It is necessary,

1. Abstract of paper read before Colorado Electric Light, Power and Railway Association, September 21, 1904. Mr. Serva is connected with the Fort Wayne Electric Works.

therefore, if we wish to obtain accurate results, to create the condition of torque proportional to cos $\phi$, which is accomplished by displacing or "lagging" the fields of the series and shunt elements 90°. Since on loads of varying power factor the current in the series element lags back of the impressed electromotive force, it is necessary for the shunt field to be lagged originally 90° back of the series field.

When $\phi$ = 0°, series and shunt fields will be displaced 90°; therefore maximum torque.

When $\phi$ = 90°, series and shunt fields will be displaced 0°; hence no torque.

Briefly, the method employed in lagging, what occurs in the meter when being lagged, its condition after lagging and its action when placed in actual service is as follows:

In Fig. 3 are shown the internal connections of the type K single-phase induction integrating wattmeter with the series and shunt elements separately connected to two independent circuits (A) and (B). Sufficient non-inductive load is placed on circuit (A) to cause the full-load current at 140 cycles to flow through the series element (c c'), and the normal electromotive force of the meter at 140 cycles is impressed on circuit (B). The electromotive force, however, impressed on circuit (B) is lagged 90° back of the electromotive force impressed on circuit (A). The 140-cycle lagging resistance (H) is then adjusted until the rotating element remains stationary, indicating a no-torque phase relation between the fields produced by the series and shunt elements.

There are features which must be carefully looked into in order to have a meter meet all the conditions of actual service. No matter how accurate a meter may be initially, unless it is so constructed that it will maintain its accuracy for a reasonable length of time it does not fulfill all the requirements.

This brings before us the questions of drag-magnet construction, torque, friction and weight of moving element. As to the first of these, viz., the drag magnet, it goes without saying that absolute permanency is essential, for without it we might liken a meter to a steam engine without a governor. Certain manufacturers, however, have discovered a process whereby magnets can be produced that will remain constant for an indefinite period, and the purchaser should always thoroughly investigate this most important part of meter construction. The torque or turning moment is directly proportional to the load and does work in opposing the forces established by the Foucault currents which are generated in the moving element by the permanent magnets. In addition to this it does work in overcoming all the friction of the moving parts. Since friction varies directly as the pressure between surfaces, it follows that the rotating element should be as light as possible. By maintaining high torque and keeping the weight of the moving element as low as consistent with good mechanical construction, we make the torque consumed by the friction a small percentage of the total torque and retain the ratio between torque and inertia of moving element at a maximum.

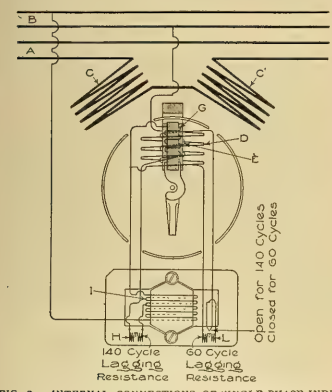



FIG. 3. INTERNAL CONNECTIONS OF SINGLE-PHASE INDUCTION INTEGRATING WATTMETER.

Unfortunately, however, the friction in a meter does not remain constant, but increases with age. By reducing the weight of the rotating element the percentage of increase of friction within a specified time is diminished but not entirely eliminated. It is essential, therefore, that some means be provided for compensating for even this slight increase in friction, which is a disturbing factor on small loads for the reason that the percentage of torque consumed by friction increases as the load decreases. The design and arrangement of such a device should be such as to be effective only on light loads. Most modern meters, however, are so provided.

High ratio between torque and weight of moving element is also a determining feature in fluctuating load accuracy. The same force applied to a light and heavy body must be applied longer to the heavy than to the light in order to produce the same speed in the two bodies. It is evident, therefore, that a meter having a high ratio between its turning moment and weight of moving element will respond more quickly to sudden change in load and record more accurately all entering energy.

It would seem, therefore, that the essential feature for maintaining continued accuracy in service is not high torque alone, nor great ratio between torque and weight of moving element alone, but rather high torque in combination with light weight of moving element and high ratio between torque and weight of moving element.

## Westinghouse Salesmen's Meeting.

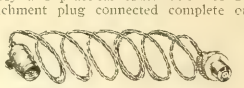
Recently the salesmen from the various district offices of the Westinghouse Electric and Manufacturing Company in the United States gathered at East Pittsburg, Pa., to attend the second in a series of three salesmen's meetings for the year 1905. The meetings were presided over by Mr. C. S. Cook, the manager of the railway and lighting branch of the company's sales department. On Thursday evening, February 2d, the officers and the heads of departments of the company gave a banquet to the salesmen at the Hotel Schenley, at which there were 100 covers laid. By wise arrangement three meetings of the salesmen are arranged for the early part of every year, a number of salesmen from each district office being present at each meeting, so that every salesman in the company's service has an opportunity to visit the works once each year, however distant the territory in which he works may be.

WESTINGHOUSE SALESMEN IN PITTSBURG.

As is generally known, the managers of the various district offices of the Westinghouse company also come together to attend an annual meeting, but this meeting usually takes place the latter half of the year. In the two meetings of the salesmen which have been held unusual interest has been shown. The gentlemen in attendance at the second meeting appear in the accompanying picture, to which the following is a key: 1, G. B. Griffin; 2, Leon Goldsmith; 3, F. W. Loomis; 4, H. N. Brooks; 5, Malcolm Carrington; 6, W. L. Conwell; 7, H. C. March; 8, E. M. Bishoff; 9, C. B. Humphrey, manager detail and supply department; 10, C. W. Davis; 11, W. D. McDonald; 12, W. S. Rugg; 13, E. E. Mead; 14, E. M. Bassett; 15, J. S. Brett; 16, A. M. Miller; 17, W. C. Draper; 18, A. H. Allan; 19, George C. Ewing; 20, S. L. Nicholson, manager industrial and power department; 21, H. B. Crosby; 22, C. V. Allen; 23, Percy C. Owens; 24, Norman Stewart; 25, E. J. Brady; 26, E. B. Goldsberry; 27, Charles S. Cook, manager railway and lighting department; 28, H. A. Coles; 29, G. O. Noble; 30, A. A. Miller; 31, W. P. Jend; 32, L. N. Reed; 33, B. P. Rowe; 34, W. F. Lamme; 35, Thomas Cooper; 36, D. E. Drake; 37, F. B. Erwin; 38, S. Q. Hays; 39, E. C. Means; 40, W. W. Briggs; 41, W. W. Lovell.

## Ben-extension Attachment.

A handy and practical combination of a socket and attachment plug connected complete on lamp cord and called a "Ben-extension" has been placed on the market by the Benjamin Electric Manufacturing Company of Chicago. The combination, as the name implies, consists of an Edison attachment plug with lamp cord and a key socket or keyless socket



BEN-EXTENSION ATTACHMENT.

## Hanger for Electrical Conduit Pipes.

The Vela Hanger Manufacturing Co., New York city is offering a new conduit-pipe hanger which is intended to overcome the usual difficulties of providing a [illegible] duit in exposed [illegible]

hung within one inch from the ceiling or support. The hanger is of a neat and ornamental design, as may be seen from the accompanying illustration, and is easily placed in position by simply gripping the flange of the I-beam with the clamp and turning the casing of the hanger until it tightens the clamp on to the beam. The hanger is made in a number of styles. Styles A and B, of a type shown in the picture, are made to take pipes varying in size from one-half inch to one inch and consist of a hollow spherical shell cast in two parts and mounted on a pivot. The shell is made to grip the pivot by means of two small screws. The clamp is adjustable to any size of beam. Style B is similar to style A, except

HANGER FOR ELECTRICAL CONDUIT PIPES.

that it is cast in one piece and is made in sizes from one-half inch up to three inches and larger. All of the styles are furnished either with a wood screw or an I-beam clamp as well as with lag screw or toggle bolt. Style J is similar to style A, but is adopted for use as an outlet box for branch circuits. It is heavily coated with enamel for insulation purposes. The outlet is furnished with an insulating nipple. Style O hanger may be used in a number of ways; for supporting on metal beams, wire moldings, cleats, rosettes, receptacles, cut-outs, conduit pipe, armored cables, etc.

Reports are again rife concerning the formation of a syndicate of Wall Street capitalists to take over the St. Petersburg (Russia) traction system. The belief has been expressed that within a short time the syndicate, if formed, would be granted the privilege of constructing something like 250 miles of track in the Russian capital.

## The Present Status of Electric Furnace Working.[1]

By Charles F. Burgess.

The electric furnace owes its place in the scientific and industrial world to certain characteristics which it possesses and to the advantages which it offers over other means of generating heat, the principal one being the high degree of temperature which is made available.

The maximum temperature which may be obtained theoretically by the combustion of carbon in oxygen is higher than that which has been attained in the electric furnace, but practical conditions place a greater restriction upon it. At high temperatures carbon cannot be consumed to $CO_2$, but rather to CO, and this gaseous product escapes rapidly and carries the heat away from the furnace. Further, it is impossible, under practical conditions, to supply pure oxygen, and in utilizing the atmospheric supply not only must the large quantity of accompanying nitrogen be heated, but the excess of air which must always be supplied also carries away a large amount of heat. The maximum temperature which has been attainable in the combustion of fuel in the gaseous, solid or liquid form, from which volatile products of combustion are formed, probably does not exceed 2,000° C., and even this value can be obtained only at a low efficiency and under most favorable conditions for the conservation of heat.

In the matter of control of heat, the electric furnace stands by itself, for the rapidity of heating, duration of heating and adjustment of the temperature is under the full and exact control of the operator. Fusions can be carried out under oxidation or reducing conditions, for the construction of the furnaces makes it very easy to operate in an atmosphere of any gas desired. Higher purity can thus be attained.

The final advantage, which is really a summary of all the others, is economy of operation. The economy of the electric furnace as compared with that of other furnaces requires the balancing of electrical energy against energy obtained from the combustion of fuel, cost of installation and maintenance of the equipment, amount of labor, value of product and danger to operatives. A careful weighing of these factors in a considerable number of metallurgical and chemical operations on an industrial scale has shown the resultant advantage to lie with the electric furnace.

The refractory materials which are available for furnace construction are silica, magnesia, lime, chromite, alumina, carbon, graphite, siloxicon and some other materials of minor importance. The choice of materials is governed by the temperature and the nature of the charge (whether acid or basic). For an acid lining silica is most satisfactory. This material in its highest degree of purity resists a temperature of nearly 2,000° C. It can be obtained in the form of bricks, with a sufficiently low percentage of lime or other binding material to lower its melting point only a small amount. Such bricks are rather fragile, but there is a promising possibility that bricks made of pure fused quartz may soon be available. Lime and magnesium oxide are the materials most successfully employed by Moissan for the linings of his laboratory furnaces, and for industrial working a durable basic lining may be made of a high-grade magnesite brick. Chromite and bauxite bricks are also valuable constructive materials. The most refractory substance which can be used is graphite, which can be obtained in a high degree of purity in any desired form, this being manufactured by molding and baking carbon and subsequently subjecting it to the graphitization process. The limitations upon this material are that it must be protected from the air or other oxidizing agents to prevent its combustion, and, being a good electrical conductor, the furnace must be constructed so as to avoid short-circuiting by the carbon lining.

The resistance medium, or "resistor," when solid, usually consists of a core of carbon, coke or graphite, the technical features governing the use of which are ably discussed by FitzGerald. Metals may also be used, as in the well-known platinum resistance furnace. Many other substances are available, especially when we include those compounds which at ordinary temperatures are insulators, but which become conductors upon heating. Where such materials are used, provisions are necessary for starting, somewhat similar to that used for starting the Nernst lamp, which, indeed, is a miniature electric furnace whose principles of construction may well be applied to furnaces of larger size.

Examples of liquid-resistance materials are the aluminum furnace and certain types of electric furnaces which have been applied for the melting of iron, steel and other metals. Gaseous-resistance mediums are utilized in the various arc furnaces and in the processes used for the production of nitric acid from the air.

Iron and certain other metals may in some cases be used as electrodes where carbon is prohibited, and, to insure their durability, they are kept cool by a continual stream of water. This protection is afforded by a decrease of efficiency, due to the carrying away of considerable quantities of heat.

Another problem, which is by no means insignificant, is the matter of electrode connection. It is difficult to insure good conductivity between a metal in contact with carbon or graphite, and poor contact results in excessive development of heat at that locality. The brittle and fragile nature of the electrode materials preclude tight clamping. One of the leading electrometallurgical companies using graphite electrodes in a process in which that material suffers little or no corrosion, nevertheless was a large consumer of graphite, as the unequaled expansion of that material and the metal terminals to which contact was made caused much breakage.

An ingenious form of furnace which avoids electrode difficulties by eliminating the electrodes altogether, has been developed. This is accomplished by causing the resistance material to constitute the secondary of a transformer. This induction type of furnace can be used only to heat materials having a good conductivity, such as a melted metal, since it is not possible to set up a high pressure in the secondary of a transformer when the secondary consists of a single turn.

It has been pointed out that the electric furnace has won an industrial position, not as a competitor of the combustion furnace, but rather in the field of high temperature, working where the latter cannot enter. To a small extent, however, it has become a rival to fuel furnaces, owing to certain advantages it possesses, such as safety to workmen and purity of product. As an example of this, take the manufacture of carbon bisulphide and phosphorus, most of which is now produced electrically. Only a few years ago it was generally predicted that there was little possibility of the electric furnace being so developed as to compete with ordinary metallurgical furnaces in the production and treatment of metals such as iron, steel, copper, lead and zinc. While it was admitted that perhaps the electric furnace might insure lower labor and depreciation charges, less waste of material, higher quality of product and other advantages, it was stated that the cost of electric energy was so much greater than an equivalent amount of heat energy, derived directly from combustion, that no possibility of equal economy could exist. Calculation, as well as recent developments, shows this view to be erroneous.

Assuming that coal at $2.50 per ton has a calorific value of 14,000 B. T. U., the quantity of heat energy obtainable for $1 is 11,200,000 B. T. U. One electrical horsepower-year has for its heat equivalent 22,400,000 heat units. If an electrical horsepower-year generated by means of steam be assigned a value of $50, $1 will produce about 450,000 B. T. U. Assuming equal efficiency in the utilization of the heat derived from the two sources, the ratio of the cost of energy is as one to 25. This discrepancy shows the handicap which steam-generated electricity has for electric-furnace operation. The development of enormous waterpower has resulted in great reduction in the cost of generating electrical energy in certain localities. There has been much discussion of late as to how cheaply hydraulically generated electrical power can be produced. In the report of the commission appointed by the Canadian government to investigate electrometallurgical process a value of $10 per horsepower-year was given as a reasonable estimate. At this figure, the heat units per dollar becomes 2,250,000, which is about one-fifth that obtainable from one dollar's worth of coal.

The efficiency of the ordinary furnace for steam generation is not far from 60 per cent., this high value being attained by the low temperature, about 250° C., to which the steam is heated. The metallurgical furnace having the highest efficiency is the blast furnace for the production of pig iron, which has a thermal efficiency of from 50 to 80 per cent. This exceptional economy is due to the fact that the fuel is in direct contact with the material to be heated, producing a direct transference of heat. However, for this purpose, the cheaper grades of fuel cannot be used, a hard, pure coke or charcoal being required, at a cost several times greater than that for the cheaper kinds of fuel.

In the reverberatory furnace, in which the products of combustion pass directly over the charge to be heated, the efficiency is much lower, and a still lower value is obtained in those furnaces in which the heat must pass through refractory walls. In such crucible, muffle and retort furnaces the efficiency varies from two to 10 per cent.

The following table gives results of efficiency calculations on several types of furnaces, as compiled from various authorities:

| Product. | Type. | Thermal Efficiency. |
|---|---|---|
| Steam | Boiler | 50-60 per cent. |
| Cast iron | Blast | 52-66 " |
| Steel | Acid process | 11.9 " |
| Steel | Basic process | 10.0 " |
| Pig iron | Reverberatory | 8.5 " |
| Wrought iron | Reverberatory | 8 " |
| Steel | Siemens crucible | 4 " |
| Steel | Greenwood crucible | 2 " |
| Zinc | Retort | 2-3 " |

The values of efficiency given for steel and wrought iron are based upon comparisons of the heat theoretically required to raise the metal to the molten state, with that furnished by the amounts of coal used in the practical operation of the various processes and assuming a calorific value for the fuel of 14,000 B. T. U.

The simplest and most easily effected of the energy transformations with which we have to deal is the change of electrical into heat energy, such transformation being easily effected at an efficiency of 100 per cent. This cannot, however, be taken as the value for electric-furnace efficiency, for we can consider only that heat which is usefully applied. The heat usefully applied may be that required for melting or volatilizing a substance, or for producing other desired physical or chemical changes in it, and it is this amount of heat as compared with the total heat equivalent delivered to the furnace that determines its efficiency. Prof. Jos. Richards (Trans. Am. Elec. Chem. Soc., Vol. 2, 1902) discusses electric-furnace efficiencies at length, and from his calculations the following table is compiled:

| Type. | Product. | Horsepower. | Temperature. | Efficiency. |
|---|---|---|---|---|
| Acheson | Graphite | 1,000 | 3,300° C | 75 per cent. |
| Jacobs | Fused $Al_2O_3$ | 200 | | 74 per cent. |
| Acheson | Carborundum | 1,000 | 3,000° C | 76-5 per cent. |

The conclusion is drawn that a commercial efficiency of 75 per cent. is readily obtainable in electric furnaces ranging in size from 200 to 1,000 horsepower, and this value can undoubtedly be raised by increasing the size and bettering the construction as regards heat insulation. The estimates of efficiency at high temperatures can be only approximations, for ignorance regarding specific heats of material at such temperatures is a bar to exact calculations.

From previous calculations, it can be seen that the industrial electric furnace operates at an efficiency over five times as great as that of the industrial combustion furnace, and consequently electrical energy at $10 per year can compete on an even basis with coal at $2.50 per ton.

Of such great promise is the use of electrical energy in the metallurgy of iron and steel that the Canadian government appointed a commission to thoroughly investigate the state of the art. The report, which has recently been distributed, is a most important addition to our electrometallurgical literature, and will undoubtedly do much toward establishing confidence in electric-furnace methods. The following table gives extracts from this report, the figures being obtained by tests which the commission made upon various processes in operation in Europe:

| Process. | Product. | Mean Horsepower. | Horsepower-year Per Ton of Product. | Power Factor. | Frequency. |
|---|---|---|---|---|---|
| Heroult | Pig iron | 218 | .47 | 75 (about) | 80 |
| Keller | Pig iron | 834 | .475 | 73-7 | 50 |
| Keller | Pig iron | 308 | .229 | 56-4 | 37 |
| Kjellin | Steel | 105 | .116 | 67.2 | 15 |
| Kjellin | Steel | 203 | .145 | 64.9 | 15 |
| Heroult | Soft steel | 480 | .153 | | 33 |
| Heroult | Tool steel | 462 | .153 | | 33 |
| Heroult | Structural steel | 465 | .10 | | 33 |
| Keller | Steel | 240 | .112 | 85 (about) | 40 |

Coke used in crucible melting in Sheffield today probably varies from two to 3½ tons per ton of steel produced, and even in the large gas fired furnaces employed in America and Germany probably one ton of slack, costing not less than $2.50 is necessary.

The 0.15-horsepower-year necessary to produce one ton of steel by the electrical processes has for its heat equivalent 3,360,000 B. T. U., and one ton of coal at 14,000 B. T. U. per pound has a value of 28,000,000 units. If the gas-firing process be assumed to have 10 per cent. efficiency, the efficiency of the electrical process figures out about 80 per cent., thus confirming previous estimates.

### Discussion.

A. Bement of Chicago sent in a written communication asking among other things how it is possible that CO instead of $CO_2$ is produced at higher temperatures. Professor Burgess answered by saying that the carbon dioxide dissociates into carbon monoxide at temperatures comparatively low for electric-furnace temperatures. Even at 2,000 degrees the tendency is quite marked.

Prof. D. C. Jackson of Madison, Wis., spoke very favorably upon the future of electric-furnace processes, and he believes that the electric furnace will do much to revolutionize many of the present ideas concerning the construction and properties of various substances.

Fritz Lubberger of Chicago asked if the action of the electric furnace might not be due to something more than the mere heat generated therein. He thought that there might be an action somewhat analogous to the phenomena presented by radium, a dissociation process among the ions of the substance.

To this Professor Burgess answered that it was a matter that has never yet been fully explained, but it is thought that some such ionic action does exist in the electric furnace. The so-called silent discharge and also spark discharges have been observed not to have a dissociating action, but when the spark is long drawn out until it takes the form of an arc the action does occur. In the production of nitrogen from the air the arc must be used to obtain results.

Secretary J. H. Warder asked about the production of fused quartz by the electric process.

Professor Burgess said that the glassware they had been able to obtain in the laboratory was all opaque. The quartz when melted seems to be of a viscous nature, which will not run so as to make a clear glass. He has been able to obtain small tubes 20 inches in length which may be thrown white hot into water without breaking. These might be used to great advantage for pyrometer tubes in taking the interior temperature of furnaces, as they could be put in and withdrawn from the furnace at once without breaking, while an ordinary pyrometer tube must be put in and taken out very slowly to prevent its breaking, several hours being necessary for the process.

1. Extracts from a paper read before the Electrical Section of the Western Society of Engineers, February 10, 1905. Prof. Burgess is at the head of the electrochemical department of the University of Wisconsin.

## Indiana Electric Railway Association.

The second monthly meeting of the Indiana Electric Railway Association was held at Anderson on February 9th. The large attendance and interest manifested places the success of the association beyond a peradventure. The principal feature of the programme was a paper on passenger traffic, read by J. F. Selechinger, superintendent of the Muncie, Hartford City and Fort Wayne Traction Company. Mr. Selechinger confined the text of his paper to the operation of the Muncie, Hartford City and Fort Wayne line by exhibiting a profile of the road and tables showing the number of stations, the number of miles between stations, the population, the fare charged and the number of passengers carried between stations during the year and the profit to the company of each class of passengers. The comparisons were figured out to a nicety and the author of the paper was heartily applauded by the members.

The reading of this paper aroused a hearty discussion as well as numerous inquiries, which Mr. Selechinger readily answered when confined to the purview of his paper. Mr. Selechinger showed how passengers could travel from interurban points in Indiana to interurban points in Ohio and other states and compared the time required, the speed per mile and the fare charged with the time speed and fare charged for the same trip by steam lines. He said that by reason of an hourly service and close connections the interurban lines could save the traveler about four hours per day and transport him from city to city at one-half the cost of steam-road transportation. He also said the traction lines had the advantage over steam lines by landing the people in the heart of the cities, whereas the steam lines landed them in the outskirts.

After discussing the interchangeable mileage tickets it was agreed that the Indiana and Ohio roads should get together on the interchangeable mileage business. It was explained that the few roads that have adopted the plan are highly satisfied with results. The president appointed the following committee to devise a plan for the use of interchangeable mileage tickets among the various traction lines: E. C. Folsom of the Fort Wayne and Wabash Valley Traction Company, C. A. Baldwin of the Indiana Union Traction Company, M. C. McKown of the Indianapolis and Eastern Traction Company, F. D. Norval of the Indianapolis and Northwestern Traction Company and J. H. McSmith of the Indiana Electric Railway Company.

F. D. Norval, general agent for the Indianapolis and Northwestern Traction Company gave an interesting account of his road's experience with low-rate Sunday excursions during the last summer. He said they had been successful and profitable.

J. W. Chipman advocated the plan of making a "week-end" reduction rate; tickets sold on Saturday and Sunday good returning on Monday. The question of free transportation of baggage was deferred until the next meeting.

J. H. Merrill, secretary of the Ohio Electric Railway Association, gave an interesting talk on Ohio methods in general.

The members of the association were the guests of A. W. Brady, president of the Indiana Union Traction Company, at a seven-course dinner at the Doxie House. After dinner the power house was visited.

The following persons attended the meeting:

Anderson, A. A., general superintendent, Indianapolis and Cincinnati Traction Company.
Atkinson, H. M., president, Lebanon and Thorntown Traction Company.
Baldwin, Charles A., superintendent, Indiana Union Traction Company.
Barry, J. A., general superintendent, Indiana Northern Traction Company.
Black, A. J., chief engineer power plant, Indiana Union Traction Company.
Brady, A. W., president, Indiana Union Traction Company.
Brown, A. C., engineer, National Bridge Company.
Chipman, J. W., general manager, Indianapolis and Eastern Traction Company.
Carpenter, L. E. C., claim agent, Indiana Union Traction Company.
Clark, C. E., manager, Indianapolis and Northwestern Traction Company.
Custer, R. J., engineer maintenance of way, Indiana Union Traction Company.
Dunbar, S. R., purchasing agent, Indiana Union Traction Company.
Emmons, C. D., general superintendent, Fort Wayne and Wabash Valley Traction Company.
Frazee, William M., claim agent, Indianapolis and Cincinnati Traction Company.
Folsom, E. C., superintendent transportation, Fort Wayne and Wabash Valley Traction Company.
Hendrickson, E. G., auditor, Indianapolis and Martinsville Rapid Transit Company.
Henry, Charles L., president, Indianapolis and Cincinnati Traction Company.
Hogate, Charles, chief engineer, power station, Indianapolis Traction and Terminal Company.
Irwin, William G., president and general manager, Indianapolis and Columbus Traction Company.
Jeffries, G. K., superintendent, Indianapolis and Northwestern Traction Company.
Kehoe, M. J., chief engineer, Fort Wayne and Wabash Valley Traction Company.
Matson, J. L., superintendent motive power, Indiana Union Traction Company.
McQuilkin, I., comptroller, Indiana Union Traction Company.
Merrill, J. H., auditor, Western Ohio Traction Company, and secretary of the Ohio Electric Railway Association.
Moore, J. W., chief engineer, Indianapolis and Cincinnati Traction Company.
Morgan, C. E., auditor, Indianapolis and Eastern Traction Company.
Nicholl, H. A., general manager, Cleveland and Southwestern Traction Company, Cleveland, Ohio.
Nicoll, G. D., representing Sargent & Lundy, Chicago.
Norval, Frank D., general agent, Indianapolis and Northwestern Traction Company.
Palmer, R. W., General Electric Company, Cincinnati, Ohio.
[illegible]
[illegible]
[illegible]
[illegible]
[illegible]
Thornton, F. C., Westinghouse [illegible] Company.
[illegible]
White, Paul H., [illegible] Rapid Transit Company.
[illegible]
Williams, R. G., [illegible]
Wood, Robert P., [illegible] Northwestern Traction Company.
Wright, W. B., [illegible] Company.

## Motor-starting Panels with Circuit Breakers.

One of the recent changes in electrical practice is the general adoption of switchboard panels containing the control apparatus for individual motors. Before their introduction and in those installations where they are not yet used, controlling rheostats, line switches and protective devices have been mounted in the most convenient places available, often with apparent disregard of fire risk or the protection of the operator. The use of a panel insures the proper mounting of the apparatus and provides a neat and convenient arrangement, with means for mounting in any desired location.

The accompanying illustrations show one of two styles of starting panels for direct-current motors designed by the Westinghouse Electric and Manufacturing Company, and employing a two-pole Type-D circuit breaker instead of the customary switch with fuses. The circuit breaker is especially adapted for this use, as one pole is connected in each leg of the circuit, the poles closing independently but tripping simultaneously. In closing the circuit, if there is an overload upon the line, the pole first closed opens immediately upon closing the second, thus instantly interrupting the circuit and preventing damage. It is strongly built, with few parts, none of which are small. It is provided with hinged, movable contacts of the brush type, and with carbon tips to which the current is shunted when the circuit is broken, preventing sparking at the contacts. The circuit is fully broken at the contacts before there is any movement of the carbon tips. There are no springs, except the strong strip of spring steel which carries the carbons, the blow of the armature tending to open the breaker and not simply to release the moving parts. The device is reliable in its action and is adjustable for different loads.

FIG. 1. MOTOR-STARTING PANEL WITHOUT FIELD RHEOSTAT.

These panels with circuit-breakers are furnished in two styles—those with field rheostats for motors requiring shunt-field regulation for varying speed, and those without field rheostats for constant-speed motors. Fig. 1 is a view of a panel of the latter style.

A starting rheostat with minimum voltage release is generally employed with Westinghouse motors. As soon as the supply circuit is interrupted the rheostat automatically opens the circuit, making it impossible to damage the motor by restoring full line potential to the circuit when the motor is at rest. The field rheostat ordinarily provided is mechanically strong, and will stand continuously the field current [illegible] made with front connections, if desired. These panels are designed in strict accordance with government specifications, and answer all requirements of the most rigid inspection.

FIG. 2. MOTOR-STARTING PANEL MOUNTED ON MACHINE.

They are especially adapted for separate machine-tool drive, being so designed as to permit mounting directly on the frame of the machine tool driven by the motor, as shown in Fig. 2.

## Carnegie Institute Building in Pittsburg.

The extensions to the Carnegie Institute in Pittsburg are rapidly nearing completion. They represent an expenditure of $5,000,000, the gift of Andrew Carnegie. The new building almost obscures the original structure, which itself, a previous gift of Mr. Carnegie, cost $3,000,000. It occupies a width of 400 feet in Forbes Street and a depth of 600 feet. In addition to the portion devoted to the library, comprised within its walls are to be found art galleries, a museum, a music hall, a lecture hall, a restaurant and the general offices required for the supervision and operation of these many divisions.

The basement will be an exceptionally busy part of the buildings, as in addition to the modeling and casting room for the art department workshops will be installed, where the repairs necessary for the maintenance of the building will be carried out. The printing office and bindery used in connection with the library and the large lighting and heating plant necessary for illuminating and warming such a large building are also situated in the basement. The scheme of workmanship is based on a high standard, the architects, Alden & Harlow, having based their designs on the leading institutions of this type, both in Europe and this country. The heating and lighting plant when completed will form a very interesting example of an installation that both in workmanship and appearance will be of high quality, the specifications on these points being unusually rigid. The contract for the electric generators has been let to the National Electric Company, Milwaukee. It consists of five 300-kilowatt, 120-revolution, 12-pole, 125-volt, direct-current, engine-type generators. These machines will be of the latest design and best material, of massive though pleasing appearance, the heaviness in outline being relieved by the elliptical section of the frame. All visible bolts will be nickel-plated and the field coils taped on the outside and finished with a wrapping of fish-net cord. The terminal boards will be of Vermont marble. The total net weight of each generator will be about 55,000 pounds, the armature and commutator accounting for 18,000 pounds. On the final test the generators will be expected to withstand a momentary overload of 75 per cent. without flashing and to operate from no-load to 25 per cent. overload without shifting the brushes.

## Ohio Telephone Notes.

The City and Suburban Telephone Company of Cincinnati has arranged to start a school of instruction for telephone operators in rooms in the Canal Exchange Building. A corps of instructors will endeavor not only to teach the routine of the operating room, but have the girls learn how to think. The management believes that operators should know how to think well in order to handle the business at the exchange. They must know what to do under certain conditions themselves, without spending time to ask others. The course is intended to balance the mind and strengthen the judgment of the operators.

A report from Lima is to the effect that C. P. Cory has been appointed receiver of the Texas Construction Company, which was organized by citizens of this state to build long-distance telephone lines in Texas. It is said the business has been transferred to the Commercial Telephone Company, in which the same persons are interested. M. D. Shaw, H. M. Daugherty, J. W. Faulkner and others are interested.

Frank L. Beam of Columbus has been made a member of the board of directors of the Home Telephone Company of Dayton. Mr. Beam is manager of the Citizens' Telephone Company of Columbus.

The Dorset Telephone Company of Dorset has been incorporated with a capital stock of $3,000 by H. A. McConnell and others.

L. E. Sims, W. F. Rhodes and others have incorporated the Bloomer Telephone Company, Bloomer, with a capital stock of $5,000.

An increase of capital stock from $10,000 to $15,000 has been made by the Barlow and Watertown Telephone Company of Watertown.

A new directory will be issued by the City and Suburban Telephone Company of Cincinnati on March 1st.

It is stated that all the repair and construction wagons of the Cuyahoga Telephone Company will be equipped with electric motors. Owing to the fact that the company has its own machinists and generating station, the operation of the motors will be economical.

An Independent company, it is understood, will be organized at Chatfield.

The Black River Telephone Company will spend $15,000 in improvements and extensions at Lorain. An exchange will be installed at South Lorain.

The Mill Creek Valley Telephone Company has been organized to operate in towns in what is known as the Mill Creek Valley, near Cincinnati. William Armstrong is president of the company, and Arthur Gillman, secretary and treasurer.

The Mount Vernon Telephone Company has purchased land on East Gambier Street in Mount Vernon, 30 by 114 feet in dimensions, on which a three-story building will be erected in the spring. Plans are now being drawn by Architect Wilber T. Mills of Columbus.

The Triadelphia-Sayre Telephone Company has been incorporated with a capital stock of $5,000 by B. H. Petit, M. R. Hearing and others. The headquarters will be at Porterville.

Dates for the district meetings of the Ohio Independent Telephone Association have been arranged as follows: No. 1, Electric Building, Cleveland, February 14th; No. 8, Boody House, Toledo, February 15th; No. 7, Lima House, Lima, February 16th; No. 6, Home Telephone Company's office, Dayton, February 23d; No. 5, St. Charles Hotel, Hamilton, February 24th; Nos. 4 and 9, Hartman Hotel, Columbus, February 28th; No. 3, Clarendon Hotel, Zanesville, March 1st; No. 2, McKinley Hotel, Canton, March 2d. It is expected that much interest will be manifested in these meetings, because of the state meeting following on March 30th. C.

## Indiana Telephone Items.

Two telephone companies filed articles of incorporation during the last week. The Fairview Co-operative Telephone Company of Tipton County, with a capital stock of $1,025, to build an exchange at Fairview and construct and operate telephone lines in Tipton and Hamilton counties, W. H. Achenback, S. J. Bozell and Charles McClury, incorporators; the Battleground Telephone Company, with a capital stock of $1,500, to operate in Tippecanoe, Benton and White counties, W. J. Walters, president, and Edward Towers, secretary.

I. D. Garrigus of Cedar Grove, Franklin County, has been granted a franchise to erect and maintain telephone lines from Highland Center to Cedar Grove and from Cedar Grove to New Trenton and other points in the county.

Citizens of Bunker Hill have petitioned the Bell Telephone Company for a monthly rental at $1 and better service. The company making no reply to the petitioners, the Town Council has granted a franchise to a company of citizens to construct an Independent telephone plant in the town.

The City Council of Spiceland has refused a franchise to the Spiceland Co-operative Telephone Company.

The directors of the Alamo Telephone Company have purchased an exchange building, into which it will remove the switchboard and offices. The system will be extended and other improvements made.

The Bell Telephone Company has completed the work of thoroughly equipping the Fort Wayne and Wabash Valley Traction line between Fort Wayne and Logansport with a telephone system both for despatching trains and for general business. The new system is the latest in use by modern interurban lines. The telephone wires are strung on the trolley poles. The work of directing all the interurban cars in operation on the line is after the ordinary methods of train despatching, except that the telephone is used instead of the telegraph.

It is reported that the De Forest Wireless Telegraph Company will give to Purdue University at Lafayete a complete space-telegraph outfit. S.

## Telephone News from the Northwest.

It has been reported that the Winona Telephone Company, at Winona, Minn., was to sell out to the Northwestern Telephone Exchange Company, but this is denied by the Winona company.

Louis Betz, city comptroller of St. Paul, suggests a tax upon each telephone and telegraph pole as a means of driving wires underground.

Considerable work will be done in the construction of farmers' lines out from Walker, Minn.

A petition has been circulated at Grand Rapids, Minn., asking the Iron Range Electric Telephone Company to extend its long-distance wires west from Cass Lake to connect with Bemidji, Fosston, Crookston and other points.

The Home Telephone Company of Grand Meadow, Minn., has been incorporated with $50,000 capital stock. The incorporators are C. F. Greening, W. A. Nolan, Martin Axness and W. P. Lewis.

The Sacred Heart Telephone Company of Sacred Heart, Minn., has been formed with $10,000 capital stock to install a local telephone system, with rural lines.

The Grant County Telephone Company has sold its Wendell and Tintah (Minn.) lines to Skinnemoen Bros. of Wendell.

O. G. Nordmarken and others have been granted a local franchise at Granville, N. D., for a telephone exchange and electric-light plant.

The General Engineering Company of Chicago has asked for a receiver for the Sioux City (Iowa) Telephone Company, whose plant is in process of being installed.

Arrangements are being made at Hector, Minn., for a local telephone system, with rural connections.

The Greene County Telephone Company has sold several of its rural lines to the Mutual Telephone Company of Grand Junction, Iowa.

The Western Electric Telephone Company has secured the withdrawal of the Osceola County Telephone Company at Sibley, Iowa, where it had asked for a franchise.

The Iowa Telephone Company will establish long-distance connection between Burlington, Iowa, and Kansas City, Mo.

The Lake Park (Iowa) telephone exchange has been sold by H. Hill to the Midland Telephone Company.

The Ogallala and Big Springs (Neb.) Telephone Company has filed articles of incorporation, with James Gray heading the list of stockholders. Capital is placed at $5,000.

The South Fork Independent Telephone Company of Amelia, Neb., has been incorporated with $2,000 capital. R.

## Growth of the Cuyahoga Telephone Company.

The report of President Frederick S. Dickson of the Cuyahoga Telephone Company of Cleveland for 1904 shows a rapid growth in the business following the improvements in the plant completed on March 5, 1904. On February 29th the company had 10,260 subscribers and in March the gain was 37. April showed 428, and the increase continued, December showing 659. The total increase was 4,110, making 14,370 in service at the end of the year. As showing the continuation of growth, President Dickson states that 651 were added in January, 1905, making a total of 15,021. The gross increase in rentals, due to the work of the year, was $106,401.50, and the increase for January was $13,396.75.

The financial requirements for current liabilities for development made during the year amount to $437,121. In January, 1905, $167,000 bonds were issued, of which $32,000 was used in acquiring the Collinwood plant. The remainder is still in the treasury, as well as $741,750 par value of preferred stock. The future development in placing 6,000 telephones will justify the issue of $533,000 more bonds, and other sums needed may be obtained either by the sale of bonds or preferred stock.

The report of the treasurer shows gross earnings of $435,274.02 for the year. Operating expenses and taxes amounted to $239,741.37, leaving net earnings of $195,532.65. Deductions for interest on bonds and for other purposes leaves a surplus for the year of $67,133.13. After paying dividends on preferred stock, employes' share of profits and other items, there is a balance of $10,991.06 for the year.

A telephone system is to be constructed in Sangamon County, Ill., by H. E., E. L. and H. M. Farnam, who have incorporated as the Sangamon County Telephone Company of Pawnee, Ill. The capital of the new company is $20,000.

## Kansas Independent Telephone Association.

The fourth annual meeting of the Kansas Independent Telephone Association was held in the Throop Hotel, Topeka, Kan., on February 8th and 9th. There was a good attendance, and the papers and committee reports were instructive to the members. The meeting was opened with an address of welcome by Governor Hoch of Kansas. A. A. Goddard, president of the association, responded with a pleasing address. After listening to a number of interesting reports from committees, the session was adjourned for luncheon.

In the afternoon the discussion centered on the question as to whether the association should ask the Legislature for something in the way of preventing people who move houses from cutting telephone wires. It was finally decided that there were enough laws on the statute books, if properly enforced, to give the telephone companies of the state all the protection needed. J. M. Doyle of Belleville read a paper on the subject, "What of the House Mover?" Other papers read and discussed were: "Community of Interests," by C. E. Wells, and "Effect of Mutual Farm Lines on Local Toll Business," by J. A. Zimmerman.

In the evening a smoker was held at the Throop Hotel, which was attended by 150 members. The occasion was very enjoyable, and as the members sat at the table a flashlight picture was taken.

A long programme of papers had been prepared for the second day's session, but on account of an unfortunate dispute which arose over the disappearance of a petition which was to have been presented to the association, the reading of several of them was omitted. The petition which caused the trouble was one which had been circulated asking that a large manufacturing house be not patronized by Kansas Independent telephone men, alleging that the company is in combination with the Bell interests. One of the principals in the difficulty was arrested.

H. D. McVeigh of Wichita read a paper on "Development and Operation of the Wichita Exchange." A paper entitled "Supply Dealers, Manufacturers and Ourselves," was read by W. H. Nelson of Smith Center. Other papers on the programme were: "Toll-line Accounting," by C. L. Brown; "The Kansas City Home Telephone Company," by O. C. Snider; "The Consolidated National-Interstate Association," by Theodore Gary, president of the Interstate association.

The election of officers resulted as follows: President, A. A. Goddard of Topeka; vice-president, J. M. Doyle of Belleville; secretary, C. E. Wells of Marion; executive committee, J. E. Byers of Ottawa, M. L. Robinson of Galena, C. E. Pearl of Hiawatha, W. H. Nelson of Smith Center.

## EXTENSIONS AND IMPROVEMENTS.

The Sunset Telephone Company is preparing to make important extensions of its system in Reno and Sparks, Nev.

The Kansas City Long-distance Telephone Company has issued bonds to the amount of $1,500,000, taking up old bonds, and to build new lines.

The stockholders of the Home Telephone Company have authorized an issue of $150,000 worth of bonds at five per cent. The money will be used to complete the system being constructed at Santa Monica and Ocean Park, Cal.

Extensive improvements will take place in the telephone service in York, Pa., in the near future. The York Telephone Company will do away with the old method of drops on the switchboard and will install the central-energy system.

A rural telephone line is to be established connecting Nooksack, Clearbrook, Forest Grove, Van Buren and the farmers along the route, with a central office in Everson, Wash., where connection will be made with the Sunset Telephone Company.

The Utah Independent Telephone Company has asked the City Council of Provo, Utah, for a franchise to operate its system in that city. The Utah company has installed an exchange at Bingham, Utah, and is preparing to make other important extensions of its system throughout the state.

The American Machine Telephone Company, which is reported to have sold its rights to the Lorimer Company of Chicago, is installing a telephone system in the city of Peterboro, Ont., in opposition to the company now operating there. Mr. Neil, the president of the company, expects to obtain a similar franchise in the city of Brantford, Ont.

The Kinloch Long-distance Telephone Company of St. Louis and the Illinois Telephone Company of Jacksonville, Ill., have completed working on toll lines to connect their respective systems. The Kinloch company is now furnishing service to all the Independent telephone exchanges in and around Jerseyville, Carrollton, Jacksonville, Pittsfield, Roodhouse, Winchester and White Hall, Ill. This addition to the Kinloch company's toll system enables it to reach every town of importance in Jersey, Greene, Scott, Morgan, Cass and Pike Counties, a territory covered almost exclusively by the Independent telephone interests.

### Telephone Line Engineering.[1]

By C. J. H. Woodbury.

The amount of capital amassed in the approximately 4,000,000 miles of line construction necessary to connect together in a unity the subscribers of the Bell telephone system is of itself a warranty as to the importance of the subject; while the rapid depreciation to which most of this property is subjected requires both technical skill and business judgment to decide upon the most judicious methods of construction of this vast plant amid varying circumstances of natural conditions and commercial use in order to reach the most economical point of investment.

The increase of every commercial application of electricity to meet the demands to supply service to patrons has been so great that an essential portion of every problem in constructive electricity must take into consideration provisions for future growth as well as the inevitable depreciation.

Although 45 per cent. of the wires are on poles, the total extent of the pole lines exceeds the length of the underground conduits, as the latter are used only in cities where the conduits contain a greater number of lines to reach the concentration of patronage. The extent of the pole lines is shown by the fact that in the Bell telephone system there are approximately 6,300,000 poles, and about 1,000,000 are required annually for replacement and for extension of lines. A number of years ago a large collection of logs, known as the Joggins raft, was towed from Nova Scotia to New York, and this raft contained many long poles which were not suitable for masts.

Some of these long poles were used for the largest pole line ever built, at the westerly side of New York city, and carrying 250 wires each. At the present time there are single underground cables comprised of 4.8 times as many conductors, and under the main streets in the principal cities are conduits of sufficient capacity to carry 400 times as many wires as one of the pole lines.

When a telephone line is built in or near cities the close connection with supplies and labor renders that portion of the work comparatively easy, but in the construction of long-distance lines across country, connecting various cities, towns and villages within speaking distance of each other, it is necessary to provide means for the execution of the work on an independent basis.

In a suitable locality a camp consisting of a number of tents is pitched, one of them being a dining tent, another is where the cook holds sway, and the engineers' tent, where such details as must be left until the work is in progress receive attention, while several tents are necessary to provide for the sound sleep which awaits the close of a good day's work.

If the route runs through a wooded country a wide swath is cut in the forest and the post holes may be made by the diggers, or in other instances a charge of dynamite deposited in an auger hole makes quick work, the greatest relative gain being in compact clayey soil.

Meantime the poles have been brought to their sites by teams and then moved to the exact place by the help of an axle mounted on a pair of wheels termed a dinkey; gains are cut and the cross-arms attached before they are raised, either by all hands with pikes giving a long push, a strong push and a hard push altogether, to change the old aphorism, or if the country is not too rough to permit, a portable derrick mounted on a wagon is drawn to the site, then the horses are taken from the pole and pulling at the rope quickly raise the pole.

The final attachment of the wires to the insulators on the cross-arms is very carefully done, because it is necessary that the wires should be drawn to an extent that they should not sway against each other, and yet not so tightly that the contraction in cold weather would put a stress on the wire which would produce danger of breakage, for at these small amounts of dip in the wires a slight difference in the length of the line will cause a great variation in the stress.

Iron poles are but rarely used in this country, the principal condition governing their selection being on some lines in prairie countries in the West where campers are so prone to cut down wood poles for fuel that tubular iron poles have been substituted. In Europe there are many iron poles, and in tropical countries infested with white ants it is necessary to use iron poles or to attach the wires to living trees.

While gravelly soil will hold a pole to the limit of its strength, it is necessary to build lines in many places where such conditions do not occur. The New Orleans and Mobile line, along the north shore of the Gulf of Mexico, traverses marshes composed of soft mud, which extends to a great depth, upon which a rank sedge grass grows 12 to 15 feet in height, whose coarse roots form a compact mass about a foot in thickness. In order to prevent this line from being injured by the fires which rage among these marshes in the early spring the grass is kept cut to a width of 100 feet along the route.

It has been possible to sustain poles along this route by bolting heavy cross-pieces across them at the ground level, having cut an opening among the roots through which the butt of the pole can be inserted, and then the pole is braced as [illegible] may require, sometimes in four directions, [illegible] these braces being supported on [illegible] at the marsh level. In some instances a [illegible] three, poles are used, each being attached to the same cross-arm.

At the Tybee marshes, near Savannah, Ga., the ground is so soft that it cannot be walked upon, and the men engaged in building the line were obliged to lay a line of boards to proceed along the route. When a pole was to be set, cross-pieces were temporarily attached to it near the lower end, and men standing upon these supports "jounced" in unison while the pole was held vertically by pikes. Under this human piledriving the pole sank rapidly, but the mud is so adhesive that in a short time the pole is securely held.

In the sandy soils, particularly in New Jersey, poles are set on the principle of the jet pile wherever there is a supply of water. A half-inch pipe about six feet in length is temporarily attached to the side of the pole, with its lower end at the butt. The other end of the pipe is attached to a garden hose, and when the pole is upended the stream of water makes a quicksand into which the pole sinks until the water is shut off, and the pole is sustained by pikes until the water settles, leaving the pole securely held by the sand, which becomes water-packed around it.

In mountainous countries the ledges are an impediment to excavations for poles, and although dynamite is frequently used, yet poles are set upon rock without excavation and a large number of stones are piled around them in such quantities as to grip the poles securely, although guys are generally necessary.

An ice-laden line swayed by the wind may be successfully resisted by the poles until the oscillations of the pendulum reach a synchronism with that of the vibration of some pole on the line which responds in like manner to the cumulative impact across the direction of the line until it breaks this individual pole. Then adjacent poles are relieved of the pull on one side, and the excessive unbalanced stress breaks them. Such is the story of a wrecked aerial line broken by stresses not included in the ordinary course of events and which must be provided for by large factors of safety.

A pole is not to be compared to a mast upon a vessel, for these extreme conditions of severe exposure to telephone lines occur in winter when the ground is frozen and holds the base of the pole rigidly, while a vessel in a gale heels when struck by puffs and the sails "spill the wind," and in this manner the masts sustain exposure to winds which would break them if held rigidly to long-continued impact.

While the currents used on the telephone system are so minute as to be without power of damage, yet their wires in crossing the lines of electric-lighting or power systems may in making short-circuits cause serious mishaps to the electric-lighting or power plant and in any event materially interfere with the service. The remedy against the liability of such crosses is the simple one stated by a judge of a United States court, in which the decree was given that the distance between the high and low-potential lines should be equal to that of the highest pole, so that in the event of the falling of a pole the wires would come short of reaching the other line. In many instances congestion of electric service and narrow streets prevent any such wide separation, and it becomes necessary to take every precaution for substantial construction.

The aerial wires are so visibly in evidence, and often to an obstructive extent, that they may be cited as the portion of the system which naturally receives especial attention from the public.

The tension on a line suspended between a pair of horizontal supports varies with the sag and is at a minimum when the sag amounts to seven-twentieths of the span, and the tension increases whether the sag is greater or less than this proportion.

For example, with No. 12 hard-drawn copper wire weighing 173 pounds to the mile and being 0.104 inch diameter and having a span of 130 feet, the minimum tension of three pounds would occur if the sag was 43 feet six inches, while it would slowly augment with increase in the sag, and if nature had furnished a chasm deep enough for the experiment it would be expected to reach its breaking tension of 550 pounds at a depth of 16,470 feet, or 3.17 miles.

On the other hand, the increase in tension proceeds rapidly as the wire is drawn to approach a straight line, the breaking tension occurring at a sag of 1½ inches.

As a comparison with this instance of the stresses in a local line, in the case of the No. 8 hard-drawn copper wire 0.165 inch in diameter and weighing 435 pounds to the mile, as used on long-distance telephone lines, when the span is 150 feet the minimum tension occurs at a dip of 52 feet six inches, when it is only 8¾ pounds, and in like manner, as in the foregoing instance, its breaking stress of 1,328 pounds would be reached at the slightly less dip of 16,100 feet, or 3.04 miles, still too great to admit of confirmation by direct experiment; but if the wire was pulled until the sag was 2.2 inches, it would require the breaking load of 1,328 pounds.

It is desirable that the wires should be drawn tight enough to prevent them from swaying against [illegible]

[illegible]

When a wire is laden with sleet the strain lengthens the wire and the increased sag diminishes the tension sometimes to an extent sufficient to save the wires, which would otherwise be broken were it not for this elongation.

The electrical advantages of copper over iron could not be utilized for aerial wires, because commercial copper has so little resilience that it will continually stretch under its own weight and become attenuated to an extent that it will break, until Thomas B. Doolittle produced the hard-drawn copper wire which is now in universal use on aerial lines. The treatment consists in omitting the annealing processes during the latter portion of drawing the wire, but it deviates from the usual method by attenuating the wire by smaller gradations at the latter die plates. The rate of diminishing the wire is wholly an empirical one, at first determined by long and thorough experimentation, and as the hardening occurs for the most part near to the surface the tensile strength per square inch of section is greater with smaller than with larger wires.

Where lines traverse mountainous districts or water courses it is frequently necessary to build spans of great length, using either one of the special bronzes or steel wire for the purpose. The Connecticut River at Middletown is crossed by wires having a span of 1,350 feet, suspended between a steel-trussed tower 185 feet high on the east side and a similar tower on the bluff on the west bank is 85 feet high.

From Enfield to Windsor Locks the Connecticut is spanned by a suspension bridge consisting of two steel cables one inch in diameter and 955 feet long, to which are fastened two-inch by three-inch joists four feet four inches long set 12 inches on centers. On this bridge are laid four cables containing 100 pairs of wires. The tower on the west bank is 45 feet high and the one on the east bank 33 feet high.

The St. Francis River, near Madison, Ark., is crossed by a span of 1,000 feet, with wires supported upon steel-trussed towers 100 feet in height, as it was necessary that the wires should be clear of steamers on the river, which has a varying level of 30 feet between flood and drought.

At the Raritan Canal crossing, near New Brunswick, N. J., a 60-foot span is raised 112 feet above the canal to avoid the shipping.

1. Abstract of a paper read before the Franklin Institute, Philadelphia, Pa., on January 12, 1905. Mr. Woodbury is assistant engineer of the American Telephone and Telegraph Company at Boston.

## GENERAL TELEPHONE NEWS.

The Dosbaugh Telephone Company has just begun constructing a plant at Cedarvale, Kan.

The Parsons Telephone and Electric Company of Parsons, Kan., has changed its name to the Kansas Home Telephone Company, and increased its capital stock to $60,000.

The Southern Bell Telephone Company's damage during the recent storms of sleet in the South is estimated at over $100,000. Many lines were either partially or completely wrecked.

A news item from Topeka, Kan., says that a bill has been introduced in the Kansas Legislature intended to compel joint service where two or more telephone systems are operated in any town.

The Camden (Mich.) Rural Telephone Company, which was incorporated about 18 months ago, has just held a stockholders' meeting and increased the capitalization from $10,000 to $25,000. The directors are reported to be negotiating with the Bell interests for a contract for toll-line service.

The city of Winston, N. C., has rescinded its action of January 21st, when a conditional franchise for a telephone system was granted to F. W. Siebert. Permission is given, however, to put in a long-distance line. It is possible that the town will construct, through the Board of Trade and Merchants' Association or by the city itself, a new system.

A telephone outfit was recently exposed by tearing up a section of floor in an apartment building in Chicago which the police believe to have been used for the transmission of racetrack information by gamblers. When an alarm was given the keeper of the resort was enabled to place two telephones and the records of the betting in a large tin box and conceal them in a hole under the floor, all within 10 seconds.

## New Long-distance Wireless Station in Chicago.

The American De Forest Wireless Telegraph Company opened its new space telegraph station at Thirty-third Street and Western Avenue, Chicago, on February 11th. With the opening of this station it is proposed to establish commercial wireless communication direct with Kansas City, Mo., and also with St. Louis, Springfield, Ill., Cleveland, Ohio, and Port Huron, Mich., where similar stations have been built. The new Chicago station is composed of a substantial building housing the apparatus and a mast 220 feet high from which the antenna is suspended. Manager Ocker of the Chicago office of the De Forest company says that the opening was entirely successful and there was no trouble in exchanging messages with the Kansas City office. Mr. Ocker said: "Eventually, however, the wireless system will probably be devoted chiefly to sending out stock quotations, market news and information that needs to reach a large number of places from a single point of origin. When our operator in Chicago presses the key the message can be received simultaneously at every station connected with Chicago. We expect also to have our service on lake vessels, so that constant communication may be had with the shore."

An attempt is to be made to communicate with the office at Key West, Fla., from Chicago.

## Efficiency of Steam-generating Apparatus.[1]

By A. Bement.

The accepted method of conducting tests of steam-generating apparatus determines the results of the performance of the combined apparatus and its manipulation. Such experiments are referred to as "boiler" tests, yet they are not properly tests of the boiler, nor do such experiments show the results of the performance of the fire or the furnace feature, except as measured through a more or less inefficient boiler. Basing results on the coal supplied to the grate less that which goes to the ash pit or is removed from the fire in cleaning is a step toward determining the efficiency of the boiler, but, with present methods, it is assumed that the effect of the fire is constant or uniform, although gas analysis is required which shows that fires differ in quality, but this fact is neglected in considering the efficiency of the boiler; yet any performance is dependent on the condition of combustion, or, in other words, the temperature of the fire.

The purpose of the boiler is to receive heat from the gases, which is supplied to them by the process of combustion. As heat only flows from a region of higher to one of lower temperature, and as its rate of flow is governed by the difference between the temperatures, it necessarily follows that most heat will flow to the boiler when its temperature is highest. It is useful in this connection to consider that heat and temperature are two entirely different things, temperature being the condition under which the heat is present. If a given quantity of heat is contained in a large amount of gas, it will be at a low temperature, but if in a small amount it will be present at high temperature. That this is true may be determined according to the formula

$$\text{Temperature} = \frac{\text{Heat developed}}{\text{Weight of gas} \times \text{its specific heat}}.$$

Thus the performance of a boiler is influenced by the temperature at which the heat is supplied; also, when a large quantity of heat is furnished, its absorption is less complete than with a small quantity, the temperature being the same in each case.

Therefore, if boilers are to be compared with each other, so their heat efficiency can be determined, it could be accomplished if supplied with the same relative quantity of heat at the same temperature. These conditions would be fulfilled if a uniform number of heat units be supplied for each square foot of heating surface per unit of time and at some accepted standard temperature.

Gauging the required quantity of heat to be supplied would present several difficulties. The heating power of the fuel could be determined by sampling an analysis previous to, instead of after, the test, which would enable the proper amount of heat in the coal to be furnished to the grate, but fuel lost in the ash-pit, removed in cleaning the fire or carried over the bridge wall, and incomplete combustion, would have a varying influence on the quantity of heat generated, and the percentage of such heat, undeveloped, must be known and provided for in the supply of the fuel to the grate. The use of a standard high-grade coal would, of course, very largely reduce these difficulties.

As different steam pressures have an influence on the amount of heat flowing to a boiler, it would be necessary to use some standard pressure, which need not be that which would be employed in service. And the loss of heat by radiation would be determined or not, as circumstances require, but with well-set apparatus it could be assumed to be constant at rated capacity.

The supply of a certain predetermined amount of heat would be a very difficult matter, and a less efficient boiler would absorb a smaller quantity of heat than a more efficient one, although the same quantity be supplied per unit of surface and time and at the same temperature; therefore, the less efficient boiler would do less work. Thus the capacity would not be the same for each, and instead of there being simply a difference in efficiency there would be a difference in both efficiency and capacity. It would probably be better to produce a uniform capacity as measured in equivalent pounds of water evaporated from and at 212 degrees per square foot of heating surface per hour, or, in other words, operate the boiler at its rated horsepower capacity, for example. This would be a simpler method than that of affecting uniform supply of heat, and a standard condition of combustion as shown by the gas analysis would insure that the heat be developed at the required temperature. Owing, however, to slight varying composition of fuels, it would be desirable to use coals in which the ratio between carbon and hydrogen is approximately the same. Thus, with standard conditions of developed capacity, initial temperature and steam pressure, the heat developed referred to the heat absorbed, will show the efficiency of the boiler, so that comparisons may be made.

The efficiency of any particular boiler is a fixed quantity, which, once ascertained according to some standard, applies to any number of reproductions, and thus need only be determined once. It does not follow, however, that the efficiency of different sizes of the same kind of boiler is the same. For example, there is a horizontal water-tube type which is usually made from nine to 14 tubes in height, the travel of the gases being three times across the tubes. The higher boilers are more efficient than the lower ones. For the reason that the gases pass across the tubes at a volume dependent on their temperature, and as the temperature drops, the volume becomes less, which results in a portion of the tube surface of the second and third passes especially not being in the path of the flowing gases, therefore the fixed path of the gases passes across 27 tubes in the boiler which is nine tubes high, and across 42 tubes in the one which is 14 inches high.

Purchasers' requirements will demand in the future, as in the past, that tests of the combined apparatus with the fuel to be used be made to demonstrate if a certain efficiency and capacity are obtainable. The results of such tests, however, are confusing when an attempt is made to determine the efficiency of boilers or of any portion of the apparatus.

It is the author's opinion that there is a greater difference in the efficiency of different boilers than is generally realized. In this connection, experiments on two boilers to determine their relative efficiency may be of value.

These boilers of a horizontal water-tube type adjoined each other in one battery. With each the gases were discharged to the same flue and steam at 175 pounds pressure to the same steam header. A chain-grate stoker was located under each, and the furnace feature of the apparatus was well developed by firebrick tile suspended from the bottom tubes of the boiler, which extends approximately 12 feet back from the front, corresponding to a brick arch of that length, in addition to the ignition arch of the stoker. These boilers are designated as A and B, and they and their associated features are exactly the same, except that of the path of travel of the gases among the tubes. With A, the gases travel with the length of the tubes once and do not act on all of the tube surface. With B, the travel is three times the length of the tubes, in separate passages, which caused the gases to come in contact with very much more of the tube surface than with the boiler A. Table I. gives the relative final temperatures of escaping gases at approximately the same capacity and condition of combustion. These experiments were not made at the same time, but the same kind of coal was used. The reason that the gas analysis was only carried to $CO_2$ is that, owing to the very efficient tile-roof furnace, combustion was always complete. The horsepower developed placed each boiler nearly on the same basis, being about three per cent. to the disadvantage of B, therefore the work done by each was approximately the same. The condition of combustion was also slightly in favor of boiler A, but this may be considered as approximately the same for each. Thus all conditions were practically the same except that of temperature of escaping gases, which showed a considerable difference in the boilers as gas coolers.

TABLE I.

| | Boilers. A. | B. |
|---|---|---|
| Condition of combustion, $CO_2$ | 10.7 | 10.3 |
| Horsepower developed | 564.3 | 580.4 |
| Heating surface, square feet | 1,800 | 1,800 |
| Temperature of escaping gases, final | 657 | 469 |
| Temperature of escaping gases, above air supply | 582 | 394 |
| Temperature of escaping gases, above steam temperature | 278 | 92 |
| Temperature of escaping gases, greater than B | 186 | ..... |
| Temperature of steam | 379 | 377 |

If the specific heat of gases at high temperature were known, the gas analysis and an ultimate analysis of the fuel would afford data for calculating the quantity of heat in a pound of gas at initial temperature, and the heat remaining at final temperature could be calculated from direct temperature measurement, and the efficiency could be expressed according to the equation,

$$E = \frac{H_1 - H_2}{H_1},$$

and it would not be necessary to determine the quantity used in such an experiment as given in Table I.

If the reduction in temperature of escaping gases from a boiler at 186 degrees may be taken as representing the work of an average economizer, then it appears boiler B possesses an efficiency equal to that of the combined efficiency of boiler A and an economizer; or, in other words, that B is as efficient without an economizer as the combined efficiency of boiler A with one, which serves to illustrate the great difference which may exist in different boilers.

These boilers were also tested by the alternate method of the standard code, which was feasible, because conditions could be exactly the same, and the object was to compare one with the other, and not with boilers in general. The tests were run at the same time, one being started 15 minutes before the other. Alternate wheelbarrows of coal from the same source were laid down before each boiler only as required. The thickness of the fire was the same. Each damper was full open and the speed of the stoker regulated so that the fuel bed extended to the end of the grate. The result is shown in Table II.

TABLE II.

| | Boilers. A. | B. |
|---|---|---|
| Pounds of pure coal burned per hour | 1,765.75 | 1,446.56 |
| Pounds of water evaporated per hour | 13,210.34 | 13,629.24 |
| Pounds of water evaporated per pound of pure coal burned | 7.47 | 9.42 |
| Heating power of pure coal B.T.U. per pound | 13,633 | 13,633 |
| Temperature of feed water | 212 | 212 |
| Temperature of gases, final | 594 | 442 |
| Temperature of gases, above air supply | 514 | 362 |
| Temperature of gases, above steam temperature | 217 | 65 |
| Temperature of gases, greater than B | 152 | ..... |
| Temperature of saturated steam | 377 | 377 |
| Draft over fire, inches of water | 0.38 | 0.22 |
| Horsepower | 383 | 395 |
| Efficiency, per cent. of heat absorbed by boiler | 52.93 | 66.73 |
| Fuel saving of boiler B over A, per cent | | 20.68 |

Pure coal is an expression which the author prefers to use instead of that of combustible, because the fuel free from ash and moisture contains oxygen and nitrogen, which are not combustibles. The capacities were lower than those in Table I., because the coal used was a less favorable size. This latter test shows the effect of the difference in efficiency of the two boilers in ordinary service.

The author prefers to recognize a steam-generating apparatus as being composed of separate features as follows: As boiler and grate, with this combination, the gases flow in contact with the heating surface immediately as they leave the fire. Also, as boiler, grate and furnace, the latter feature consisting of a refractory roof over the fire which extends back a considerable distance, its presence making it possible for the gases to be mixed together a sufficient extent while at high temperature, so that no combustible escapes oxidation. Such feature here designated as a furnace, if of a length of about 14 feet, will produce an ideal mixture of the gases if the coal is supplied to the grate at a uniform rate, but, if not, its ability to effect mixture of the gases is not sufficient for complete combustion. With the thick fire of a chain-grate stoker feeding bituminous coals, a considerable amount of combustible gas escapes from the front of the fire, such a quantity in fact, that an ignition arch alone, although five feet in length, does not cause sufficient mixture of the gas and air to produce complete combustion. Therefore, if the maximum requirement of the furnace is to thoroughly mix together the gases from a chain-grate fire, then the efficiency of such furnace features as fitted under boilers A and B is ideal, because proper regulation of the quantities of air and fuel supplied by the grate, resulted in the production of 18 per cent. $CO_2$ with complete combustion and no smoke.

The performance of the chain-grate stokers under boilers A and B are unsatisfactory in two respects: First, that with desirable strength of draft the available thickness of fuel bed does not supply sufficient combustible to satisfy the air supply. Second, fuel is wasted by passing over the end of the grate with the ash. This latter fault may be remedied by running the grate at a speed which will allow the fuel to burn away before it reaches the end, but this results in increased excess of air, therefore the chain-grate stoker, in combination with the above-described furnace feature, is inefficient to the extent by which it fails to supply a sufficient thickness of fire or quantity of combustible, and the loss of fuel with the ash is not a fault of the stoker, because if the supply of combustible was sufficient to satisfy the air the grate could be run at a speed which would insure that the fuel all be burned.

It is the author's wish, in presenting this paper, to suggest the advantages of more detailed study of steam-generating apparatus. Such results as shown by boiler B over boiler A would justify considerable investigation in connection with either selection or design, and the burning of inferior bituminous coal without smoke is a feature of increasing value.

1. A paper presented at the New York meeting (December, 1904) of the American Society of Mechanical Engineers.

The Capitol City Mills at Salem, Ore., are putting in a new electric-light plant.

## Chicago Union Traction Earnings.

Earnings of the underlying companies of the Chicago Union Traction Company for the last quarter of 1904 are shown by the report of the receivers to have exceeded by a considerable amount those for a corresponding period in 1903. The following table compares the earnings of the three systems for the last quarter of the last two years:

| | 1903 | 1904 |
|---|---|---|
| NORTH CHICAGO | | |
| Gross earnings | $[illegible] | $250,[illegible] |
| Operating expenses | 181,601 | 177,118 |
| Net earnings | 62,291 | [illegible] |
| Fixed charges | 67,893 | [illegible] |
| Deficit | [illegible] | 16,8[illegible] |
| Depreciation, rentals | 20,086 | [illegible] |
| WEST CHICAGO | | |
| Gross earnings | 436,88[illegible] | 476,8[illegible] |
| Operating expenses | 333,872 | [illegible] |
| Net | 103,010 | 15[illegible],429 |
| Fixed charges | 124,727 | 118,[illegible] |
| Deficit | 17,480 | 39,1[illegible] |
| Depreciation, rentals | 48,638 | 1,98[illegible] |
| CONSOLIDATED TRACTION | | |
| Gross earnings | 98,504 | 110,69[illegible] |
| Operating expenses | 89,231 | 115,070 |
| Net income | 9,366 | 4,378 |
| Fixed charges | 64,690 | 59,1[illegible] |
| Deficit | 48,676 | 57,138 |

The increase in earnings of the two systems is ascribed by the receivers largely to the operation of the new cars. Passenger traffic of West Chicago for the three months ending December 31, 1904, aggregate 5,556,656, against 13,736,764 in the corresponding months of 1903. The total passenger traffic of North Chicago aggregated 8,142,642, as against 7,600,738 in 1903. The consolidated traction companies show an increase of 263,357 passengers in the three months.

## Power-transmission Data.

A California reader asks: "What will be the drop in voltage in six miles of No. 8 B. & S. wire? Current supplied at the generator will be 11 amperes at 2,200 volts. Also, what would be the cost of step-up and step-down transformers, and what would be the best voltage to use in such case?"

Answer.—The ohmic drop in six miles of No. 8 B. & S. wire carrying 11 amperes is about 220 volts If the inquirer means a single-phase circuit six miles long from generator to delivery point, the ohmic drop would be 440 volts. With 2,200 volts at the generator, this would be a drop of 20 per cent.

Step-up and step-down transformers will cost from $6 to $8 per kilowatt f. o. b. factory. Transformers delivering 5,000 volts to line, with coils arranged so they can be connected to deliver 10,000 or even 20,000 volts when the load has increased sufficiently to warrant operating at such voltage, would be advisable.

With a load of only 11 amperes at 2,200 volts, an ordinary 2,200 to 220-volt transformer connected to "boost" (secondary in series with one side of line and primaries across the line) will probably answer, as this will raise the voltage 10 per cent.

## The Detroit Lighting Situation.

The Detroit Common Council has accepted the offer of Mr. Alex Dow, general manager of the Detroit Edison Company, to pay for an examination of the Public Lighting Commission's accounts, plant and basis of operation. It is practically decided also that Professor Cooley of the University of Michigan will be asked to conduct the examination, and it is possible that Professor Carhart of the same institution will be asked to assist him. The principal point to determine is what rate or rates would have been charged by a commercial company for the current which has been furnished to the public buildings by the lighting plant for the year 1903-4.

The corporation counsel now has the new lighting bill ready for consideration by the Common Council. It will enable the Public Lighting Commission to go into the business of furnishing light commercially. The new bill takes away from the commission the power to direct where poles and wires shall be placed by private corporations.

## Business Opportunities Abroad.

Three electric street railways are to be built in the city of Berne, Switzerland.

The municipalities of Gleisdorf, Steyermark, Austria, and of Kastelruth, Tyrol, Austria, have decided to introduce electric-lighting and power stations.

The street-railway lines in the city of Guatemala are to be operated by electric traction. Detailed information will be supplied by Director Ricardo Echeverria, Guatemala City.

An electric-railway line is to be constructed which is to run from Aigle to Sepey, Leysin and Feydey in Switzerland. For particulars address the Aigle-Ollon Monthey Railway Company in Aigle, Switzerland.

C. H. Stanley, J. C. Moir, H. J. Hartzberger and others have organized a $40,000 company to construct and operate an electric-light plant at Roanoke, Va.

# CORRESPONDENCE.

## Great Britain.

London, February [illegible].—There [illegible] the public in Great Britain [illegible] against the [illegible] of [illegible] tion of telegraph and telephone [illegible] to time the [illegible] people have formed themselves [illegible] for an abatement of what they are pleased [illegible] nuisance. All who are not members of such a society as that referred to above must sympathize with the postmaster-general, who is in an unhappy position. He has to give a service both telegraphic and telephonic—on the cheapest possible terms, and yet he is being continually asked to place all such wires throughout the country underground. The one request is not consistent with the other, and he was obliged once more, a few days ago, to make [illegible] usual reply to a deputation from a number of associations who watch the interests of the public in various parts of the country. The postmaster-general seems to think that the only way to mitigate the evil complained of would be to give him compulsory powers over private property, but this would certainly have the effect of propagating another evil, viz., strong opposition on the part of the private owners. The present position is, however, that the government will give the fullest attention to all cases of disfigurement of scenery brought before its notice, and this seems to be all that can be done. Even agreement with the railway companies for carrying the poles alongside their railway tracks would not meet the needs in every case.

The deadlock—for that is practically what it is—that has arisen with regard to the introduction of electric traction upon the horse tram lines in the North of London is a fine example of giving municipalities too far-reaching powers on the one hand, and of a bad example being set by a county council to the less important authorities. When electric traction was first proposed in London the County Council strongly advocated the conduit system, in order to obviate what was termed the unsightly overhead construction. In this the County Council was strongly supported by the Borough Councils. Consequently, in order to remove certain little powers which the borough councils possessed over the roads, the County Council agreed in a bill that no overhead system should be installed except with the consent of the borough councils. So far so good. Now, however, the County Council is finding this agreement irksome, inasmuch as the borough councils are enforcing it, and the County Council, presumably in view of its experience with the conduit system in the South, wishes to adopt a mixture of the trolley and conduit systems. The result is that the electrification of the northern lines would appear to be "hung up" almost indefinitely. At one time it was proposed to ask Parliament to override the agreement referred to above, but the result of such an application was regarded as being so doubtful that the idea was wisely abandoned. Another difficulty is that the County Council has secured certain powers with regard to the purchase of land in connection with the new lines in the North, and in consequence of the delay alluded to the time for these will shortly lapse. A definite course of action, therefore, had to be decided upon to avoid the expense to the ratepayers of haying to go to Parliament again in the same connection. It has, therefore, been decided to equip a short length of line upon the conduit system, to prevent the lapse of the powers, and as being cheaper than allowing this to take place. For these lines a slot of one-inch diameter has been sanctioned by the Board of Trade.

An unfortunate fire broke out on Friday in one of the largest city exchanges of the National Telephone Company, resulting in a great deal of inconvenience. This is the second time within a few years that a disastrous fire has occurred at the exchange, but the results this time were less serious than before, as a new and larger exchange to take over the subscribers dealt with by the arc burned out, was almost completed, and the work of transference was accelerated and almost completed during the following day.

A trial trip has been run over a portion of the Inner Circle, adapted for electric traction, with very satisfactory results, so far as the electrical arrangements are concerned. In connection with the work of converting the District Railway to electric traction, a protest has been lodged by the London Trades Union against the employment of cheap labor. I am afraid it is hardly likely to have much effect, if a knowledge of the character of the masters in charge goes for anything. Similar trouble in this direction has arisen before, I believe.

In addition to the London borough councils which, as reported in these notes a few weeks back, are vigorously opposing the proposals by companies to supply electrical energy in London, wholesale, a similar opposition is being prepared by all the municipalities outside the metropolis. In addition, each of the companies will be opposing every other one, so that the parliamentary proceedings this session promise to be well above the average of many sessions past.

A new application of electricity was revealed in an action which was brought before the Sheffield [illegible] it, with the result that the electric shock was so [illegible] damages.

G.

## New York.

[illegible] plans for a municipal lighting plant. [illegible] to take no action with regard to the application of John J. M[illegible] with electric lighting, "as the city is at present taking proper steps toward municipal ownership of electric lighting."

The Interborough [illegible] pillars in the subway are likely to affect the vision of the motormen, and accordingly this week some experiments are being tried with paint of another color. A painter working in the tunnel today was shocked by a stray current, which fact seems to show that the ironwork of the tunnel is apt to be charged at places.

Postmaster Wilcox is outlining a proposal for using the rapid-transit subway for the conveyance of mail in the near future.

The franchise for the tunnel of the New York and Jersey railroad was finally passed on Tuesday. This line will begin at the exit of the Hudson River tunnel at Christopher Street, proceeding eastward to Sixth Avenue and northward to Thirty-third Street, with a branch to Fourth Avenue and Ninth Street. The terms of the franchise provide for the transportation of both passengers and freight on two tracks operated by electricity or some other power not involving combustion in the tunnel.

Reports were published today showing that, in spite of the competition of the subway, there was a gain of more than 16,000,000 passengers on the elevated lines during the quarter ended December 31st.

Some electric work is required in the basement of the new Hall of Records, Manhattan, bids being receivable until February 24th. The city also advertises for wiring for the Criminal Courts Building and for electric equipments in the DeWett, Clinton and in other schools.

An expenditure of $98,000 has been authorized for improvements at various city hospitals. These include the installation of electrical machinery to the value of $10,000 at the Riverside Hospital on North Brother Island, and $500 for wiring at the Willard Parker Hospital.

A sum of $100,000 has been appropriated toward the cost of placing the fire-alarm circuits underground in the Borough of Brooklyn.

The Trumbull Electrical Manufacturing Company is putting in distributing panels on each of the floors of the 15-story building at 41 Park Row, Manhattan.

North Hempstead, L. I., is the headquarters of the newly incorporated Nassau Illuminating and Power Company, which has a capital of $100,000, and a strong directorate, including W. B. Hord, W. H. Noyes and Jesse Sterns of New York city.

D. W. W.

## Dominion of Canada.

Ottawa, Ont., February 11.—William Mackenzie of Toronto, Ont., and several associates have arranged for the purchase of the concession for the electric car lines for Monterey, Mexico. The men are also negotiating with F. S. Slayden of New York to buy his system of mule cars and convert the two systems into one electric line.

The Dominion Iron and Steel Company of Sydney, Nova Scotia, is about to install new electrical appliances in various departments of its works. The latest devices calculated to facilitate production and reduce expenditure will be adopted.

A bill to incorporate the St. Mary's and Western Ontario Railway Company has been reported to the Dominion Parliament by the railway committee. The company has a capital stock of $1,000,000, with the head office at St. Mary's. The proposed line runs from the Canadian Pacific railway, between Woodstock and London, and thence via St. Mary's and Exeter to Sarnia. Power is given the company to operate by electricity, to generate power for the operation of the railway and to dispose of surplus power.

Negotiations are now under way by which the Mackenzie and Mann syndicate of Toronto, Ont., will secure the controlling interest in the Montreal terminal railway. If the negotiations go through, Mackenzie and Mann will have tramway systems in Montreal, Que., Toronto, Ont., and in Winnipeg, Man.

A London (England) cable message says that at the meeting there of the Marconi company it was stated that in view of the commercial working between England and America a new space-telegraph

station, with the latest improvements, was nearly completed in Canada. Four stations had been equipped on the St. Lawrence and a new contract had been entered into with the Canadian government by the Associated Canadian Company, representing the extension of the organization of space-telegraph stations already established to the order of the Canadian government. Five stations had also been equipped in fishing centers along the Labrador coast. When other stations contemplated had been erected there would be a chain which will offer the Newfoundland government direct wireless communication between the Labrador coast and Canada. W.

Winnipeg, Man., February 11.—The city has received $20,777 from the Winnipeg Electric Street Railway Company, being five per cent. of the company's gross earnings due the city for 1904. Besides this $1,300 in license fees for 65 cars has been paid by the company. The street-railway company's receipts for the year were $407,542. The total number of passengers carried was a few short of 10,000,000. The company has acceded to the request of the City Council to extend its line along the Academy Road to the large new park, about four miles out, which the city has purchased as a recreation park for the citizens. The city is asked to bear half the cost of the three subways which have to be built under the different railroads.

An electric railway is projected to run between New Westminster and Chilliwack, B. C. J. Burt Morgan is the promoter. The road will cost approximately $15,000 per mile, including roadbed and rolling stock, and the Board of Trade has indorsed a petition to the provincial government asking a bonus of $3,000 a mile. The distance between New Westminster and Chilliwack is 50 miles.

The directors of the Calgary Electric Street Railway Company, who were granted a charter in 1893, are considering an offer from Mackenzie & Mann for the purchase of their franchise. Fourteen years ago John Lineham, George Lesson and James Scott secured a Dominion charter and an agreement with the city which required work to commence by June 1, 1904, and, as the agreement has not been complied with, the citizens want the municipality to build and operate the road. In the meantime it is said that Mackenzie & Mann have already bought the franchise, but as the agreement with Calgary has expired and would have to be renewed there are numerous complications ahead. H.

## New England.

Boston, February 11.—The first month's traffic in the East Boston tunnel showed an average of nearly 30,000 passengers carried daily therein by the Boston Elevated Railway Company. The railroad collects a five-cent fare or a transfer check, and the city, which owns the subway, collects one-cent toll additional. It is estimated that the city's revenue annually will amount to nearly $100,000, as summer travel is expected to bring the yearly total of passengers close up to 10,000,000.

The Holyoke Street Railway Company has notified the commissioners that it has leased the Hampshire Street Railway Company for 25 years, guaranteeing five per cent. dividends on the stock, beginning January 1, 1905.

The West End Street Railway Company of Boston has petitioned the commissioners to issue $200,000 bonds to take up bonds of the South Boston Street Railway Company, a leased line, maturing May 1, 1905.

The Worcester and Southbridge Street Railway Company, which is owned by the New York, New Haven and Hartford railroad, has petitioned the railroad commissioners for authority to issue $100,000 additional stock for the purpose of purchasing the Worcester, Rochdale and Charlton Depot Street Railway Company and the Southbridge and Sturbridge Street Railway Company.

## Southeastern States.

Charlotte, N. C., February 11.—An interurban trolley line is being agitated to be run between Clinton, Union, Spartanburg and other points in South Carolina.

At Goldsboro, N. C., where the city has bought the water and electric-light plants, there is much agitation over the question of rates charged by the city, and it is rumored that the debate may be carried to the courts.

The commissioners of the District of Columbia have forwarded to the chairman of the House committee on the District of Columbia their recommendations in regard to the bill providing for the extension of the lines of the Capital Traction Company. The report approves the extensions proposed. The annual report of the Capital company shows that during the year ended December 31, 1904, the receipts were over $1,540,000, and over 35,000,000 passengers were carried.

It is reported that the International Power Company has bought a controlling interest in the Alabama Consolidated Coal and Iron Company. There are other interesting rumors with regard to the reported transaction and it is intimated that great developments in the southern field are on foot.

The town of Cape Charles, Va., has advertised a lighting franchise to light the town by electricity. The bids are to be in by March 6th.

H. L. Miller of Morganton, N. C., having secured a franchise from the town of Oxford, N. C., has commenced work on a new light, water and ice plant, which will be operated by the Southern Public Service Corporation of Washington, D. C.

A bill has been introduced for the incorporation of the Cherokee, Spartanburg and Union electric railway to connect these South Carolina towns with Asheville, N. C., and other summer resorts. A. N. Wood and State Senator T. B. Butler of Gaffney, S. C., are among those interested. The capital stock is placed at $250,000.

The Andrews Light and Power Company of Andrews, N. C., has been incorporated with $100,000 authorized capital. J. Q. Barker, E. C. Henneman and others of Andrews are interested.

The annual meeting of the Birmingham Railway, Light and Power Company was held recently and recommendations of engineers for the expenditure of $700,000 this year were ratified. Directors were chosen and they in turn re-elected Robert Jemison as president and J. A. Emery as vice-president and general manager.

The courts after lengthy discussion of the matter have decided that the Richmond (Va.) and Chesapeake Bay railway may be chartered, this being the company in which Mr. Gould is interested, proposing to build a line to be operated by steam or electricity from Richmond to a point on the Chesapeake Bay.

The charter of the city of Asheville, N. C., has been amended so that the city may establish a reservoir and an electric-light plant.

The sale of $24,000 bonds of the town of Sylacauga, Ala., has been confirmed, the proceeds to be used in constructing an electric-light and water plant for the town. Contracts will be let at once.

Application for a charter for the Asheville-Henderson (N. C.) electric railway, 28 miles long, it is said, will be made at once, the boards of trades of both towns being interested in the matter. L.

## Ohio.

Cleveland, February 11.—For some time the health department has been arranging to inspect the cars on the various lines in Cleveland. This week 12 sanitary policemen were stationed at the various barns and inspected each car as it came in. Their reports indicate that the cars were all in good condition.

An ordinance has been introduced in the Village Council of Bowling Green requiring all street and electric-railway companies to pay into the treasury of the town on the first Monday of every month five per cent. of their gross earnings, prorated as to distance in the corporation with the mileage outside. The corporation is about three miles square. The ordinance limits the speed of cars through the corporation to six miles an hour.

A deficit in the funds for maintaining the municipal gas and electric-light plant is again bothering the people of Hamilton. The plant has proved rather an expensive experiment.

The work of grading the roadbed of the Akron, Richfield and Cleveland electric road has been resumed near Brooklyn, a suburb of Cleveland. The road was projected by H. B. Camp of Akron and some work was done on it, but abandoned because an entrance could not be secured at either of the terminals, Akron and Cleveland. It is said that arrangements have now been made to enter Cleveland, and a private right-of-way will be used into Akron. A line to Massillon and Canton is also projected, it is said.

The Erner-Hopkins Company of Columbus has been reincorporated with a capital stock of $200,000. The officers are: President, William Hopkins; vice-president, Theodore Huntington; treasurer, F. R. Huntington; secretary, T. M. Livesay. The company has just moved into a new building at 162-164 North Third Street, where the required amount of space for the increased business has been obtained. Under the articles of incorporation the company may buy, sell and manufacture electrical, gas and steam fittings and fixtures, and may furnish electric, gas and steam power. The main business has been in the electrical line in the past.

Officers of the Barberton, Wadsworth and Western Traction Company of Barberton have been elected. Byron M. Clendening of Cincinnati is president, George H. Heffner of Celina is general manager, and J. E. Collins of Barberton chief engineer. A corps of engineers is at work on the line, which will extend from Barberton to Seville or Crestop, connecting the Northern Ohio Traction and Light road with the Cleveland and Southwestern.

Trial postal cars will probably be placed on the Northern Ohio Traction and Light Company's lines and the Canton-Akron road. A government inspector has been looking over the ground in connection with the proposed test. Cars have been built for the purpose of carrying both passengers and mail.

E. S. Martin has arranged for the sale of the bonds of the Perry Electric Railway, Light and Power Company, which proposed to build a road from New Straitsville to Zanesville. The bonds will amount to $1,400,000.

A franchise has been obtained in the village of Columbus by the Toledo, Ottawa and Lima Electric Railway Company, the last to be secured on the line. This is the company promoted by Joseph B. Mayer, president of the Lima Electric Railway and Light Company. The line will parallel the Cincinnati, Hamilton and Dayton steam road.

President J. G. Schmidlapp of the Cincinnati Rapid Transit Company has submitted answers to a number of questions that have been asked by the City Council regarding the proposed elevated and subway system of roads the company has planned. He says that drawings and blue prints will be submitted as soon as completed.

The Brilliant Electric Company of Cleveland has reduced its capital stock from $100,000 to $75,000.

Two lines of the Springfield Railway Company of Springfield will be extended the coming summer and the car barn and repair shops will be enlarged. The power plant will also be improved and enlarged.

M. W. Van Zant, Valentine Winters, I. E. Stout, H. P. Clegg and C. P. Clegg have been chosen directors of the Oakwood Street Railroad Company of Dayton.

It is probable that the case of the Cleveland Electric Railway Company against the Forest City Railway Company, in which the former secured a permanent injunction against the latter last week, will be appealed to the United States Supreme Court. The case involves the Woodland Avenue and Kinsman Street franchises.

J. B. Taggert, manager of the Richmond and Magnetic Springs Traction Company, has been closing up right-of-way contracts between the two towns within the last week.

Officials of the Western Ohio Railroad Company are planning for the proposed extension from Lima to Findlay, forming a link between lines that will connect the lake and the Ohio River.

Invitations have been issued by George E. Hawkins, manager of the Postal Telegraph-cable Company at Columbus, for the opening of the company's new offices in the Ruggery Building.

Receivers of the Appleyard roads are said to be considering an arrangement by which through passenger business from St. Louis to Southern, Central and Eastern Ohio may be established by a connection with the Clover Leaf road. These roads, in connection with the Dayton and Troy, Western Ohio, Indianapolis and Eastern and Indianapolis and Northwestern, also form a line between the capitals of the two states and many points in Ohio and Indiana. O. M. C.

## Indiana.

Indianapolis, February 11.—The Bicknell Light and Power Company has been incorporated with a capital stock of $10,000 and has secured a franchise to light the town of Bicknell. The company will also furnish heat and power to patrons in the city and light and power for the Lynn coal mine north of the city.

The Winona Assembly Company has purchased the Warsaw Water and Light Company's plant and the 50-year franchise for lighting the city. It is the purpose of the company to expend $600,000 on the power plant and build with sufficient capacity to supply all power needed for the various enterprises under its control, including new water and light holdings, the Winona-Warsaw electric railway, the Warsaw-Goshen line and the proposed Warsaw-Wabash and Peru lines, which are to be built this year.

The Fort Wayne and Wabash Valley Traction Company has authorized a bond issue of $1,000,000. The proceeds will be used to build a central power plant and to put the whole line into first-class condition. It is proposed this spring to run through cars from Fort Wayne to Indianapolis in five hours.

An enthusiastic meeting was held in Terre Haute on the 7th instant by delegates from points in Indiana and Illinois to promote an electric road over the 70 miles between Terre Haute and Olney, Ill.

The interurban railway interests of the state have influenced the codification commission to make several important changes in the bill pending in the Legislature on municipal corporations. One will be the removal of the section providing for the condemnation of street-railway systems by municipalities. The same will apply to interurban companies. The clause limiting franchises, granted by cities and towns, to 25 years will be stricken out, leaving it a matter of contract between the cities and corporations. They are also pleading to have the provision stricken out which proposes that interurban and street-railway companies shall bear the entire cost of improving the portion of streets that lie between their tracks. Also a provision prohibiting them from holding stock in or owning coal mines, quarries or gravel pits except to supply the needs of their business. They are asking that the matter of street improvements be left for settlement in the franchises granted companies by the cities and towns. They are also opposing a section of the proposed statute which requires corporations to file with the secretary of state a list of the stockholders residing in the state and the amount of stock owned by each. Other minor points are opposed.

A report is current that the Indiana Union Traction Company will build its central car shop in Hartford City and that it has already secured an 80-acre tract on the east side for a site.

The commissioners of Grant County have granted a franchise to the Geneva Traction Company, which

progress to build an electric road from Marion to Celina, Ohio. The road will connect the oil regions of Ohio and Indiana. The company will begin construction as soon as the frost leaves the ground.

The Postoffice Department is arranging to establish a mail service on the Indianapolis, Columbus and Southern traction line between Indianapolis and Columbus. It is highly probable that within a year all the traction lines will be carrying mail out of Indianapolis.

The City Council of Noblesville has granted a 10-year contract to G. W. Heinzmann & Co. to light the city. The contract requires 80 arc lights at $70 each per year. Ten cents a kilowatt-hour will be charged for incandescent lights. The old electric-light company, which has had the contract, and the Noblesville Hydraulic Company have consolidated with the new company. It is the purpose to complete the dam in White River and generate electricity for power and light by waterpower.

George S. Cook has secured a franchise to establish an electric-light plant in Hope, Ind. The town has never had street lamps and a new plant will be erected.

A bill has been introduced in the Legislature providing for the sale of municipal light or water plants as other public utilities in case cities desire to rid themselves of them. This bill is for the benefit of municipalities which have tried the experiment of owning their own water and light plant, and it appears from the number of cities advocating the passage of the bill that municipal ownership in Indiana had proved a failure. S. S.

## Northwestern States.

Minneapolis, February 11.—The Electrical Engineering Company of Minneapolis is planning the erection of a three-story and basement brick block which will cost about $25,000. The new building will be occupied exclusively by the owners for the offices and storerooms, and will be 50 by 90 feet in size.

The contract for furnishing a new dynamo for the electric-light plant at Sioux Falls, S. D., has been let to the Fort Wayne Electric Works at $1,400.

A street-car franchise has been granted at Excelsior, Minn., to F. E. Kenaston and E. J. Phelps of Minneapolis, and an electric railway from Minneapolis through Excelsior, Chaska and St. Peter to Mankato, Minn., is now assured. The promoters will apply for permission to build its line to the center of Minneapolis. The Twin City Rapid Transit Company and the Minnesota Power and Trolley Company had also made application for a franchise at Excelsior, intending to build lines to Lake Minnetonka, but their petitions were not granted. The Twin City company says that it will build a line to the lake in spite of the fact that it was refused a franchise.

A franchise has been granted at Watertown, S. D., to the Watertown Transportation Company for a trolley line from that city to Lake Kampeska.

D. D. Crowley of Duluth has applied for a lease of the municipal electric-lighting plant at Hibbing, Minn. There is considerable opposition to the proposed move.

The Madison (Wis.) and Interurban Traction Company has been incorporated, with $750,000 capital. It is the intention to construct an interurban railway between Milwaukee and Madison. B. K. Miller is the principal mover in the project.

The Berggren Electric Company of St. Paul has been awarded the contract for installing the electrical fixtures at Fort Russell, Wyo., at $2,950.

Permission will be asked of Congress to construct a dam across the Mississippi River at Keokuk, Iowa, for the purpose of furnishing power. The proposed dam will be 22 feet high and about a mile long. The government canal around the rapids at this point, being already constructed, will simplify the work. R.

## Rocky Mountain States.

Salt Lake City, February 11.—Surveyors will shortly be at work on the route of the projected electric railroad between Boise and Pearl, Idaho, the company being formed to promote the enterprise having definitely decided to begin active work at once. When completed, this system will be the longest electric line in the state.

The Elko Electric Light and Power Company, which will build and equip an electric plant, has filed articles of incorporation at Wells, Nev., with a capitalization of $100,000. The incorporators are John J. Hylton, A. W. Hesson, R. H. Mallett, C. J. Hood, Webster Patterson, E. M. Hansel, Charles E. Noble and W. C. Owens.

A petition has been circulated by residents in Peaceful Valley, Wash., asking the Spokane Traction Company of Spokane, Wash., to extend its electric road into that section, and it is believed favorable action will be taken on the request.

The Western Electric Company has filed a copy of its articles of incorporation with the county clerk of Salt Lake County, Utah. The local agent for the company at Salt Lake is Mr. M. S. Allen.

A meeting of representative citizens and business men of the towns of Moscow, Pullman and Colfax, Idaho, was held recently with a view to furthering the interest of the prospective electric road through these cities, to be constructed by the Spokane and Inland Electric Railway Company.

Filings have been made on the waters of Little Cottonwood and Big Cottonwood Creeks, near Salt Lake City, where a company now being formed will establish a big power plant. James J. Chalmers, the chief promoter, is in the East in the interest of the project. G.

## Michigan.

Detroit, February 11.—A. Jacobs of Detroit is figuring on securing a gas and electric-lighting franchise in Pontiac. Mr. Jacobs was formerly in business in this city as the East Side Electric Company, which was afterwards sold to the Detroit Edison Company.

Frank A. Russel has been granted an electric-light franchise for commercial lighting by the Township Board of Springwells.

The Common Council of Grand Rapids has set on foot a movement to secure legislation enabling cities to own and operate street railways. This matter is brought up now as the result of an understanding reached by the Municipal League of Michigan at its recent meeting at Ionia. This is a matter which was agitated considerably last year by Mayor Maybury of Detroit, who inaugurated the movement. It is probable that a constitutional amendment will be necessary.

The Ann Arbor railroad has been enjoined from using recently built tracks crossing an electric line at Owosso.

Negotiations are now on for the transfer of all the Boland interests in the Detroit, Ypsilanti, Ann Arbor and Jackson Road to the Hawks-Angus people. It is understood that some arrangement will be made so that Mr. Boland can build the road to Lansing. The settlement of this long-standing dispute will be of advantage to both parties. The Commonwealth Power Company of Kalamazoo, which is the title of the consolidated electric-power properties in Kalamazoo, is making plans for a new $100,000 steam power house, and it is probable that power will be furnished to the Detroit, Ypsilanti, Ann Arbor and Jackson road by this company.

A special visit was made to the city of Adrian over the Toledo and Western electric railway by a party of 20 electric-railroad capitalists, and it is understood that there is a movement on foot to consolidate all of the traction lines running out of Toledo into one company. The inspection trip was made in the private car of H. A. Everett of the Northern Ohio Traction Company. This car cost $21,000 and is a model of convenience and luxury. J. C. Hutchins, general manager of the Detroit United Railway, was one of the party.

Space for the Detroit automobile show is being taken up fast and late requests are coming in from firms exhibiting at the Chicago show requesting space in the Detroit Light Guard Armory. The show opens on the 13th.

The electric-lighting plant of Plymouth which has been stopped owing to the bursting of water mains is now in operation. Water had to be carried to the boilers and the main is not yet repaired.

It is now announced that the proposed Detroit-Bay City electric railway will be built and that its financing has been accomplished. The Westinghouse Electric and Manufacturing Company is at work on the details of the entire equipment of the road and it is expected that active work will begin soon. The road will pass through Lapeer, Caro, Pontiac and a number of other smaller towns between Bay City and Detroit.

Two electric railways are seeking a franchise for electric railways through Saugatuck. Dunkley, Williams & Bardean of South Haven and W. E. Dobson of Chicago have each filed an application. Both of the lines propose to run from Saugatuck to South Haven and thence to Benton Harbor. Dobson & Co. will put up a bond of $1,000 guaranteeing the completion of the road within one year from date of franchise. C. G. W.

## PERSONAL.

Lord Kelvin has accepted the nomination of the council for the presidency of the Faraday Society in succession to Sir Joseph Swan, F. R. S.

Parks Foster, who constructed the Toledo, Maumee and Perrysburg (Ohio) electric belt-line railway and served as president of the company for some time, died at the home of his daughter in Chattanooga, Tenn., on February 6th.

H. S. Reynolds, who has been general manager of the Columbus (Ga.) Railroad Company, which embraces all the street-car lines and the electric-lighting plant of that city, has tendered his resignation, to take effect February 18th. Mr. Reynolds will go with J. G. White & Co. of New York.

President Dickinson MacAllister of the Metropolitan West Side Railroad Company of Chicago handed in his resignation on February 13th, to take effect April 4th. Mr. MacAllister came to Chicago as constructing engineer for the South Side elevated railway after a long experience as engineer for the Brooklyn Union and the Manhattan elevated roads. He left the South Side road to take charge of the construction of the Metropolitan and became president of the latter upon its reorganization in 1899.

[redacted]

The [redacted] ability of a number of designers of electri[redacted] Grand prize [redacted] son, Swampscott, Mass.; [redacted] electricity; also to C. P. Steinmetz, Schenectady, N. Y., for electric lighting, and to F. J. Sprague, New York city, for the application of electricity to transportation. Gold medals have been given to C. G. Curtis of New York city, to W. L. R. Emmet of Schenectady, N. Y., in recognition of their work on the steam turbine, and to W. B. Potter, Schenectady, N. Y., for applications of electricity to transportation. Silver medals were awarded to W. S. Moody, Schenectady, N. Y., for transformers; E. M. Hewlett, Schenectady, N. Y., for distribution of energy, switchboards, etc.; H. F. T. Erben, Schenectady, N. Y., for apparatus for generating electricity; H. G. Reist, Schenectady, N. Y., for apparatus for generating electricity; L. T. Robinson, Schenectady, N. Y., for scientific apparatus, measuring apparatus and laboratory and standard instruments, and to F. P. Cox, Lynn, Mass., for measuring instruments.

## ELECTRIC LIGHTING.

George S. Cook has secured a franchise to establish an electric-light plant at Hope, Ind.

The electric-light plant at Liberty, Mo., was wrecked recently by the explosion of a boiler.

The Benton Electric Light Company of Fort Benton, Mont., has been incorporated with $15,000 capital.

J. W. Hale of Hartford, Ky., is building an electric-light plant for the Kentucky Light and Power Company.

The Las Cruces (N. M.) Electric Light and Ice Company has been incorporated with a capital stock of $50,000.

The Mexico Electric Light Company has turned off the lights in Mexico, Mo., until a new franchise is granted the company.

A special election in Sturgeon, Mo., resulted in the approval of a proposition to build an electric-light plant in the town.

The Lumberton (N. J.) Light, Water and Sewerage Company, with a capital of $50,000, has been incorporated by Henry Conrow, Moses S. Watson and others to operate an electric-light and water plant.

The Commonwealth Electric Company of Chicago has ordered from the General Electric Company a fourth turbo-alternator unit for its large Fisk Street station, where three 5,000-kilowatt machines are now in operation.

Among recent Illinois incorporations is the St. Clair Light and Power Company of East St. Louis, incorporated with a capital of $75,000, to furnish electric light and power. C. L. Gray, H. C. Barnard and R. W. Sikking are the incorporators.

The Carolina Water, Light and Power Company, with a capital of $250,000, has been incorporated by J. W. Johnson and W. J. Montgomery to construct and operate a light, water, heat and power plant at Columbia, S. C.

The Aurora (Ill.) Manufacturing and Lighting Company has recently been incorporated, proposing to do general manufacturing and to furnish light, heat and power. The capital of the company is $12,000 and the incorporators are P. G. Lincoln, F. W. Detray and T. J. Helphrey.

An idea of the Edison Electric Illuminating Company of Boston may offer a suggestion to central-station managers in the larger cities. The Boston company has prepared several nurses' electrical outfits which consist of one electric fan and cord, one portable lampstand for lighting the bedside, one Hylo lamp for giving a faint light during the night, two bedwarmers, one milk warmer, one electric stove and the necessary plugs and attachments. These sets are to be rented out at a specified sum per month.

## ELECTRIC RAILWAYS.

The Sedalia Transit Company of Sedalia, Mo., has secured control of the city street-railway and lighting systems under a long lease. H. S. Rumsey of St. Louis is president of the company.

The British Columbia Electric Railway Company intends to commence the construction of a branch line from the city of Vancouver to the Gorge this

spring. Only that portion which will permit of the company handling the Queen's Birthday traffic to the Gorge on the annual celebration of Victoria Day, May 24th, will be built this year.

Right-of-way has been secured by the Shenango Traction Company for an electric railway between Cambridge Springs and Newcastle, Pa. The plan of the company, it is said, is to build a line from Pittsburg to Buffalo.

It is said that Cincinnati capitalists will take an interest in building an electric railway at Lexington, Ky., over the right-of-way that was originally acquired by the Bluegrass Traction Company, but now owned by Clifford D. Beebe of Syracuse, N. Y.

Alderman Thomas M. Hunter of Chicago recently declared to the River Improvement Association in favor of the immediate electrification of the existing cable lines of the Union Traction Company. If this were done, he said, the tunnels under the Chicago River could be removed in 90 days.

The San Jose-Los Gatos Interurban Railway Company has applied to the City Council of San Jose, Cal., for a franchise to construct an electric railway upon the public streets of the city. The council proposes to grant the franchise and will receive sealed bids until February 27th.

Another electric railway, with Aurora men as the projectors, is being figured on. It is reported that the line is to be constructed from Yorkville, Ill., south along the Fox River branch of the Burlington steam road, and will touch the cities of Millbrook, Sheridan, Wedron and other points. This will take it nearly all the way to Ottawa.

The Clarksville Railway and Light Company of Clarksville, Tenn., is the new name of the Clarksville Electric Street Railway Company according to a charter amendment just filed. The company proposes to build various extensions of its line. The incorporators are N. L. Carney, J. F. Gracey, William Daniel, H. C. Merritt, J. F. Shelton, M. H. Clark and Lewis Clark.

The Fayette Traction Company has purchased the Bluegrass Consolidated Traction franchises in Woodford County, Ky., from C. D. Beebe & Co. of Syracuse, N. Y. This firm purchased them at receiver's sale some time ago. It is asserted that the Fayette Traction Company will commence building a line from Lexington to Versailles in the spring. C. J. Bronston is the president of the company.

No less than 14 electric mountain railways are now under construction in Switzerland, it is said. Within the course of a few years all the leading Alpine heights can be reached by mountain railways. Switzerland is spending many millions on these enterprises, and it is believed that with these increasing facilities the number of tourists will become greater every year. The Jungfrau and Chamonix railways will be completed and open for passenger traffic by the summer of 1906.

The annual meeting of the Detroit United Railway resulted in the re-election of all the old directors, with Mr. J. C. Hutchins as president. The president's report for last year shows gross earnings of over $4,500,000 and a surplus income of over $245,000. The total number of miles operated at the close of the year was 536. The company shows a gain in gross earnings of over $154,000, notwithstanding that the operating expenses for 1904 were over $149,000 more than the preceding year.

R. D. Smith, general superintendent of the Central Illinois Construction Company, the McKinley syndicate operating electric railroads in Illinois, has let the contract for building 80 miles of track between Edwardsville and Carlinville, Ill., to the J. H. McInerny Construction Company of Grand Forks, N. D. A large quantity of ties and steel rails is said to be en route to the scene of activity, and work will be begun in March. The McKinley syndicate is the promoter of the proposed Litchfield-Hillsboro electric line. The Edwardsville-Carlinville line runs through Litchfield.

The citizens of Santa Rosa, Cal., are rejoicing over the court decision in the grade-crossing suit instituted by the California Northwestern steam road, by which the Petaluma and Santa Rosa Interurban Electric Railway Company will now enter Santa Rosa. Judge Seawell decided that the California Northwestern could not control the tracks laid on Railroad Street, over which the electric road had a franchise, and declared that the electric franchise was valid. The interurban company now promises to construct its tracks and trolley up Fourth Street without further delay.

A plan recently mentioned in the Western Electrician to transfer all of Chicago's second, third and fourth-class mail matter between railway stations and the new postoffice has been finally adopted by the government officials in Washington. The Illinois Tunnel Company will operate for this service special mail cars, to be locked with United States locks and to be used exclusively for carrying mail. The present tunnel system is to be extended to include the Northwestern railway station. Until the new postoffice building is completed the temporary building will be equipped with a sub-basement and an elevator and will be connected with the tunnel.

## POWER TRANSMISSION.

An appropriation of $50,000 for an electric power plant at the New Orleans naval station has been recommended by the chief of the Bureau of Yards and Docks.

Electrical machinery agents of San Francisco are sending in bids to the Nevada Power, Mining and Milling Company for two 750-kilowatt, three-phase generators for the new hydro-electric transmission plant. It is the company's purpose to install a water-power plant in California and transmit electricity at 30,000 volts a distance of about 90 miles to Tonopah, Goldfield and surrounding mining districts in Nevada.

A representative of the Punjab Power Association, composed of British capitalists, is now in India with a view to harnessing the waterpower there, especially from the great irrigation canals now running to waste in the Punjab, and to employ it in generating electrical power for public and private lighting and for mechanical propulsion. One of the first objects contemplated is to bring to Lahore and to Amritsar, both very busy and increasingly important centers of commercial activity, a cheap and ample supply of permanent electrical power. Negotiations with the government, with a view to obtaining the necessary concessions, are now understood to be in progress.

## PUBLICATIONS.

The Southern-Western Pine Lumber Company, Monadnock Block, Chicago, a new dealer in cedar poles, of which A. E. Darling is the general manager, is distributing to its customers and friends a handsome calendar. In spite of the large number of calendars distributed this year the one issued by this company will be found desirable.

Price lists A and X of the Electric Storage Battery Company, Philadelphia, contain besides the tabulated prices remarkably good illustrations of the battery cells of the two well-known types, the Exide batteries and Chloride accumulators, the former being shown in price list X and the latter in list A. Cells for lighting, power and automobile service are included.

"Pipe and Boiler Coverings and Their Uses" is the title of a small pamphlet distributed by the H. W. Johns-Manville Company of New York. Described in the pamphlet are Asbestos sponge-felted coverings, J-M 85 per cent. magnesia coverings, Asbestos fire felt, Asbestocel fireproof covering, Magnesia-asbestos, J-M air-cell fireproof covering, Champion and aqua and Zero coverings; the coverings are of the sectional variety. These products and a little dissertation upon native asbestos and its properties make up the contents of the pamphlet.

In a neat book having a cover of original design the Edison Electric Illuminating Company of Brooklyn presents to large light and power users something concrete and convincing as to the most economical and advantageous method of securing light and power. The book is entitled "Five Thousand Dollar Bills" because it gives principally some data concerning a few subscribers to the Edison lighting and power service whose bills for current are annually upward of $5,000. Some fine half-tone illustrations on richly tinted calender paper do credit to the company and to the printer.

Two catalogues of merit are to be credited to the Emerson Electric Manufacturing Company of St. Louis, which are entitled, respectively, "Emerson Fan Motors" and "Trojan Fan Motors." The first catalogue mentioned is devoted to fans adaptable to alternating-current operation, which range in size from small desk fans to the larger sizes for exhaust purposes. Each particular type is described fully and illustrated in a pleasing manner. The Trojan fan is likewise of the alternating-current variety but is confined to the desk, bracket and ceiling types. This fan includes a number of special features, embodied in the bearings and the switching apparatus. For a careful study of this apparatus the catalogue on Trojan fans will be found adequate for the purpose.

## SOCIETIES AND SCHOOLS.

The electrical, mechanical and civil engineers of Des Moines, Iowa, met recently at the Iowa Railroad Men's Club rooms and organized the Des Moines Society of Engineers. The plan of the association is to bring together the engineers of the city for the purpose of scientific study and research. The officers are: President, J. Van Liew; vice-president, G. E. Dobbins; secretary and treasurer, E. Manhard. Another meeting will be held February 24th.

The faculty of Purdue University announces a course of three popular lectures by distinguished American engineers. The lectures will treat broadly of large industrial and engineering questions. The first will be given by Henry R. Towne, president of the Yale & Towne Company; the second by William Barclay Parsons, who was chief engineer of the New York subway, and the third will be given by Dr. F. A. C. Perrine, consulting electrical engineer of New York city.

## TELEGRAPH.

A sleet storm of wide extent did much damage to telegraph lines in the South last week, extending from Ohio to as far south as New Orleans. Natchez, Miss., was shut off from communication for days. Vicksburg, Miss., was cut off for two days and for a time Atlanta, Ga., was in the same plight. Miles of telegraph and telephone lines were down in all parts of the country covered by the storm. The Western Union reported over 3,000 poles down.

Representative Mondell has introduced a bill in Congress authorizing Henry Bratnober of California, Charles F. Manderson of Nebraska, George W. Holdredge of Nebraska, George C. Hazelet of Alaska, John Tod of New York, James Kelby of Nebraska and Edward Gillette of Wyoming, under the name of the Trans-Alaska Railroad Company, to locate and construct a continuous railroad and telegraph line from a point on the north shore of Valdez Bay toward Eagle City, on the Yukon River. The capital stock of the company shall be $10,000,000.

## SPACE TELEGRAPHY.

It has been decided by the Savannah Line Steamship Company to equip with space-telegraph instruments for operation its entire fleet of 11 vessels, plying between New York and Savannah and Boston and Savannah. This makes the second coastline steamship company to install the wireless service.

The Sultan of Turkey has authorized a German firm to establish space telegraphy between the Island of Rhodes and Derna, a seaport in Tripoli. The system, according to the contract, must be capable of transmitting at least 4,000 words in 24 hours and the engineers must remain in charge until efficient service is given.

Bids have been received by the bureau of supplies and accounts, Navy Department, for furnishing the space-telegraph outfits as follows: One on board United States steamship Colorado at League Island—American De Forest Wireless Telegraph Company, $2,490; W. W. Massie, Providence, R. I., $4,070; National Electrical Signalling Company, Washington, $6,250; Marconi Wireless Telegraph Company of America, New York, $11,851. The same companies submitted bids in the same amounts as above for an installation on board the West Virginia at Newport News, Va.

## MISCELLANEOUS.

The dislike that Secretary Loeb has for an electric bell accounts for an ingenious device used at the executive offices to notify the secretary when he is wanted by President Roosevelt. The device consists of two wooden clappers. When the president wants his secretary he touches a button, which, by an electric device, releases one of these wooden clappers, and it comes down on the other with a sharp, explosive report.

Attendance at the automobile show in Chicago last week was 122,421. In the respect of attendance and amount of sales the show is said to have eclipsed anything of the kind ever held in this country. The machines purchased during the week represent an investment of $7,000,000, according to the daily papers, the prices ranging from $350 to $12,500. The record attendance was reached on the closing day, when 26,000 people entered.

A practical test is to be made in the conversion of magnetic black sand, which lines the shores of the Pacific Ocean, into steel. The project is backed, it is said, by Cincinnati men who for a number of years have leased 500 acres of land on Damon's Point, Gray's Harbor, between Hoquiam, Wash., and the ocean. W. T. Shaw of Cincinnati, who will make the tests at Hoquiam, is said to be confident that a good grade of crucible steel can be produced from this sand, several shipments of which have been made to Ohio and Pittsburg for experimental purposes.

The Kansas City Court of Appeals in the case of Winkelman against the Kansas City Electric Light Company has decided that electrical companies must exercise caution to prevent people getting hurt or killed by contact with the wires. Winkelman was a painter working upon a building. He touched a live wire and was hurt. He sued the company for damages. In deciding the case the court said: "Considering the noiseless, hidden and destructive power of electricity, it is the duty of those who maintain such appliances to use the utmost care to thoroughly insulate the wires and to keep them insulated."

## TRADE NEWS.

Mr. Jacob Bunn, secretary and treasurer of the Sangamo Electric Company of Springfield, Ill., stopped at Chicago last week after a trip to Montreal and New York in the interests of the new direct-current meter which this company has lately put on the market.

Yazoo City, Miss., desires to grant a franchise over its streets for an electric street railway to the person making the best proposition therefor. A copy of the proposed franchise, with blanks for insertion of route, gauge, percentage of gross receipts

to be paid city, schedules, maximum fare, etc., will be furnished on application to E. J. Poursine, city clerk of Yazoo City.

The Belden Manufacturing Company, Chicago, wire manufacturer, announces its removal to a larger factory, with better facilities, located at 192-194 Michigan Street.

The W. H. Gough Electric Company of Syracuse, N. Y., has filed its schedule in bankruptcy, which shows the liabilities to be $13,943.86. The assets of the company are $9,918.69. Most of the creditors are out-of-town supply firms.

M. Klein & Sons, 81 West Van Buren Street, Chicago, pride themselves upon the reputation they have attained in the manufacture of tools and appliances used in all kinds of electrical construction work. The firm states it makes only the best.

Bids have been invited for the electric lighting of the city of Shreveport, La., for periods of five and 10 years, the number of lights to be not less than 150 and subject to increase. Bids are to be in the hands of the city comptroller by April 11th. Further particulars may be obtained from the city comptroller, C. G. Rives of Shreveport.

Sealed proposals are invited by the bureau of supplies and accounts, Navy Department, until March 14th for furnishing the Mare Island and Puget Sound navy yards with insulating tape, electric wire, transformers, searchlights, incandescent lamps, electric cable, tape and globes. Blank proposals will be furnished on application to the navy pay offices at San Francisco and Seattle.

Owing to general development of its business in the southern and southwestern territory, the Standard Underground Cable Company of Pittsburg has established in the city of St. Louis its southwestern sales office. Mr. E. J. Pietzcker, who has been attached to the western sales department, with headquarters in Chicago, for the last two years, has been appointed manager of the new office and is located at 521 Security Building. Mr. Pietzcker has had many years' experience in the wire and cable business and his long residence in the South will enable him to greet many old friends in returning to that territory.

The firm of W. C. Sterling & Son, dealers in poles and ties, has been incorporated under the name of W. C. Sterling & Son Company, with a capital of $100,000. The new firm is composed of W. C. Sterling, president; Walter P. Sterling, vice-president; W. C. Sterling, Jr., secretary and treasurer. The main offices and yards will be located at Monroe (Mich.), Bay City and Omer. The Bay City and Omer office and yards, as well as all the northern branches of the timber business, will be under the management of W. P. Sterling. The Monroe office, finances, sales and contracts will be managed by W. C. Sterling, Jr., at Monroe. Mr. Sterling retires from active business, saying that he has wasted his young years getting rich to the neglect of shooting, fishing, yachting and ice-boating, to which he will now give proper attention.

## BUSINESS.

W. N. Matthews & Brother of St. Louis report that Stombaugh guy anchors have been adopted for the following departments of the United States government: The United States Army, United States Navy, United States River Commission and United States Signal Corps. These different departments use the anchors for various purposes. The army for anchoring electric-light and telephone poles. The navy for anchoring space-telegraph masts in Florida, Porto Rica, Cuba and Panama. The river commission uses them for anchoring abattis on the Missouri and Mississippi Rivers, and the Signal Corps for anchoring signal poles.

The Imperial Brass Manufacturing Company, 245-247 South Jefferson Street, Chicago, recently incorporated, has equipped its factory with a full line of modern machinery for the manufacture of all kinds of brass, bronze and aluminum work, including casting, machining, polishing, plating, stamping and spinning. The company will also make a line of specialties, including its Imperial carburetter and Imperial injector, already in big demand. Charles

[redacted]

In the United States Circuit Court for the South[redacted] injunction, against the National Battery Company for the infringement of the Exide battery plate, made under the Bradbury-Stone patent, which is owned by the Electric Storage Battery Company. This is for the staggered or cage-type of grid.

The American Electric Fuse Company of Chicago has issued a circular in which it is said that "The suit of the American Electric Fuse Company against the Rolfe Electric Company and Charles A. Rolfe, involving the ownership of all the Rolfe pioneer self-soldering protector patents, was decided on February 4, 1905, in favor of the American Electric Fuse Company. The decision confirms the American Electric Fuse Company's exclusive right to make all forms of self-soldering protectors, and makes all self-soldering protectors made by any other manufacturers infringements on the American Electric Fuse Company patents. Since the suit was begun the American Electric Fuse Company has also acquired all of the patents of William Kaisling, which patents, combined with those of Charles A. Rolfe, completely cover all forms of self-soldering, self-repairing or self-restoring heat coil protectors. * * * * "The American Electric Fuse Company is prepared to replace all infringing self-soldering protectors now in use, by either Rolfe or Kaisling protectors, of the latest improved type, at a comparatively small additional expense, and will afford to every user of Cook self-soldering protectors ample time to make the necessary changes. Under no circumstances, however, will the American Electric Fuse Company give its consent to the further use of Cook self-soldering protectors."

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued (United States Patent Office) February 7, 1905.*

781,639. Railway Signal. Frank L. Dodgson, Rochester, N. Y., assignor to the General Railway Signal Company, Gates, N. Y. Application filed March 27, 1903.

Signaling apparatus for a railway comprises a motor signal at each end of a block, a counter related to each signal for counting cars entering and leaving the block, apparatus in both counting devices for automatically controlling the motor and track instruments at opposite ends of the block for controlling each counter.

781,650. Commutator Brush Holder. William Heap and William A. Barnes, Bolton-le-Moors, England. Application filed August 15, 1904.

Mechanical features of the device are described in the patent, which include among other things a pawl and ratchet mechanism which acts to press the brush firmly upon the commutator.

781,661. Stringer Support for Electric Third Rails. Frank E. Kinsman, Plainfield, N. J. Application filed July 28, 1903.

A stringer of wood is provided with a conductor and with sockets to receive the heads of insulators mounted upon suitable pins.

781,686. Binding Post. Clarence C. Sibley, Perth Amboy, N. J. Application filed November 24, 1902.

A retainer in substantially annular form has an opening leading through one side and located in the space between the binding post and its head. The retainer is provided with a sharpened end or prong projecting in the direction of a conductor and adapted to engage the latter. Means prevent the retainer from rotation on the post.

781,688. Electric Ingot Extractor. James R. Speer and Willie H. Baltzell, Pittsburg, Pa. Application filed May 17, 1900.

An electric traveling crane carries the ingot extractor.

781,706. Alternating-current Generator. Emil Ziehl, Berlin, Germany. Application filed September 30, 1904.

Electrical machines with monophase or polyphase current excitation and giving monophase or polyphase currents are supplied with an energizing winding on the stationary part with a similar winding on the revolving part.

781,721. Guard for Trolley Wheels. Merwin M. Hart, Chicago, Ill. Application filed April 15, 1904.

The head of the trolley wheel, which is rotatably mounted thereon, carries idler guard wheels on each side of the trolley wheel. Inwardly projecting lugs are placed on the inner faces of the guard wheels.

781,736. Neutral Relay. Charles D. Olsen and John M. Kinnear, Denver, Colo. Application filed August 1, 1904.

The main lever and sounder of a neutral relay contains an auxiliary magnet for automatically holding the main lever in the position to which it has been attracted by an energized differential magnet after the latter has been deenergized. An auxiliary lever is located in proximity to the differential magnet and a circuit is closed to energize the auxiliary and sounder magnets when the main lever is held in position and the auxiliary lever is away from its back stop. A short-circuit around the auxiliary magnet is closed by the auxiliary lever when the latter it against its back stop. (See cut on next page.)

781,745. Negative Pole Plate. Paul Seeliger, Hagen, Germany, assignor to the Electric Storage Battery Company, Philadelphia, Pa. Application filed June 18, 1903.

Negative-plate active material is composed of material possessed of loose structure, the product being derived from expansion and disintegration induced by reducing and discharging a mixture of active and inert materials.

781,752. Telegraph. Frank A. Stumm, New York, N. Y. Application filed December 4, 1902.

Ameliorating current fluctuations in balanced lines used for purposes of communication is accomplished by determining the mean variation of the main circuit from a predetermined normal, increasing the resistance of the main-line circuit to an extent proportionate to the variation thus determined and balancing the main-line circuit with its resistance thus increased.

781,757. Automatic System of Signaling for Electric Railways. Samuel M. Young, New York, N. Y. Application filed November 15, 1904.

A system of automatic signaling for electric railways comprises a source of power current, a source of signaling current, a trackway divided into block sections, means for rendering the block sections electrically continuous for the power current and electrically separated for the signaling current, a signaling device actuated by the power current and means controlled by the difference of potential between the rails, which will control the passage of the power current through the signaling apparatus.

781,762. Electrical Dental Furnace. Luther L. Bosworth, Cleveland, Ohio. Application filed March 5, 1904.

Electrical dental furnace comprises a two-part separable muffle having one part telescoped within the other and a heating coil covered in between the parts.

781,785. Circuit Controller. Louis Pfingst, Boston, Mass., assignor to the Pfingst Electric Manufacturing Company, Kittery, Me. Application filed April 4, 1904.

An electric circuit controller or switch for closing or breaking the circuit is supported by the regular brake handle.

781,793. Sanitary Attachment for Telephones. Isaac M. Slocum, Boston, Mass. Application filed June 22, 1904.

A sanitary appliance comprising means to support separate sheets of paper of a size to cover the mouthpiece of the telephone transmitter is described.

781,795. Storage-battery Electrode. Elmer A. Sperry, Cleveland, Ohio, assignor to the National Battery Company, Buffalo, N. Y. Application filed January 27, 1904.

A storage battery electrode consists of a frame having openings containing electrode sections. Each section comprises a support carrying active material secured to the frame by a rigid union along the middle of its upper edge, but free at its ends.

781,797. Telephone Receiver. Axel R. Thollander, Chicago, Ill. Application filed October 1, 1904.

Combined with a casing and diaphragm are a magnet, a bridge piece fixed in the front end of the casing and through which the ends of the magnet extend, and an adjusting block which is fastened between the ends of the magnet and is adjustably supported on the bridge piece.

781,802. Valve and Valve Gear for Explosive Engines. William Barber, Brooklyn, N. Y., assignor to Ada S. Barber, Brooklyn, N. Y. Application filed February 24, 1902.

An electric spark igniter is described among the other features of the valve gear.

781,805. System of Electrical Distribution. Theodore Bodde, Schenectady, N. Y. Application filed November 18, 1903.

Combined with a multiphase transmission circuit are two or more sets of transforming apparatus so related that the phases of the secondary current in the subsequent groups occur at times, dividing the interval between phases in the first group. Rectifying apparatus is connected to all the sets and transmitting lines lead to translating devices and receive in series the rectified currents of the several groups and phases. (See cut on next page.)

781,817. Battery. Uri D. Foster, Meriden, Conn., assignor of one-half to Albert W. Foster, Meriden, Conn. Application filed September 30, 1904.

The characteristic features of the battery are a carbon and a zinc, an antisplash device between the tar and carbon, an antisplash device between the carbon and zinc, a screw-threaded member secured to the zinc, a washer surrounding the screw-threaded member and mounted on the zinc, means for airproofing the joint between the zinc and carbon and means to hold the washer in place.

781,823. Telegraphy. William C. A. Hammel, Baltimore, Md., and Joshua W. Gore, Chapelhill, N. C. Application filed September 4, 1900.

Means for sending induced electrical impulses over the line have a switch included in the line circuit. A coherer is connected with the switch and signaling devices are controlled by the coherer and a key including the switch. A battery and a ground connection for the switch are supplied, whereby the key of the coherer can be included in circuit with either side of the line.

781,828. Coin-controlled Apparatus for Delivery of Liquids. Erik C. Janson, Stockholm, Sweden, assignor to Adolf Ohman, Stockholm, Sweden. Application filed May 24, 1904.

The coin in falling into the slot closes a circuit in which is included an electromagnet. This raises a valve and allows the fluid to be measured to flow into a measuring vessel. When the vessel is full a float opens the circuit and thus closes the valve, at the same time allowing the liquid to flow out into a glass.

781,842. Multiple-contact Trolley. Lewis M. McBride, Denver, Colo. Application filed July 5, 1904.

The trolley pole is provided with an arm connected to the pole. A trolley wheel is mounted on the pole, another on the arm. Means are connected between the trolley wheels and the pole and arm whereby the wheels turn at right angles to their vertical rotative plane independent of the pole and arm and of each other.

781,873. Wireless Telegraphy. Patrick B. Delany, South Orange, N. J. Application filed July 10, 1903.

Combined with the coherer is a relay and its circuit and a tapper magnet, whose circuit is controlled by the relay. A second magnet, whose circuit is also controlled by the relay, has means under the control of the second magnet whereby the winding of the relay is shunted from its circuit each time the relay armature lever is moved from its normal or retractive position. A local circuit contains a receiver and is also controlled by the second magnet. (See cut on next page.)

781,878. Dynamo Electric Machine. Henri A. E. Harle, Paris, France. Application filed August 12, 1902.

The dynamo-electric machine comprises a stator and a rotor, the rotor being provided with terminals for polyphase current and a commutator. Independent, stationary commutator brushes equal in number to the phases which the machine is arranged to receive or deliver are provided, and also an external lead from each of the brushes.

781,888. Telephony. Isidor Kitsee, Philadelphia, Pa. Application filed April 4, 1901.

A common battery is used in the exchange together with movable means for one terminal of each of the subscriber's circuits. A series of movable means is connected to one terminal of the battery circuit, the movable means of the outlying circuits being connected each electrically to one of the series of the movable battery device. Two of the outlying circuits are connected by two plugs.

781,919. System of Electrical Distribution. Charles W. Stone, Schenectady, N. Y., assignor to the General Electric Company. Application filed September 30, 1901.

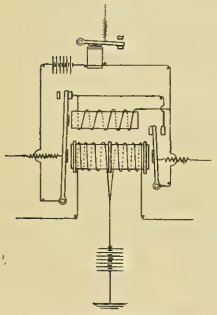
A set of balancing machines are connected between the mains, and other mains extend from connections between the balancing machines. A circuit-breaker is supplied for each main, an auxiliary tripping coil for each circuit-breaker, and means operate upon the tripping of any one circuit-breaker for energizing the auxiliary tripping coils of all of the circuit-breakers.

781,921. Gas or Fuel Engine. Elihu Thomson, Swampscott, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 14, 1898.

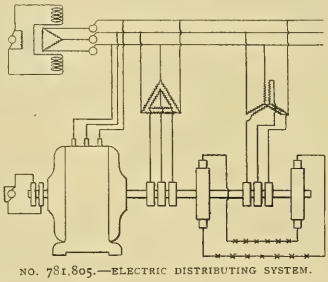
The only electrical feature about the engine is an electric igniting device.

781,931. Means for Protection Against Short-circuits. Charles E. Barry, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 15, 1904.

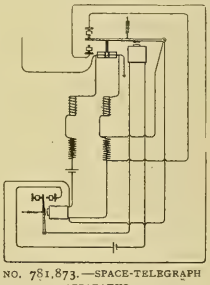
In combination with a conductor is a source of power



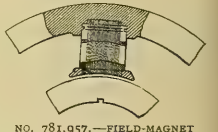
NO. 781,736.—NEUTRAL RELAY.



NO. 781,805.—ELECTRIC DISTRIBUTING SYSTEM.



NO. 781,873.—SPACE-TELEGRAPH APPARATUS.



NO. 781,957.—FIELD-MAGNET CORE.

connected thereto, a magnet winding connected between the conductor and the opposite polarity of the system, a normally closed switch controlled by the magnet winding and means controlled by the switch for breaking the connection between the conductor and the source.

781,932. Alternating-current Apparatus. Edward Bennett, Pittsburg, Pa., assignor to George Westinghouse, Pittsburg Pa. Application filed October 13, 1902.

Combined with a current-using means of variable receptivity are a cut-out having a coil in series with the means and a movable armature for the coil that serves to close a shunt around the coil and current-using means when the coil is deënergized.

781,937. Electric Arc Lamp. Albert G. Davis and John E. Hubbell, Schenectady, N. Y., assignors to the General Electric Company, Schenectady, N. Y. Application filed July 7, 1904.

A non-consuming electrode, a consuming electrode, a film-puncturing device carried by the non-consuming electrode, means for causing the puncturing device to engage the consuming electrode in the feeding operation of the lamp and means for moving the film-puncturing device out of the arc-path after an arc is started between the electrode are the characteristic parts of the lamp.

781,938. Vapor Electric Apparatus. John T. H. Dempster, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 27, 1904.

An exhausted envelope or container holds a main positive electrode. A combined negative electrode and positive electrode consists normally of coalescing bodies of mercury. Means permit of passing current through the mercury and other means act upon the current for breaking the continuity of the mercury between the electrodes.

781,945. Electric Meter. Edward S. Halsey, Chicago, Ill., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 13, 1902.

In an electric meter are a mercury receptacle, an armature mounted for rotation therein, a magnet having a pole piece in proximity to the armature and means for decreasing the resistance of a stationary return path through the pole piece for Foucault currents generated in the armature.

781,957. Field-magnet Core for Dynamos and Motors. Keijiro Kishi, Tokio, Japan. Application filed August 25, 1902.

Magnet cores are cast into the yoke of the field magnet, each of which consists of a bundle of iron wires held tightly together by an iron casing. Longitudinal interstices are left between the iron wires, which reach to the face of the pole. (See cut.)

781,962. Trolley. Edward H. Miller, Pittsburg, Pa., assignor of one-half to Harry Carr, Harry E. Weaver and Louis H. Rosenthal, Pittsburg, Pa. Application filed September 30, 1904.

The trolley wheel is mounted on a long shaft in a forked trolley harp. The shaft is provided, on each side of the wheel, with spiral grooves running toward the wheel, which always tend to conduct the wire toward the center and onto the trolley wheel.

781,968. Dynamo-electric Machine. Joseph Sachs, Hartford, Conn. Application filed September 19, 1903.

In combination are a generator armature, a motor armature and a common magnetic system, in which both the armatures operate. A common source of magnetomotive force and means other than the source for magnetically strengthening the flux through either of the armatures at the expense of the flux through the other are the other features.

781,984. Magnetizable Conductor Conduit System. William J. Alexander, Philadelphia, Pa., assignor to the Union Electric Construction Company, Philadelphia, Pa. Application filed July 1, 1904.

Electrically charged magnetizable cable divisions within the conduit have their end portions extending side by side past each other and independent of each other. Securing devices hold the ends of the divisions.

781,993. Circuit Closer. Walter J. Bell, Los Angeles, Cal., assignor of one-half to Leon F. Moss, Los Angeles, Cal. Application filed October 9, 1903.

An electromagnet is mounted on a car. A circuit-closer in the primary circuit is arranged to be operated by the magnet. A circuit-closer in the operating circuit is operated by the closing of the primary circuit.

782,007. Third Rail. Leonard T. Crabtree, Crandon, Wis. Application filed April 14, 1904.

The construction of the rail embodies a continuous feed wire extending through insulated supports and itself insulated from the supports.

782,028. Coin-freed Electric Meter. Frank Holden, Rugby, England, assignor to the General Electric Company, Schenectady, N. Y. Application filed March 3, 1903.

Prepayment mechanism is embodied in the meter, comprising a measuring-out element, coin-controlled mechanism for deflecting the element, means operated by the meter for returning the element to its initial position, a switch included in the meter circuit and means for actuating the switch. Means controlled by the position of the measuring-out element operatively connect the switch and its actuating means.

782,029. Prepayment Attachment for Electric Meters. Frank Holden, London, England, assignor to the General Electric Company, Schenectady, N. Y. Application filed September 4, 1902.

Coin controlled means for permitting the engagement of a switch member by the operating means of the meter are associated with mechanism controlled by the meter for preventing the engagement.

782,030. Electric Meter. Frank Holden, Rugby, England, assignor to the General Electric Company, Schenectady, N. Y. Application filed September 23, 1903.

In a motor meter are a continuously rotatable armature, collector brushes connected with its terminals, a reversing switch in circuit with the brushes and means for automatically operating the switch.

782,038. Thermal Cut-out. Charles E. Lockwood and George A. Lutz, New York, N. Y. Application filed October 28, 1903.

A thermal cut-out comprises a casing, a fuse wire or strip therein, caps fitting over the ends of the casing and provided with bayonet slots opening through the inner edges of the caps and screws passing through the slots and the casing and connected with the fuse wire or strip.

782,054. Induction Motor. Henry G. Reist, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 11, 1904.

In an alternating-current motor are a rotor body, conductors carried thereby, a conducting ring of smaller diameter than the rotor, and U-shaped conductors, each connecting a number of the rotor conductors to the ring.

782,066. Automatic Alarm Telegraph. Albert D. Shaw, New York, N. Y. Application filed April 15, 1904.

Telegraphic apparatus embodies signaling mechanism and mechanism for controlling the signaling mechanism, comprising a generator, a normally open local circuit connected with the generator and comprising a pivoted lever, a spring connected with the lever to hold it normally in contact with a portion of the circuit and means operated by the signaling mechanism to tilt the lever and break the local circuit at the completion of the operation of the signaling devices.

782,099. Telegraph System. William E. Athearn, Brooklyn, N. Y. Application filed June 2, 1902.

A quadruplex system is described, containing among other things current-transmitting devices and a damming coil contiguous to the devices.

782,131. Electric Temperature Alarm. Cowan P. Hepler, Smithton, Pa. Application filed February 20, 1904.

A bulb containing an expansible liquid has a tube extending therefrom. A conducting rod extends into the tube and a projection is fixed to the rod. Means are supplied for adjusting the rod to fix the projection at any desired point on a scale and indicate temperatures. An alarm and electric connections from the liquid and rod to the alarm complete the apparatus.

782,134. Asymmetric Shunt for Direct-current Electric Circuits of High Inductance. William S. Horry, Niagara Falls, N. Y. Application filed October 29, 1904.

A direct-current electric circuit, comprising a main circuit containing an inductance, contains also a switch controlling the circuit, and an asymmetric shunt circuit arranged to furnish a discharge path for the current generated in the inductance when the switch is opened.

782,150. Telephone Toll Register. George A. Long, Hartford, Conn., assignor to the Gray Telephone Pay Station Company, Hartford, Conn. Application filed August 30, 1904.

Details are described.

782,181. Wireless Telegraphy. George O. Squier, San Francisco, Cal. Application filed November 10, 1904.

Means for shunting a portion of the electromagnetic waves absorbed by living vegetable organisms, through a branch electrical circuit, and a suitable receiving device operated by the waves thus shunted are the points upon which the patent is based.

782,195. Trolley-pole Controller. Clarence V. Greenamyer, Los Angeles, Cal., assignor to William Hyman Holabird, Los Angeles, Cal. Application filed February 4, 1903.

In an electric railway having an overhead feed wire and supporting span wires, a trolley controller is used which is actuated by fluid pressure so as to maintain the required trolley contact on the wire and to lower the trolley automatically to a predetermined point below the span wires when it accidentally leaves the trolley wire.

REISSUE.

12,313. Apparatus for Operating Electric Signals for Elevators. Henry Pedersen, Brooklyn, N. Y. Application filed June 20, 1902. Original application filed July 18, 1899.

Electric signal apparatus embodies a movable device movable at a given rate of speed, two or more groups of contacts provided with conductors, each of which is yieldingly attached to the device, and a stop device for each group of contacts, whereby each group of contacts may be adjusted relatively to the movable device by contact with its stop device.

## EXPIRING PATENTS.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on February 14, 1905:

377,745. Galvanic Battery. T. M. Foote, Boston, Mass.
377,763. Printing Telegraph. J. H. Linville, Philadelphia, Pa.
377,788. Telephone System. E. P. Trayer and G. H. Kugler, New York, N. Y.
377,862. Combined Telegraph Key and Sounder. B. Oehmen, New York.
377,872. Electromedical Apparatus. T. R. TenBroech, New York, N. Y.
377,879. Telegraphy. C. Ader, Paris, France.
377,884. Current Regulator for Dynamo Electric Machines. W. A. Crowdus and H. M. Sutton, Dallas, Tex.
377,894. Support for Electric Conductors. M. J. Hart, New Orleans, La.
377,895. Secondary Electric Clock. W. B. Harvey, Memphis, Tenn.
377,916. Electric Bell. J. E. Tirrell, Somerville, Mass.
377,953. Tubular Metallic Pole for Telegraphic and Other Uses. A. Mills, U. S. Army.
377,994. System of Electrical Conversion. E. N. Dickerson, Jr., New York, N. Y.
377,996. Dynamo Electric Machine. R. Eickemeyer, Yonkers, N. Y.
378,021. Underground Electrical Conduit. R. F. Silliman, Troy, N. Y.
378,029. Electric Current Indicator. E. P. Warner, Chicago, Ill.
378,030. Telephone Exchange Central Office Connection. E. P. Warner, Chicago, Ill.
378,044. Telephone Transmitter. T. A. Edison, Menlo Park, N. J.

# WESTERN ELECTRICIAN

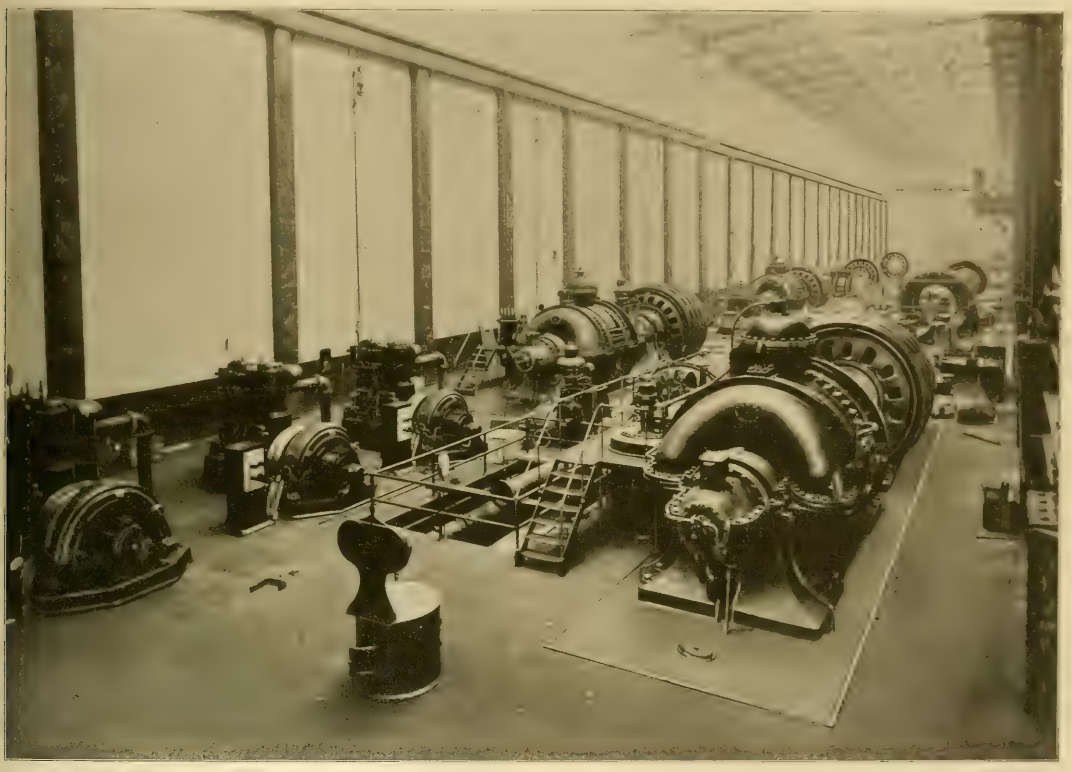
**EVERY SATURDAY**

Vol. XXXVI. CHICAGO, FEBRUARY 25, 1905 No. 8

## Power Plant and Sub-stations for London Underground Railway.

It is now several years since Mr. C. T. Yerkes came to London with the express intention of changing the cheerless conditions prevailing upon what was known as the "Inner Circle," the main steam railway encircling the heart of London. Everybody realized the magnitude of the task, which was not minimized by the fact that more than one company was interested in the question of a change in the mode of traction. That electric traction was the only solution was self-evident, but there were several engineers advising the Metropolitan company—the partner in the transaction—that the high-tension single-phase system would best adapt itself to the conditions obtaining. The advisers of Mr. Yerkes, on the other hand, strongly advocated the low-tension continuous-current system, and so, naturally, a complete deadlock occurred. The consequence was that most expensive arbitration proceedings took place to determine which system should be adopted, and, as is now well known, the continuous-current system gained the day. Mr. Yerkes' main stumbling block was thus removed, and he forthwith set to work to marshal his forces and make a start upon his arduous task. How he has succeeded the following article will show.

All the work has been carried out without any cessation of the existing steam service—no mean feat this, on a track where the trains of three companies were continuously running right into the small hours of the morning. A map of all the lines controlled by the Underground Electric Railways Company of London has already appeared in the Western Electrician (June 21, 1902), and in the following notes chief attention is paid to the sub-station equipment, as this is the most interesting part of the installation. It should be said, however, that the Lots Road generating station of the company is destined to supply electrical energy for working the whole of the system belonging to the District Railway Company, and also the following deep-level tube railways: The Baker Street and Waterloo, the Great Northern, Piccadilly and Brompton, the Charing Cross, Euston and Hampstead, as well as the Edgware and Hampstead line, which is a surface railway yet to be constructed. These lines amount to over 63 miles of track, the District Company representing 40 miles, and will unitedly represent by far the heaviest and densest traffic of any electric line.



LOTS ROAD POWER HOUSE FOR LONDON UNDERGROUND RAILWAY.

### Lots Road Power House.

Necessarily the joining together in one working scheme of so many undertakings, all of considerable importance, has called for a generating station of unusual proportions and design, and the now practically completed Lots Road power house contains 60,000 horsepower of generating plant, covers over 3½ acres of land, and has cost some $12,500,000. The site upon which the station stands measures 1,100 feet facing the river, and has a depth of 824 feet. There are four large chimneys, built on the Custodis principle with a height of 275 feet and an internal diameter of 19 feet. The arrangement of the boilers on two floors is a decidedly novel one in England, but represents nothing new in American practice. Coal is taken direct from the barges to the conveyors. Mr. J. R. Chapman, like Mr. Yerkes, formerly of Chicago, is responsible for the design.

The boiler house contains 64 Babcock & Wilcox water-tube boilers supported directly on the steel framework of the building, and space is left for [illegible] square feet of heating surface, and [illegible] a superheater of 672 square feet [illegible] divided up into sets of eight, the number required to operate each turbine unit at full load. There is no steam connection between the various groups except in one case, where a header for supplying steam to the auxiliaries is fed from two of them Chain-grate stoking gear is provided, with 83 square feet of surface for each boiler. Economizers with 10-foot tubes are grouped behind the boilers, with a by-pass flue, and the total pipe area installed allows 1,540 square feet of feed-water-heating surface per boiler.

The main steam piping runs down the boiler-house side of the dividing wall and under the engine-room floor to the turbines, and is supplied with the usual valves and water pockets.

In the engine room there are installed eight Westinghouse steam-turbine generating sets, each consisting of a turbine of 7,300 brake horsepower, coupled direct to a three-phase alternator of 5,500-kilowatts capacity. The former are of the Westinghouse single-cylinder, double-flow type, and are designed to run with a steam pressure of 165 pounds per square inch, a superheat of 100° F. and at a speed of 1,000 revolutions per minute. They are capable of sustaining an overload of 50 per cent. by aid of automatic by-passes, and are extremely economical in steam consumption. The three-phase Westinghouse alternators are of the revolving-field type, and on a non-inductive load will supply a current of 289 amperes per phase at a pressure of 11,000 volts. They are of 5,500 kilowatts capacity, with a frequency of 33.3 per second. The revolving field is a solid forging of Whitworth fluid-pressed steel of good permeability, and is wound in the

usual manner. The armature core of laminated iron is supported by a heavy cast-iron frame, divided horizontally, and is wound in slots on its inner surface.

The auxiliary plant is as follows: The four exciter units consist of an Allen-British-Thomson-Houston combination, and have a capacity of 125 kilowatts at 125 volts when running at 375 revolutions per minute.

The condensers are on the dry-vacuum principle, with separate motor-driven air and water pumps. They are installed in pits between the two rows of turbines, and have each 15,000 square feet of cooling surface which is fed with circulating water conveyed through 66-inch pipes from the Thames.

The cooling system is based on the principle of the syphon, and the 20-inch centrifugal pumps have simply to overcome the friction in these pipes.

The switch gear is arranged on three galleries placed principally across the north side of the engine room. It was supplied by the British Thomson-Houston Company, and all the high-tension switches are motor-operated by means of a low-pressure circuit controlled from a small pilot switchboard.

The cables were supplied by a British concern, and are laid in Doulton stoneware ducts. There are 24 sub-stations on the line, to each of which a duplicate feeder is run; 64 ducts have therefore been laid, which allow for some extension. The feeders are carried through the streets to the Earl's Court station of the District Railway, which is the nearest point to Lots Road.

### Sub-stations.

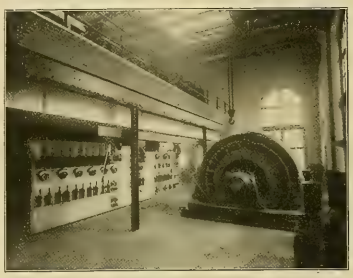
The sub-stations of the Metropolitan District Railway supply direct current to the southern half of the Inner Circle, and to a very wide area extending from East Ham to Hounslow and from Sudbury to Wimbledon and Richmond. These points form approximately the bounds of the company, and are all primarily supplied with power from Lots Road. As all the sub-stations are to a great degree similar in design and construction, it will suffice to select one of them for description.

Three-phase current at 11,000 volts is supplied from Chelsea by means of four feeders, and after being converted to direct current at approximately 600 volts, is conveyed by 24 cables to the track rail. In addition, there are direct-current feeders that supply current to the tube stations for operating the lifts and alternating-current feeders set apart for the lighting of the stations and tunnels. Typical views are given of the company's sub-stations.

Westinghouse spark-gap lightning arresters protect the high-tension feeders directly upon their entrance into the building, after which they pass to isolating switches of a single-knife pattern and operated by a long insulating pole fitted with a hook at the end. These switches are, of course, only used upon rare occasions, their function being to cut the pressure off from the oil-brake feeder switches when cleaning or repairs are to be undertaken. Like arrangements are made upon the other side of the oil switches, that is, between them and the bus bars. Reverse-current relays are installed for the protection of the high-tension feeders from the sub-station end, and thus, if a short-circuit occurs on any feeder, current will not flow to it from the sub-station bus bars.

The main high-tension bus bars are divided into four sections, each of which has one feeder and one rotary converter connected to it. By the agency of selector switches of the same type and method of operation as the isolating switches, these bus-bar sections may be so connected as to use the feeders separately or in parallel, as desired, and similar selector switches being included in the rotary circuits, a very flexible and convenient arrangement is secured. The pressure transformers, used in connection with the measuring instruments, are also provided with selector switches, and thus may be fed from any particular pair of bus bars if necessary. The transformers for the alternating-current lighting circuits are connected to the middle set of bus-bar selector switches, which arrangement makes it possible to supply the load from either pair of incoming feeders.

The circuit to the primaries of the step-down transformers is completed by isolating and main oil switches in series, and connection is made from the secondaries to the collecting rings of the rotaries through sets of three single-pole knife switches. The main oil switch of each converter is hand-operated in the ordinary way, but it is also fitted with an overload time-limit relay, which comes into operation, automatically tripping the switch, if a prolonged short-circuit or overload occurs. In addition there is a push button on the switchboard, the pressing of which will electrically open the main switch.



INTERIOR OF RAVENSCOURT PARK SUB-STATION FOR LONDON UNDERGROUND RAILWAY.

Two knife switches, one for each pole, are provided for the direct-current side of the rotary converter, and there is also a reverse-current circuit-breaker in the negative side and the usual equalizing switch, which latter, however, is not placed on the switchboard, but on a cast-iron pillar close to the machine. A small induction motor, coupled direct to the shaft, is provided for starting each rotary, and its switch is placed on the alternating-current converter panel of the switchboard.

As direct current is supplied from this sub-station to three railway systems controlled by the Underground Electric Railways Company, it has been necessary to split the positive bus bar up into three sections on the far side of the main load panel, and in each of these is interposed a suitable direct-current integrating wattmeter. The first and second meters measure the power in one train section and four track feeders, and the third, that in two track feeders. The three other cables that convey the current for operating the lifts are fitted in a like manner.

All lighting is carried out on the three-phase system, each sub-station being responsible for as much as lies half way between it and the neighboring ones. By the use of interconnecting switches it is possible, however, to couple up the sections, so that the lighting will not be interfered with in the event of a sub-station breaking down or being stopped.

A triple-pole automatic oil switch is interposed between the main switchboard and the high-tension lighting panels, which are mounted separately and distinct from the former. The current is transformed down, and then passes through a triple-pole switch and a small separate set of bus bars to the low-tension alternating-current bus bars, which are divided up into three sections, each feeding two lighting circuits. These run in duplicate to the District Railway, the Charing Cross, Euston and Hampstead Railway and the Baker Street and Waterloo Railway, respectively, and are each provided with integrating wattmeters for measuring their consumption.

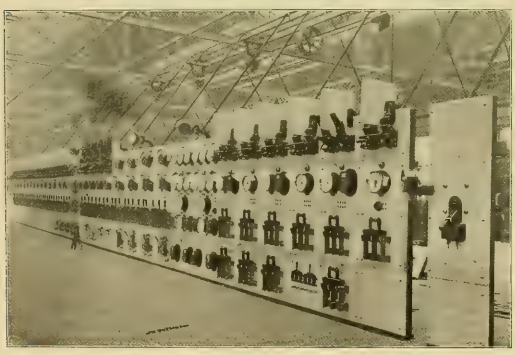
The switchboard instruments and controlling gear are mounted upon polished blue Vermont marble panels, which, collectively, give a total length of 69 feet four inches.

Beginning from the right-hand side, there are first the six alternating-current lighting panels, referred to above. Each pair of these contains two double-pole circuit-breakers, two ammeters, one integrating wattmeter, two 800-ampere triple-pole knife switches and one triple-pole 1,000-ampere switch for connecting the sub-lighting bus bars and the main bus bars. There are also two triple-pole two-way 100-ampere switches, for starting the fan motors that supply cooling air to the transformers, and one triple-pole main switch, for disconnecting the lighting transformer on the low-tension side. The usual swinging arm is attached to these panels, in this case carrying a 300-volt instrument, and plugs and sockets are provided that will allow of its connection to any phase and any low-tension feeder for purposes of voltage measurement. The four in-coming high-tension feeders are connected, two each, to two instrument panels placed adjacent to the lighting section of the board. These panels are fitted each with six 300-ampere ammeters, two synchroscopes, two integrating wattmeters and two polyphase reverse-current relays. Adequate illumination of the instruments is obtained by four incandescent bracket fittings. The two red signal lamps below the ammeters are so connected with the two main feeder switches that they will light up, and so warn the attendant in the event of either of these opening automatically on a fault. These panels also contain two push buttons for tripping the main oil switches and two voltmeter switches, one for each feeder.

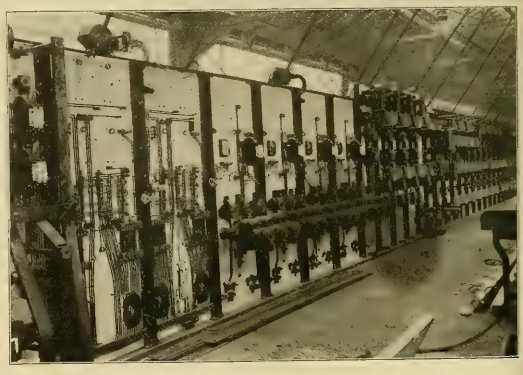
Following the feeder section of the board, there are four alternating-current low-tension panels for the rotary converters, each of which contains a large illuminated-dial ammeter, one power-factor meter and one polyphase, overload, time-limit relay. Red lamps are also fitted and connected with the main switches for the purpose described above. The alternating-current side of the rotary is controlled by three large single-pole knife switches, placed conveniently on the lower portion of the panel, and the sub-base of each contains a starting switch for the induction motor used for starting the converters.

Centrally placed above the four panels is a Westinghouse synchroscope mounted on a double-jointed bracket that enables it to be turned in any direction.

The four direct-current panels for the same machines stand next, and contain each one 4,000-ampere circuit-breaker, with a reverse-current relay



Front View.



Rear View.

VIEWS OF SWITCHBOARD IN CHARING CROSS SUB-STATION FOR LONDON UNDERGROUND RAILWAY.

attachment, one large illuminated dial ammeter, one voltmeter plug switch, two 4,000-ampere single-pole knife switches and a rheostat dial switch on the sub base.

Then follows the main load panel upon which are mounted an illuminated-dial voltmeter for the bus bars and another similar one for the machines and an illuminated-dial ammeter that measures the total bus-bar current. Next is the wattmeter panel, containing three instruments of 8,000, 6,000 and 4,000 amperes capacity, respectively, which are used for metering the power supplied to the three lines before mentioned. The lift panels follow this, three in number, and are each fitted with a suitable wattmeter for measuring the power absorbed by each railway in its lift circuit. After these come 12 train-section and track-feeder panels with a capacity each of 3,000 amperes. They are individually fitted as follows: Two single-pole, 3,000-ampere circuit-breakers, one 4,000-ampere illuminated-dial ammeter and two 3,000-ampere single-pole knife switches. This double-pole arrangement is necessary, as both the positive and negative-current rails are insulated from earth throughout.

The bus bars, which are built up of six by one-fourth-inch copper strap, are arranged with a ventilating space between each section, instead of being clamped together solid, as is frequent practice.

The small wiring of the switchboards, which so often constitutes a danger, has been very carefully carried out, and is neat and at the same time thoroughly mechanical.

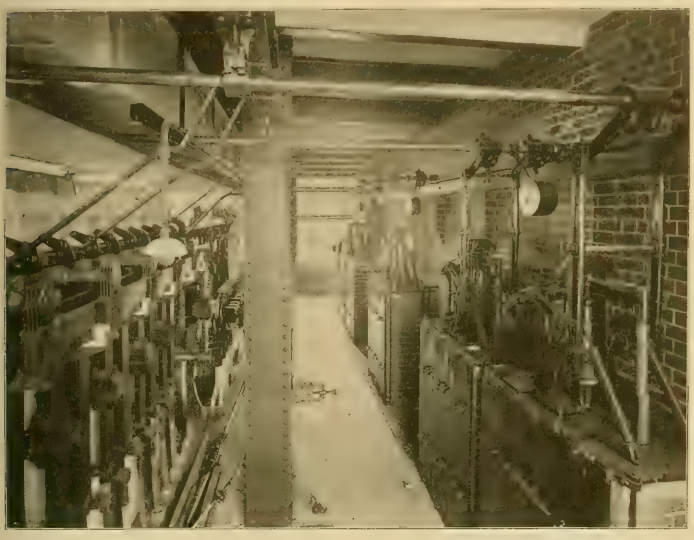
The low-tension alternating-current ammeters are all operated by small series transformers, which in themselves are decidedly unique. They consist only of a magnetic circuit and a secondary winding, and all that is necessary is to slip them over the switch studs which form the primary, inducing by the virtue of the current flowing in them the secondary current that operates the instrument.

By the arrangement of the whole of the high-tension gear, such as cable ends, series transformer, etc., on an incombustible brick wall, divided into small cells, fire and life risks are minimized to a great degree. In similar but horizontal cells the high-tension bus bars are placed, and the lightning arresters have each a separate compartment with a fireproof door completely isolating it, but rendering access easy.

Hand operation is used for all the oil-break switches in the sub-stations, and this is effected through gearing by large levers; as before mentioned, they are electrically tripped.

The switches are erected in a masonry structure with each of their three poles, and the oil tank in which they are immersed, in a separate fireproof compartment. Two stationary contacts mounted in large porcelain insulators are provided for each pole, one being connected to the incoming lead and the other to the outgoing. The movable contact consists of a copper bridge piece mounted on the end of a strong wooden rod, which latter is fastened at the upper end to a cross-bar common to all three poles. In closing, the magnets, mounted on top of the contacts with the armature, initially, of a pair of balance springs, and through the agency of a system of levers that give a straight line motion. The switch is kept closed by a toggle joint, which automatically locks the levers, but upon putting the tripping gear into action, the toggle is released, and gravity, assisted by a powerful spring, causes the cross-bar and contacts to drop to the open position. The oil tanks, which may be readily disengaged from the contacts, are constructed of heavy sheet metal and lined interiorly with an insulating cement molded to fit closely around the terminals and moving contacts. The amount of oil required and fire risk are thus reduced to a minimum, and the wooden rod carrying the contact piece interposes an effectual barrier between the two terminals of each pole.

The tank is fitted with a gauge glass that shows the oil level at sight, and draining and refilling arrangements are provided that allow the oil to be changed without putting the switch out of service.



OIL SWITCHES, ETC., IN HOUNSLOW SUB-STATION FOR LONDON UNDERGROUND RAILWAY.

The small double-pole two-way knife switch mounted on the top of each case is connected in the red lamp indicating circuit above mentioned, and is operated by the movement of the main switch levers, changing its position as the switch moves from "on" to "off," or vice versa. The essential features of this oil-break switch may be shortly summarized as follows: A positive and direct action, the maintenance of the open position by gravity, the immersion of all live parts in oil, high insulation and great freedom from fire and shock risks and accessibility for cleaning and repair.

The contract for all of the District Railway sub-stations was awarded to the British Westinghouse Company, which is responsible for the design, manufacture and installation of all the buildings and plant.

## Death of S. L. Barriett.

S. L. Barriett of the Barriett Electric Company of Cincinnati died suddenly in Dayton, Ohio, last week. He was an inventor of considerable note and had earned his reputation in the design of electrical machinery, one of his products being the well-known Cincinnati motor. He was at one time associated with the Sprague Electric Company and worked out various controlling devices for that company. Mr. Barriett organized the Cincinnati Electric Motor Company, the name of which on July 1st last the directors changed to the Barriett Electric Company in honor of him. Much money was spent on the equipment of the factory before any work was done, supplying it with all sorts of automatic apparatus after his ideas. The company was also equipped for the manufacture of a new motor, upon which Mr. Barriett was working.

S. L. BARRIETT.

## Chicago Traction Developments.

[illegible] come of franchise-extension negotiations. With the Union Traction Company nothing new has developed [illegible] to the City Council outlines a plan for a municipal street-railway system to cover the lines for which the franchises have expired. This would be in accordance with a resolution passed by the council on July 11, 1904, and would constitute chiefly the Chicago Passenger Company system and connections with such other lines as are not protected by the 99-year act. The [illegible] certificates issued under the provisions of the Mueller law and would [illegible] bidder, putting the rental money into a sinking fund which would be used to take up the certificates when they fall due and to prepare for the time when the city might assume the operation of the property.

### New Officials of South Side Company.

The directors chosen by the new owners of the Chicago City Railway stock have elected Thomas E. Mitten of Buffalo, N. Y., as the new operating head of the road. Mr. Mitten will be the first vice-president and will assume his duties on March 1st. No president was elected and there is no intention of naming one, for some time at least. J. A. Spoor as president of the board of directors and chairman of the executive committee will be at the head of the company as far as matters of finance and general policy are concerned. The other officers elected are: Second vice-president, Lawrence A. Young; general manager, Mason B. Starring; secretary, C. N. Duffy; treasurer, T. C. Penington. Besides Messrs. Mitten, Young and Spoor, the names of A. J. Earling, Robert M. Fair, Edward Morris and P. A. Valentine also appear on the board of directors.

Thomas E. Mitten, the new operating head of the company has had extensive connection with electric-railway development, following about eight years in steam-railroad service. He is at present general manager of the International Traction Company of Buffalo and Niagara Falls, having been with the company since 1901. While superintendent of the Denver, Lakewood and Golden railroad he substituted electricity for steam on many of the company's lines near Denver. After two years in Colorado he went to Milwaukee, and his success there led him to Buffalo to prepare for handling the Pan-American Exposition crowds. He was born in Susseex, England, in 1865, and came to the United States in 1880. At the age of 19 he began his railroad career as a telegraph operator for the Chicago and Eastern Illinois road.

THOMAS E. MITTEN.

### Republicans on Traction Issue.

The Republican party has placed in nomination John M. Harlan for mayor of the city. Mr. Harlan, it is known, does not believe in immediate municipal ownership, but concedes to the voters the right to pass upon any traction ordinance before it is finally passed by the council. Adequate facilities for rapid and inexpensive transportation he considers as the immediate and vital question for the city to solve. On the traction question the platform adopted at the Republican convention says:

"It is the duty of the City Council and the mayor to formulate and present to the people a definite and comprehensive plan for the immediate rehabilitation and improvement of our street-railway service. This plan should contain ample provision for municipal ownership and operation when the city shall be legally and financially able successfully to adopt it."

"It is our settled conviction that no ordinance for the solution of the street-railway problem should be placed upon its final passage until ample opportunity shall have been afforded for a referendum under the public-opinion law. If disapproved by the people, such ordinance should not be passed, for this particular matter is of such general interest and of such vital importance to the people that no solution should be adopted of which the people disapprove."

## Use of Trees in Military Space Telegraphy.

In all successful forms of space-telegraph apparatus as yet developed some form of metallic aerial wire, usually vertical and called an antenna, is required when any considerable distances are to be spanned. These aerials present one of the principal items of expense in a station and at the same time one of the most serious engineering problems of the installation. From a military viewpoint the ability to use space telegraphy without employing cumbersome masts and accessories which would have to be transported in the field would add much to the value of this method of communication. As is well known, the Signal Corps of the United States Army has done much in the way of equipping various government space-telegraph stations; and quite prominent in this work is Major George O. Squier.

To Major Squier a patent has just been granted which relates to a method of using trees as the antennæ of space-telegraph stations for work in the field, and a description of his method of operation will be found of interest.

Major Squier has discovered that for at least moderate distances all such forms of aerial conductors, plates, or surfaces or other means of absorbing electromagnetic waves ordinarily used can be entirely dispensed with, using in place living vegetable organisms, such as growing trees, preferably covered with foliage.

It is well established in the art of space telegraphy that it is several times more difficult to practice the system over land than over the sea. It is also known that this is largely due to the absorption of the electromagnetic waves by the surface of the earth, intervening hills, mountains, etc., and by objects on the surface of the earth, such as buildings and foliage in general. It has been discovered that growing vegetation, particularly in the form of tall trees

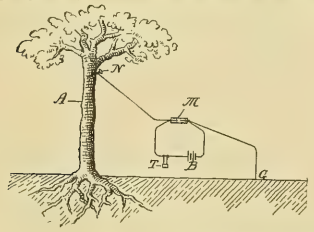



FIG. 1. USE OF TREES IN MILITARY SPACE TELEGRAPHY. —RECEIVING APPARATUS.

covered with foliage, absorb the electromagnetic waves passing through them to a remarkable degree, to such an extent that instead of becoming an obstacle to space telegraphy they themselves may be used for efficient antennæ, absorbing the Hertzian radiation sufficiently to enable the ordinary forms of electric-wave detectors to be used for the reception and transmission of messages.

Experience has shown the great importance attached to a good ground connecting the transmitting and receiving antennæ with the earth, and various expedients are resorted to to secure this. Among these may be mentioned the burying of large conducting plates in water deep in the earth, or surrounded by coke or other material, or the insertion of metal strips in the surface of the earth or beneath it in the vicinity of the foot of the transmitting and receiving antennæ. Experience has also shown the importance of a good electrical conducting area on the surface of the ground in the vicinity of the foot of the antenna, particularly to a distance at least equal to a quarter of a wave length of the radiations used, and numerous suggestions have been made for increasing this surface conductivity of the earth by spreading metallic nets or other devices at the foot of the antenna, either surrounding it entirely or in the direction of the distant station or stations. A living vegetable antenna, as presented in a growing tree, with its large number of roots generally extending out radially from the trunk and often to great depths, therefore conducts electromagnetic waves with great facility, affording an excellent ground for intimately joining electrically the vertical antenna to the earth.

The roots of a tree are organized cells filled with saps or juices composed of water, starch, cellulose, protoplasm, various vegetable acids, and mineral substances of various kinds, depending upon many conditions well known to the botanist. This sap has been found to possess electrical conductivity, and it, as existing in the living cells of growing vegetable organisms, is well adapted for the transmission of electromagnetic waves. It is also well known that there is no more intimate connection between earth and air, both of which are essentially involved in wireless telegraphy, than is found in growing vegetation, which, in fact, lives and grows from the constituents of both. The main roots of a tree are covered by innumerable microscopic organized hair roots and rootlets, through the surfaces of which the tree obtains its nutrition from the soil and the general vegetable circulation is maintained, and the fluids thus involved in this circulation in the organized cells have been found to be good conductors for electromagnetic waves. Again, it is a general object in space telegraphy to increase the capacity of the vertical antenna by adding extra

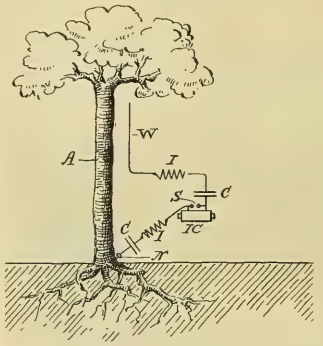



FIG. 2. USE OF TREES IN MILITARY SPACE TELEGRAPHY. —CONNECTIONS FOR SENDING.

wires or conducting metallic plates or surfaces. In the vegetable antenna here proposed the great aggregate surface of the growing leaves elevated from the surface of the earth acts as the capacity areas and greatly increases the electrostatic capacity of the whole. These leaves act in much the same manner as conducting plates for electromagnetic waves and can be charged and discharged in the same general way through the conducting cells and juices throughout their structure. In general, this large surface of growing leaves serves as a large plate of a condenser, whose other plate is the earth, the stem or trunk of the tree connecting the root system below. This root system also seems to insure a good conducting space or area of earth around the base or foot of such an antenna to a considerable radial distance and conduces to keeping the surrounding earth bed in a moist and therefore good conducting state for electric waves.

The accompanying diagrams indicate a few of

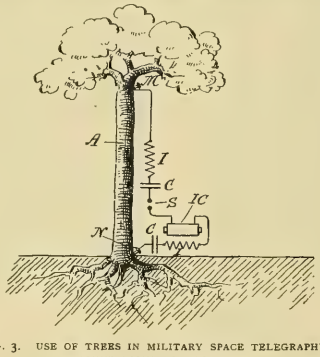



FIG. 3. USE OF TREES IN MILITARY SPACE TELEGRAPHY. —CONNECTIONS FOR SENDING.

the simplest arrangements found in practice to be successful.

In Fig. 1, (N) represents a point of electrical connection with the tree, formed in any suitable manner, such as driving a metallic nail into the tree. A suitable detector for electric waves, such as a coherer or microphone, is shown at (M). The electrical connection with the earth may be made by any suitable means, such as driving a metallic pin into the surface. A telephone or other suitable device is used to interpret the effects caused in the receiver or detector by the electrical waves. Obviously, the detector (M) may be connected to the circuit through a suitable oscillation transformer.

For the electrical waves absorbed by a growing tree, as indicated in Fig. 1, it has been found, as theory indicates, that there is a general potential node for the electric waves in a region at or near the base of the tree where the earth line intersects its trunk or stem. It has been found by experiment that a vertical wire or antenna grounded at its lower extremity possesses a potential node at the point of contact with the earth for electric waves sent or received. This potential-node region has been found by experiment to be one of the advantageous points of connection for the receiving circuit.

The arrangement indicated in Fig. 1 gives good results and have been operated over distances of several miles with complete success. Investigation has shown that the point (N) may be a point of electrical connection with the tree through its main trunk or stem, its branches, buds or leaves.

Figs. 2 and 3 show simple methods of transmitting electric waves by the invention. Manifestly, the electrical waves may be impressed upon the aerial through the medium of an oscillation transformer or in any other suitable manner. Since the capacity of an aerial wire is increased by the presence near it of another conductor, the aerial wire (W) (indicated in Fig. 2) may be placed at various distances from the trunk or stem of the tree and parallel thereto to produce changes in the efficiency of transmission.

## A Simple Lightning Recorder.[1]

By Henry F. Alciatore.

In the latter part of August, 1902, the writer, at his own expense, constructed and erected in the local office of the United States Weather Bureau

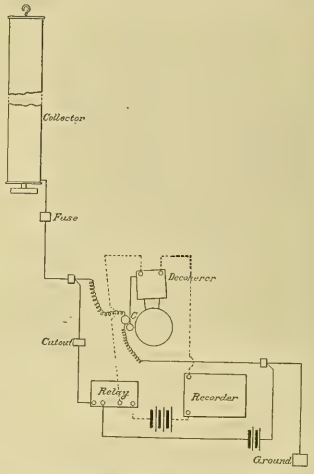



DIAGRAM OF SIMPLE LIGHTNING RECORDER.

in New Orleans, La., a lightning recorder which has proved fairly satisfactory. Our object was to obtain automatic records of the hundreds of electric discharges, visible and invisible, that usually precede and accompany thunderstorms and to study the same with a view to increasing the accuracy and value of local weather forecasts.

The action of the instrument is based upon the effect that high-tension electric waves in free air, such as lightning, have upon metal filings suitably arranged in a glass or other insulating tube between two metal electrodes, one of which is connected to a collector above the ground and the other to the earth. In their normal state the filings rest loosely at the bottom of the tube between two electrodes about one-sixteenth inch apart, and their electrical resistance is comparatively high. Now, when lightning occurs in the vicinity of the filings some of the electric waves traveling through the air pass through the filings from one electrode to the other; this causes the filings to stick together and their electrical resistance is greatly reduced, thereby rendering it possible for the current from a local battery to operate a relay in circuit with the filings, which in turn operates a device that separates the filings and restores them to their original condition and at the same time records the passage of the electric waves.

The collector is a hollow cylinder 14 feet long and 11 inches in diameter, made of two sheets of commercial zinc nailed to three disks of wood, one at each end and the third in the middle. The edges of the zincs are soldered. There is an eye hook at the top of the guy lines and a quarter-inch bolt, about two inches long, at the bottom, which fits into an ordinary telegraph glass insulator, fixed to a six by six wooden board one inch thick nailed to the floor of the platform, upon which the collector

1. Condensed from the Monthly Weather Review.

stands in an upright position. The top of the collector is about 110 feet above the ground.

The coherer, indicated at (C) in the diagram, consists of a piece of thick glass tube, one-quarter inch inside diameter, two inches long, into which are closely fitted two silver electrodes each one-quarter inch in diameter and three-eighths of an inch long, with a piece of copper wire soldered to each. The electrodes are about one-sixteenth of an inch apart. In the space between them are placed a few filings filed from a dime with a coarse file. One dime will give enough filings for a dozen receivers. The spaces back of the electrodes are filled with plaster of paris, to keep the moisture out.

The decoherer is an ordinary 3½-inch electric bell, to the hammer of which is soldered a stout piece of wire, two inches long, at right angles with the axis of the hammer, and to which the coherer is attached by a piece of insulating tape. When the bell rings, the filings are shaken and separated.

The relay is of the ordinary kind used in telegraphy and has a resistance of about 150 ohms.

The fuse is a piece of two-ampere fuse, about three inches long, such as is used in electric-light circuits.

A sewer, gas or water pipe, of metal, under the ground, or a small piece of metal buried in the earth will answer for a ground.

A small cut-out, with ebony handle, such as is used in electric-light wiring, and two double connectors of the kind used in telegraphy are used.

Two batteries are used, one of two dry cells for the coherer and one of four dry cells for the decoherer and recorder circuits.

A piece of No. 10 weatherproof, electric-light wire, to lead from the collector to the coherer, and a supply of office bell wire for office connections will be needed.

The recorder consists of a strong clockwork, a hollow wooden cylinder 3¼ inches in diameter and 3¼ inches long, mounted on an endless screw fixed to an upright iron support at one end, and a small door-bell magnet, on whose armature is soldered a self-inking pen made of a hollow brass cone about one-quarter of an inch in diameter at the base and one inch long. The cylinder carries a sheet of paper divided into hour and five-minute spaces, and makes a complete revolution once every hour. A fresh sheet is placed upon the cylinder every 24 hours. Every time the recorder ticks, the pen, which is suspended over the cylinder about one-sixteenth of an inch therefrom, strikes the paper and imprints thereon a dot.

## Detroit Lighting Situation.

Manager Alex Dow of the Detroit Edison Company has withdrawn his offer to pay $1,000 for an expert investigation of Detroit's municipal public lighting plant. The offer was accepted by the city, but, owing to the conditions placed on the examination by the aldermen, Mr. Dow has declined to proceed. It is contended by Mr. Dow that lights are not being furnished as cheaply as reported by the commission.

Alderman Gibbons, chairman of the special council committee which is making an investigation of the prices charged by the Edison company, has requested the general public to make all complaints known, so that the matter may be brought to the attention of Mr. Dow at a meeting to be held soon.

The Detroit Public Lighting Commission has ascertained that the issue of bonds for the extension and enlargement of the plant would not be legal, has cut out $22,270 from the original estimate providing for the purchase of a lag generator. The total amount allowed as it now stands is something over $282,000, which is over $50,000 more than was allowed last year.

## Electrical and Other Mosquito Traps.

Experiments have been in progress during the last two or three years in the direction of insect destruction by mechanical means. The apparatus shown in one of the accompanying diagrams is one in which the mosquito is lured to the device by the tuneful buzzing sounds of harp-like music produced by vibrating steel cords, only to meet with death by electric shock. Since the first presentation of the device, according to a Massachusetts contributor, who supplies the Western Electrician with this information, the design and mechanism have been improved, and the trap is nearer the stage of success now. The contrivance is designed for adjustment upon a pole or other arrangement, so as to make the apparatus free of access. Fig. 1 is a sectional view of the dome, inside of which are found the mechanical devices for performing the work of destruction. The dome is of cast iron or sheet metal, as the case may be. The diameter should be about 40 inches for the full size and reduced to 10 and even five-inch domes for lighter work. The largest domes are intended for swamps and places where millions of insects are to be destroyed. Sometimes the dome is oval or bell form, and again it may be conical. In either event the interior fittings are about the same. Several of the domes may be connected in one electrical circuit.

The dome is painted jet black on the outside and a glossy, attractive white inside. Every effort is made to make the spot an inviting one for the mosquito, as he has to be fooled into entering the dome to his destruction. The object is to lure the insects to the spot by the humming sounds in imitation of the buzzing mosquito. The mosquitoes or other insects usually arrive in swarms and follow the direction of the arrow up into the dome, as shown in Fig. 1. Magnetic coils (A) (A) are fixed and the proper wire connections made with the wire main. Coils of 1,000 ohms resistance are used. The point of connection with wires is at (B). The globe or reservoir at (C) contains sweet-odor-producing ingredients, and there is a perforated top to admit drops of water. Rainwater is caught in the tunnel fitted above the dome, and the arrangement is such that the water drops slowly and gradually downward to the perforations of the globe (c). The moisture thus produced makes the necessary odor come forth from the perfume-producing ingredients in the globe. This odor serves to attract certain species of insects where the humming tunes fail. The establishment of an electrical arc light in the dome, or very near it, according to the common manner of adjustment, completes the setting. The light, of course, is required only for night service. In some cases the light is not employed at all. In the day the degree of killing depends upon the number of insects called into the trap by the deceptive music.

Fig. 2 shows one of the harps, the cords of which can be vibrated by the motion of the air or by electrical connection. The tunes sounded are soft, light and [illegible] light, fixed in position where the odor chamber is shown in Fig. 1.

As to the harp in Fig. 2, this is made of a hard-wood-finished frame (E) and (G), with the necessary brackets of metal to secure the pieces in proper order. The wires are then strained to correct tightness. The air-waves play through the light wires, and music that appeals to the mosquito is produced. Usually the destroyed insects fall to the ground. It is essential, however, that the apparatus be cleaned each morning to remove the dead insects adhering to parts.

Fig. 3 illustrates another style of the insect-destroying device. This consists of the dome arranged horizontally as shown. There is no electrical current for destroying life, but intense fumes are made to arise from the reservoir at (J) to overcome the insects, which are sucked into the dome by the action of the propeller (H). This affair is self-acting, there being a four-bladed wind-wheel at (I). This wheel is fitted to the shaft that carries the interior propeller (H). Thus when the wind blows, the propeller is caused to [illegible] insects are attracted to the spot by the light which is provided for this purpose, and as they get near the air currents are drawn into the dome and, coming in contact with the poisonous fumes, are killed.

Fig. 4 is a detail of another of the magnetic-coil devices. The coils are shown at (K). The wire connection is marked (M). The capped chamber for retaining liquids is indicated at (N). Though in the experimental stages, considerable practical work has been done with the electrical devices here mentioned, and it is possible that their practical application may be valuable.

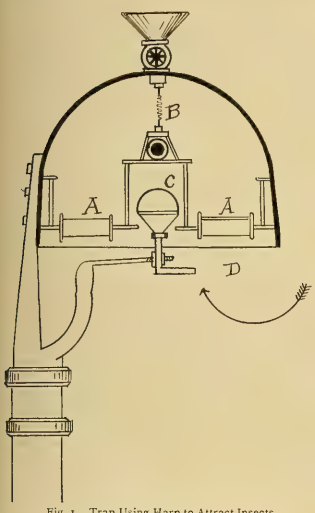


Fig. 1. Trap Using Harp to Attract Insects.

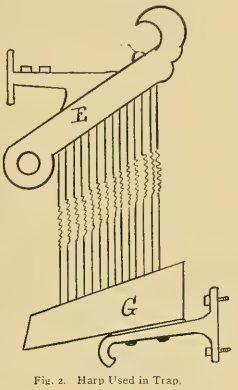


Fig. 2. Harp Used in Trap.

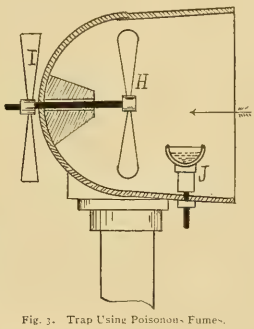


Fig. 3. Trap Using Poisonous Fumes.

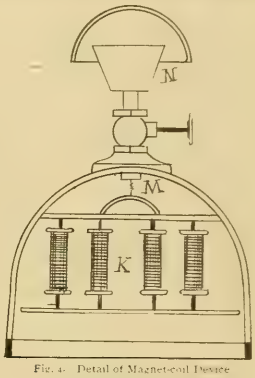


Fig. 4. Detail of Magnet-coil Device

ELECTRICAL AND OTHER MOSQUITO TRAPS.

## Electrothermic Production of Iron and Steel.

At the recent meeting of the Canadian Society of Civil Engineers, Dr. E. Haanel, Dominion superintendent of mines, read a paper on "The Electrothermic Production of Iron and Steel," in which he summarized briefly the work of the commission appointed last year by the Canadian government to examine the leading smelting plants of Europe and the Ruthenburg plants in the United States. Dr. Haanel showed conclusively that electric manufacture of high-grade steel is commercially practicable already; that the manufacture of ordinary steels, if not yet practicable, is likely to become so almost immediately, and that in localities having good ores and ample waterpower, even pig iron can now be made by electricity at a cost but little greater than that made with coke. Dr. Haanel predicted a very rapid development of electrical methods. The older ways of making iron and steel had almost reached their limit of economic development, and no very startling reductions in cost are probable, whereas electrothermic methods, although new, have already been so successful as to justify the belief that they will soon become of commercial importance.

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## DATES AHEAD.

Iowa Telephone Association (annual meeting), Chamberlain Hotel, Des Moines, March 14th to 16th.

Ohio Independent Telephone Association (annual meeting), Columbus, March 30th.

Iowa Electrical Association (annual meeting), Hotel Julien, Dubuque, Iowa, April 19th and 20th.

National Electric Light Association (annual convention), Denver, June 6th, 7th and 8th, and Colorado Springs, June 9th and 10th.

National Interstate Telephone Association (first convention of consolidated telephone associations), Chicago, June 21st, 22d and 23d.

International Association of Municipal Electricians (annual convention), Erie, Pa., August.

Ohio Electric Light Association (annual convention), Hotel Victory, Put-in-Bay, August 16th to 18th.

American Electrotherapeutic Association (annual meeting), Academy of Medicine, New York city, September 19th, 20th and 21st.

AMONG quite a large number of bills relating to matters of electrical interest and now pending in the Legislature of Wisconsin is one providing for a state board of assessment to fix the taxes for electric-light plants and another to prevent the standing of passengers in street cars. A third provides that "The net proceeds or profits of operation of any municipal light or water plant shall be devoted exclusively to the payment of the debt incurred in acquiring, building, repairing, improving or extending such plant. All light or water furnished shall be paid for on a uniform scale of rates sufficient to pay the expenses of operation of such plant and the charges above specified. Whenever the income from such plant for service rendered shall be more than sufficient to pay the expense of operation and the charges above mentioned the rates for service shall be reduced."

Electrical interests should watch closely the work of the legislators in the various states.

AUTOMOBILE progress, as demonstrated by the winter shows, is not without its crumbs of comfort to the friends of electric vehicles, although, to be sure, the gasoline machine rather occupies the center of the stage. As a recent unprejudiced writer expresses it, "In American hands the electric vehicle has also risen to an eminent state of perfection, and is now manufactured in nearly every size and style, from the light runabout to the five-ton truck. It is the prevailing vehicle for cities, where it is largely represented by cabs, hansoms, stages and wagons; and the periodically recurring necessity of recharging the storage batteries is, we may safely assert, the only serious obstacle to an indefinite extension of its use. It is the easiest to handle, the cleanest, and, allowing that its driver observes all rules on the care of his battery, also the least liable to become disabled." Perhaps it may be questioned whether the electric is quite the "prevailing vehicle" among automobiles in cities, although when the useful but not showy delivery wagons and trucks are taken carefully into account, it may be that the statement is an exact one. At any rate, the electric vehicle, with the drawbacks due to the weight and recharging necessity of the battery, has several conspicuous advantages over all other types, such as simplicity, ease of operation, absence of noise and odor, and general attractiveness. It is holding its own well in the automobile field, not as an uncouth racing machine or a lumbering Noah's Ark on wheels, but as a sensible vehicle for sensible people.

THE COST of producing power for electric-railway purposes in the state of Indiana formed the basis of a paper read by Mr. A. S. Richey at the meeting of the Indiana Electric Railway Association held in Indianapolis last month. In the paper are given some interesting figures relative to the cost of production of power for the purpose stated. These figures were obtained by the author from answers to a number of letters of inquiry sent out by him to the principal electric-railway companies of the state, the responses representing about 85 per cent. of the total installed generating capacity. These power stations generate, on the average, 5,845,450 kilowatt-hours a month at an average total cost (for labor and materials) of $44,136.38, or 0.755 cent a kilowatt-hour. The average cost, itemized, is as follows: Fuel, 0.526 cent; labor, 0.158 cent; lubricants, waste and miscellaneous supplies, 0.032 cent; repairs, 0.039 cent. The lowest cost a kilowatt-hour was 0.505, the highest being 2.024 cents. Lowest cost for fuel reported was 0.368 cent, while the highest was 1.405 cents. The lowest costs for labor, for lubricants, waste, etc., and for repairs were 0.10 cent, 0.015 cent and 0.01 cent, respectively. The highest costs were 1.331 cents, 0.086 cent and 2.18 cents, respectively.

The costs given above are calculated at the generating station switchboards, and it is evident that as six of the 13 stations reporting are alternating-current stations, with transmission lines and sub-stations, these costs must be increased by the addition of the sub-station expenses. Taking this factor into consideration, the total cost of power delivered to the direct-current feeders is $47,500.01, or 0.964 cent a kilowatt-hour, the lowest cost reported being 0.747 cent and the highest 2.024 cents a kilowatt-hour. The total amount of coal burned by the stations reporting amounts to 532½ tons daily. The power-station capacity per interurban car operated averages about 200 kilowatts, the lowest being 150 kilowatts. The roads reported a monthly car-mileage of city cars amounting to 1,122,060 miles and of interurban cars 630,258 miles. The average power consumption is 1.48 kilowatt-hours a car-mile for city cars and 5.18 for interurban cars. The average cost of power a car-mile for city cars is 1.48 cents and for interurban cars five cents.

These figures are not only of much interest but of considerable importance as well. They will be of especial value to designing engineers and station managers—a meritorious addition to the existing literature on the subject.

REPORTS of the "wireless" companies are always cheerful reading, for the gentlemen engaged in the promotion of space telegraphy certainly take an optimistic view of the future. This pleasing enthusiasm is to be seen in the directors' report of Marconi's Wireless Telegraph Company for the year ended September 30, 1904, presented at the annual meeting held a few days since in London. The net profits increased about $10,000 for the year, being $60,000 for 1904 against $50,000 for 1903. We are told that the business of the company is making satisfactory progress all over the world, and with the stations for transatlantic service in operation a new era in the company's affairs may be anticipated. The directors consider that, as a result of Mr. Marconi's experiments, the company is now in possession of all the data necessary for the equipment of stations for good commercial working between England and America, and a new station embodying the latest improvements equipped on a commercial scale is already nearly completed in Canada. The question of a site for a new station in Great Britain is still under consideration; the greater part of the machinery has, however, already been ordered, and it is expected that a station similar to that nearly completed in Canada will be equipped in the United Kingdom a few months after the site has been finally selected. It may be stated that a single pair of stations is capable of working at a speed of from 30 to 35 words a minute; a pair of the company's stations now operating commercially shows an average working speed of 24 words a minute, calculated from one hour's working on six successive days.

Reference is made to the arrangement (now in effect) for the collection at all postoffices in the United Kingdom of messages to be transmitted through the Marconi shore stations to ships at sea. Certain ships have recently been in communication with England, by wireless, throughout the whole of the voyage from Gibraltar. "Four stations have been equipped during the year on the St. Lawrence with our apparatus, and a new contract has been entered into with the Canadian government by our associated Canadian company, representing extensions of the organization of wireless-telegraph stations already established to the order of the Canadian government. Five stations have been equipped at fishing centers along the Labrador coast. When the other stations contemplated have been erected in Canada, the chain of stations will offer to the Newfoundland government direct wireless communication between the Labrador coast and Canada." Extensions in Italy and Chile are mentioned, and there is the following interesting allusion to international action: "A proposal to the powers was, it is understood, made by Germany for a further conference in August of last year, and when that date was found inconvenient, for a meeting in October. Certain of the powers were unable to attend the conference on the dates proposed, and it is now understood that it is likely to take place in April." The report continues: "The works have been fully occupied during the whole of last year, the machinery going night and day by double shifts of workmen. Orders in hand and in prospect are beyond the capacity of the existing works, and the directors are taking steps to provide new works."

It will be seen, therefore, that it is a pleasing picture that the Marconi directors are enabled to project on their canvas. The invention they exploit is a most interesting one, and while it is not making way as fast as some of its advocates predicted several years ago, being not in commercial use anywhere where wires can be used, it is making a field for itself.

## Proposed Municipal Lighting Plant in New York.

Mayor McClellan's plan for a proposed municipal lighting plant for New York city and Comptroller Grout's investigation into the cost of producing gas and electric light continue to cause discussion. Both advocates and opponents of municipal ownership have presented arguments and figures in the daily papers, and the controversy has been interesting.

The commission of experts appointed by Mayor McClellan to investigate plans and estimates for municipal lighting plants has made its first report to the Board of Estimates and Apportionment, and the board has instructed Comptroller Grout to confer with the commission in regard to sites. The report estimates the cost of establishing an electric-light plant capable of serving 6,000 arc lamps of 2,000 candlepower and 250,000 incandescent lamps of 16 candlepower at $4,100,000. The report, after telling the sources of the figures given, says:

"The total cost of a power station with a capacity of 10,000 kilowatts, including coal storage and coal-handling apparatus, ready to deliver power to high-pressure feeders, will be $1,250,000. The total cost of high-pressure cables, sub-station buildings and all appliances necessary to make a complete operative plant up to and including lamps, including the cost of real estate, but excluding the cost of the main duct system, will be $2,850,000. The total cost of the complete system will be $4,100,000. We estimate that the total annual cost of operating a 7.5 ampere-inclosed, alternating-current arc lamp for 4,000 hours a year, including all costs, depreciation at 7.5 per cent. on the total investment and interest at 3.5 per cent. will be $75.40. The total cost for incandescent lamps a kilowatt-hour at the lamp will be 5.15 cents. The total cost of operating the plant for 6,000 arc lamps and 250,000 16-candlepower equivalents will be $906,000."

In a newspaper communication Arthur Williams of the New York Edison Company presents the side of the central-station companies in the question of costs, especially in relation to the lighting of the Brooklyn Bridge, and points out where the municipal-ownership advocates err in their estimates.

A letter from Mayor Carter H. Harrison of Chicago, published in the Brooklyn Eagle, sets forth the alleged advantages and economy of Chicago's municipal plant. To this letter Mr. Ernest H. Davis, president of the National Electric Light Association, answers, saying that Chicago's lighting system is inadequate, wasteful and expensive. Unfair calculation in arriving at figures is alleged, and among many other things Mr. Davis says: "Does Mayor Harrison imagine for a moment that the city is not paying interest upon the bonds issued for these properties; that it is not subject to large sums annually for their maintenance; that there is not a depreciation in both life and in relative efficiency going on from year to year until finally it will be necessary to replace them (the land excepted, of course); does he not realize that if the vacant property or the lands upon which public buildings stand were occupied and owned privately they would all pay taxes and in other ways contribute to the support of the city, and to that extent lessen the burdens upon the taxpayers?"

F. B. Thurber of New York adds an interesting letter to the controversy from the business man's viewpoint. He declares that public-ownership waste exceeds corporate profit, and, referring to the letters of Mayor Harrison and E. H. Davis, gives the latter the better of the argument. "But," he says, "there is a far more important question involved, and that is how far we should go in the direction of socialism, increase the office-holding, tax-eating class and diminish the individual incentive and energy which this country has thus far been celebrated for." He then quotes the late Senator Hanna as follows: "The menace of today, as I view it, is the spread of socialism—one of those things which is only half understood, and is more or less used to inflame the popular mind against all individual iniative and personal energy, which has been the very essence of American progress."

## Publicity Candidly Discussed.

Mr. Arthur Warren, manager of publicity for the Allis-Chalmers Company, delivered "A Plain Talk on Trade Journals" at a meeting of the American Trade Press Association held in New York on February 17th. The address was in Mr. Warren's well-known incisive and epigrammatic style, and in it the publishers were told of many of their faults as well as a few of their virtues. A few extracts from the address may be of general interest.

"The trade and technical press is a vehicle for industrial publicity. And because of that you flourish. If your papers were wholly, or even chiefly, devoted to high-class technical writing, understood only by the few, their circulations would fall like autumn leaves on a wind-swept hill. Your readers want to know what is going on in their trades, and your success is measured chiefly by the liberality with which you give them this information."

"Industrial publicity is a new thing. * * * * There is no industry among all those represented on this occasion that has all the publicity it needs; there is none that has begun to more than taste the fruits of advertising; there is no industry, there is no metal-working manufactory that spends money enough on publicity. Manufacturers are, no doubt, accustomed to say, 'Publicity costs so and so,' but they are not yet accustomed to think 'Publicity earns so much.' That is a part of the lesson they have got to learn. And they will learn it and appreciate it."

"I reveal no secret when I say that advertising is not the purchase of space, but the handling of it."

Standing, as he expressed it, on his own side of the fence, Mr. Warren made many other points which he considered pertinent in relation to the advertising and circulation of trade journals. A warm discussion followed the address, and while some of Mr. Warren's arguments were conceded, others were vigorously contested. It is expected that Mr. Warren will read his address at a meeting of the Chicago Trade Press Association, to be held at the Hamilton Club, corner Clark and Monroe Streets, on the evening of February 27th.

## Electrical Music for the Portland Exposition.

By W. E. Brindley.

It has been less than 20 years since Edward Bellamy, in his sociological novel, "Looking Backward," startled the world with his fantastic theories and dreams of future happenings. And yet one of the most fantastic of Bellamy's dreams has come true. The first public demonstration of the practical working of this dream will be given this summer at the Lewis and Clark Exposition, when the visitors to the Coast Fair will have an opportunity to see and hear Dr. Thaddeus Cahill's marvelous invention by which music, produced by electricity, may be transmitted an indefinite distance.

Dr. Cahill, the audacious inventor, is but 38 years old. He is a graduate of Columbian University at Washington, D. C., and was for some years a patent lawyer. The invention which will make him as famous as Edison or Morse or Bell is the result of 12 years' labor. The underlying principle on which the electrical music machine is based is not a new one. Before starting his experiments Dr. Cahill studied the art and science of music from a scientific viewpoint until he confirmed in his own mind the truth of the assertion that vibration is the basis of all sound, and that any method by which vibration may be secured at regular intervals would enable him to produce music from any source that would produce the vibration. Following that principle he conceived the idea of building an electrical generator that would set up the exact number of vibrations required to produce each note of the musical scale. For example, there are 256 vibrations per second necessary to produce middle "C." This is the principle upon which the machine works. The details are too complicated for the purpose of the present article.

The operator who produces music on Dr. Cahill's machine plays on a keyboard similar to that of a piano. It is asserted that a musician who can play the piano can learn to operate the Cahill machine in a month. When the operator presses a key there is no immediate sound, as in a piano. The key is really a button connected with electric wires. When the key is pressed a circuit is completed, the required vibration is secured and sound is produced, not at the point of operation but at the other end of the circuit, perhaps a hundred or a thousand miles away. When the circuit is made complete each wire sounds a note upon a metallic disc, being translated into coherent music. And the music is not necessarily similar to that produced on a piano. By increasing the number of generators, which are operated by an elaborate system of stops and keys, the machine will produce any kind of music—violin, banjo, mandolin, guitar, etc., or the combination of a number of kinds, thus giving the orchestral effect. The volume of the music may be regulated by means of a rheostat, which is operated like the controller of a street car. With a machine equipped with 72 generators an orchestral programme might be rendered in three keys and with considerable modulation.

The practical working out of Dr. Cahill's wonderful invention is being rapidly perfected. Telharmonic companies will be organized and managed much as are telephone companies, and for a time it is expected that telephone lines will be utilized in the transmission of music by Dr. Cahill's method. It is expected that subscribers may be served with music for $5 a month. Operators will be employed in the various central offices, and these will play continuously. A daily programme will be arranged and mailed to subscribers. Thus one may look at the programme, consult the clock and turn on the music. Immediately the room will be filled with a symphony, a lively march or a popular "rag-time" air, depending on what the operator [illegible] central office at the time.

Transmission of music by means of Dr. Cahill's device is practically unlimited in extent. An operator in Chicago might produce music for a concert in New York city. Transmission for so great a distance would probably not be found economical, however, and the territory covered by one central office will not exceed that included within a radius of 25 or 30 miles.

## How to Extend the Range of a Voltmeter.

By W. A. Hyde.

It frequently happens that it is desired to measure voltage a little beyond the range of a given voltmeter. To do this readily is not difficult, if there are certain known resistances at hand.

To take a specific case, let us assume that we have a 150-5-volt Weston direct-current voltmeter and wish to measure eight volts. On the cover of the retaining box we find that the resistance of the 150-volt coil is 15,000 ohms and of the five-volt coil is 500 ohms. The current through the movable coil that will produce a full-scale deflection is then

$$\frac{5}{500} + \frac{150}{1,500} = 0.01 \text{ ampere.}$$

If, now, we add 500 ohms to the low-range circuit of the voltmeter and apply five volts to the circuit, the current will be

$$\frac{5}{500 + 500} = \frac{5}{1,000} = 0.005 \text{ ampere.}$$

which is just half the current we had previously and half the full-scale deflection will be the voltmeter reading. It is evident, then, that 10 volts may be applied to the voltmeter circuit, 0.01 ampere will be the current flowing and the needle will indicate full-scale reading. Any readings taken with this arrangement must be multiplied by

$$\frac{500 + 500}{500} = 2, \text{ to get the true volts.}$$

By putting 1,000 ohms in series with the voltmeter the current flowing at five volts will be

$$\frac{5}{500 + 1,000} = \frac{5}{1,500} = 0.0033 \text{ ampere,}$$

and the multiplying factor will be

$$\frac{500 + 1,000}{500} = \frac{1,500}{500} = 3.$$

It will rarely happen that the multiplying factor will come out a whole number; the voltmeter resistance might be 532.4 ohms and the only known and available external resistance 427.4 ohms. The multiplying factor in this case would be

$$\frac{532.4 + 427.4}{532.4} = \frac{959.8}{532.4} = 1.80, \text{ approximately,}$$

the numerator in all cases being the total resistance in the circuit and the denominator being the original resistance of the voltmeter.

To give full-scale deflection on 150 volts, the current must be 0.01 ampere, and then by Ohm's law,

$$R = \frac{E}{C} = \frac{150}{0.01} = 15,000 \text{ ohms.}$$

It is but a step to the measurement of high unknown resistance by means of a voltmeter. If the potential applied is constant, the current flowing, and hence the deflection will be inversely proportional to the resistance of the circuit.

Suppose that a lighting circuit is available and 110 volts is the voltmeter reading; open the circuit and insert the human body as part of the circuit, say through the two hands. The reading will vary; but let us say the reading is 55 volts—we then have the proportion

$$\frac{X + 15,000}{15,000} = \frac{110}{55} = 2$$

$X + 15,000 = 30,000$, whence

$X = 15,000$ ohms.

It will be noticed that the voltmeter reading and hence the resistance of the human body is largely a matter of contact, a fact which is often lost sight of.

This method is often used to measure the insulation resistance of cables, dynamos, storage batteries, etc., and is of fundamental importance in such work.

The Albany Power and Manufacturing Company of Albany, Ga., has awarded the contract to B. H. Hardaway of Columbus, Ga., for the construction of a $100,000 dam and electric power house. The company will transmit electric current for lighting and factory purposes.

## The Tantalum Lamp.[1]

By Dr. W. von Bolton and Dr. Feuerlein.

Part I.—By Dr. W. von Bolton.

While the carbon filament incandescent lamp remained for nearly two decades the sole representative of glow-lamp manufacture, progress was being quietly made in this art. The firm of Siemens & Halske has for many years been working at a solution of the problem of an economical incandescent lamp, and arrived some time ago at the fundamental principle that the visible part of the radiation of an incandescent body increases progressively with its temperature. This warrants the postulate that the most economical lamp will be that whose incandescent material will withstand the highest temperature.

Messrs. Siemens and Halske had arrived at this conclusion and charged me several years ago with the task of discovering a material which should have a melting point considerably above the temperature at which incandescent lighting becomes highly economical, so that filaments made of such a material would not melt or disintegrate at that temperature. While our laboratory work, founded upon this idea, was going on, the first two advances in incandescent lighting were made public, one being the Nernst and the other the osmium lamp.

There are certain metals the melting points of which are known to be considerably above 2,000° C., and the task resolved itself into finding one which, while fulfilling the above requirement, could be easily worked to form a filament and not be very rare or difficult to procure. It was early observed that brown vanadium pentoxide, which, according to Berzelius, does not conduct electricity, is, as a matter of fact, a conductor even when cold. This observation induced me to try whether vanadic acid could not be electrically decomposed. In this I succeeded, but the melting point of the vanadium obtained proved too low for the purpose in view. Since the metals niobium and tantalum are members of the vanadium group, niobium having an atomic weight double that of vanadium, while the atomic weight of tantalum is double that of niobium, it was thought that one or both of these metals might prove to have the desired qualities. On experimenting with niobium on the lines adopted for vanadium, it appeared that this metal has a considerably higher melting point than that of vanadium, but not, however, sufficiently high; moreover, some of the niobium filaments which I made had a very strong tendency to break up when heated by the electric current.

Tantalum was tried next. I reduced potassium tantalo-fluoride in the manner prescribed by Berzelius and Rose and found that the finely divided tantalum so produced became fairly coherent on rolling, so that by this treatment metallic strips of it could be made. It was also attempted to work tantalum oxide into the shape of a filament by mixing it with paraffin and to reduce it directly into the form of a metallic thread. In these experiments there was observed for the first time a minute globule of molten tantalum, and this globule was of sufficient toughness to permit hammering and drawing into wire. Following out this observation, tantalum powder was melted in a vacuum, and then it was found that the highly heated metal parted with the gases it contained. In this manner I produced my first filaments of pure metallic tantalum, which were, however, very small. When these had been used in lamps with promise of good results an attempt was made to devise a definite process of purification. The potassium tantalo-fluoride was reduced to metallic powder; this powder contains a small proportion of oxide and of hydrogen, which is absorbed during the reduction. When the powder was melted in a vacuum the oxide and absorbed gas disappeared and a reguline metal remained; on carefully remelting this it became so pure that no appreciable impurities could be detected in it.

The chemical properties of this pure tantalum are very remarkable, and some of them are of such a nature as to lead me to suppose that nobody other than myself has ever had metallic tantalum in his hands. When cold the material strongly resists chemical reagents; it is not attacked by boiling hydrochloric acid, aqua regia, nitric acid or sulphuric acid, and it is also indifferent to alkaline solutions; it is attacked solely by hydrofluoric acid. Following the behavior of steel, when heated in the air it assumes a yellow tint at about 400°C., and the tint changes to dark blue when the tantalum is exposed for some time to 500°C., or for a shorter time to 600°C. Thin wires of the substance burn with low intensity and without any noticeable flame when ignited. It absorbs hydrogen as well as nitrogen with great avidity, even at a low red heat, and forms with them combinations of a metallic appearance, but rather brittle. It combines with carbon very easily, forming several carbides which, as far as they are at present known, are all of metallic appearance, but also very hard and brittle. The product which Moissan thought to be tantalum was clearly a carbide of this nature or an alloy of a carbide with pure tantalum, for Moissan himself stated that his metal still contained one-half per cent. of carbon. Considering the high atomic weight of tantalum (183), it is obvious that a very small quantity of carbon suffices to carburize a relatively large quantity of tantalum. This view of the constitution of Moissan's product is confirmed by the properties he ascribed to the metal—namely, specific gravity 12.8, great hardness and brittleness. These are not properties of pure tantalum. When in the form of powder, still containing, as previously stated, oxide and hydrogen, the specific gravity of my material is about 14; when purified by fusion and drawn into wire it has a specific gravity of 16.8. It is somewhat darker than platinum and has a hardness about equal to that of mild steel, but shows greater tensile strength than steel does. It is malleable, although the effect of hammering is relatively small, so that the operation must be rather long and severe to beat the metal into a sheet. It can be rolled as well as drawn into very fine wire. Its tensile strength as a wire is remarkably high and amounts to 95 kilograms per square millimeter, while the corresponding figure for good steel is 70 to 80 kilograms, according to Kohlrausch.

The electrical resistance of the material at indoor temperature is 0.165 ohm for a length of one meter and a section of one square millimeter (specific conductivity as compared with mercury 6.06). The temperature coefficient is positive and has a value of 0.30 between 0°C. and 100°C. At the temperature assumed by the incandescent filament in the lamp at 1.5 watts per candlepower, the resistance rises to 0.830 ohm for a length of one meter and a section of one millimeter. The coefficient of linear thermal expansion between 0°C. and 60°C. is 0.0000079, according to experiments made by the Imperial Normal-Aichungs Commission. Fusion is preceded by a gradual softening, which appears to extend over a range of temperature of several hundred degrees. The specific heat is 0.0365, so that the atomic heat is 6.64, which is in accord with the law established by Dulong and Petit.

Part II.—By Dr. O. Feuerlein.

The results of the work carried out in our chemical laboratory, as described by Dr. von Bolton in the first part of this paper, were of course of the utmost interest to our incandescent lamp manufacturing department. As soon as Dr. Bolton's experiments showed that the originally brittle tantalum could be made ductile enough to draw into wire by the usual methods and that this wire could be bent and coiled like a thin steel wire, it became possible to test it thoroughly as to its usefulness for incandescent lamps. The first trials with wires of about 0.3 millimeter diameter gave most promising results. They confirmed the fact that tantalum has a very high melting point and that it is but slightly subject to disintegration in a vacuum, even when subjected to a heavy current.

The first tantalum lamp that proved moderately satisfactory, in that it admitted of an exact measurement of the electric and photometric conditions and stood a burning test for some time, was completed just over two years ago—viz., on December 28, 1902. This lamp had a loop-shaped filament made of the first tantalum wire ever drawn. The diameter of the wire was 0.28 millimeter, its effective lighting length 54 millimeters and its electrical resistance when cold 0.29 ohm. This corresponds to a specific resistance (one meter length, one square millimeter section) of 0.331. The photometric measurements made at efficiencies of two, 1½ and one watt per Hefner candlepower showed potential differences of 4.9, 4.95 and 5.9 volts, currents of five, 5.46 and 6.2 amperes, and illuminating values of 11, 18 and 37 Hefner candlepower, respectively. On being burnt at one watt per candlepower the lamp had a life of 20 hours, during which it blackened considerably.

As the chemical and mechanical manufacturing processes developed and the material became purer and the wires more uniform the results obtained also improved. The lamps lasted longer and blackened less; at the same time the specific resistance decreased until it had dropped to the present figure of 0.165 for the pure metal. It is clear that the material used for the first lamps still contained a considerable quantity of impurities, probably niobium and carbides, which caused the great disintegration and the nearly double specific resistance. During these first trials we looked very carefully into the question as to what dimensions the filament of a tantalum lamp ought to have for ordinary voltages and illuminating values. From the dimensions of the filament used in the first lamp we calculated that, with this rather impure material, we should require a filament about 520 millimeters long and 0.06 millimeter diameter for a lamp for 110 volts, 32 Hefner candlepower and 1.5 watts per candlepower. These unusual figures increased when the specific resistance of the material had diminished to the present value of 0.165, at which for a 32 Hefner candlepower lamp a filament of about 700 millimeters in length by 0.055 millimeter in diameter was required; for a 25-Hefner candlepower lamp a filament of about 650 millimeters by 0.05 millimeter diameter was required. Thus, in order to construct a practical and useful lamp for standard voltages and illuminating values we had to solve the problem of drawing the tantalum wire in sufficient length down to a diameter of 0.05 millimeter to 0.06 millimeter; this we succeeded in doing after long and laborious trials.

In July, 1903, we possessed the first tantalum lamp with a filament of about 0.05 millimeter diameter. It had a loop-shaped filament 54 millimeters long and it took 0.58 ampere at nine volts and gave 3.5 Hefner candlepower at 1.5 watts per candlepower. On the basis of these figures a lamp having the same quality and diameter of wire and working at the same efficiency on a 110-volt circuit would have a filament 650 millimeters long and would give 43 Hefner candlepower. The experiments thus far had proved that the task of producing lamps for 110 volts and a maximum of 25-32 Hefner candlepower was not an easy one in several respects. We had to solve the problem of suitably and reliably fixing a filament rather more than two feet long within a glass globe which should not exceed to any great extent the dimensions of the usual incandescent lamps. The first and most obvious attempt was made of course by adhering to the loop shape and accommodating the required length of wire by connecting several such bows in series within the lamp. However, lamps made according to this plan with two to four tantalum loops gave results which were anything but satisfactory.

It appears that, like all other metallic filaments which have hitherto been used for incandescent lamps, tantalum wire softens sensibly at the temperature attained when worked at 1.5 watts per candlepower. To use loop-shaped or spiral filaments similar to the carbon filaments of the common incandescent lamps was, therefore, out of the question. There was no difficulty in suspending the loops, but in that case the lamps would have to be used exclusively in a vertical position, a limitation which we wished to avoid in all circumstances. Besides, such a construction would necessitate staying the loops firmly to prevent them from becoming entangled with each other during transport of the lamps. Nor did lamps made with loops of corrugated wire or of plain or of corrugated metal ribbon give satisfaction; for although the loops were certainly shortened in this way, there were other drawbacks which caused us to abandon this construction. It soon became apparent that the one road to success lay in the direction of dividing the filament into a number of short straight lengths supported at their ends by insulated holders. In this manner we succeeded at last, in September, 1903, in producing the first really serviceable lamps for about 110 volts. This lamp contains two glass disks cast to a central wire-holder; each disk carries laterally 12 arms, having small hooks at their ends and insulated from each other. Through these 24 hooks the thin tantalum wire is drawn up and down between the two disks. This is believed to be the first metallic incandescent lamp for nearly 110 volts which, like the common carbon glow lamp, can burn in any position whatsoever. This lamp supplied about 30 Hefner candlepower on a 94-volt circuit at 1.5 watts per candlepower. It lasted for 260 hours and lost during that time 9.5 per cent. of its illuminating power.

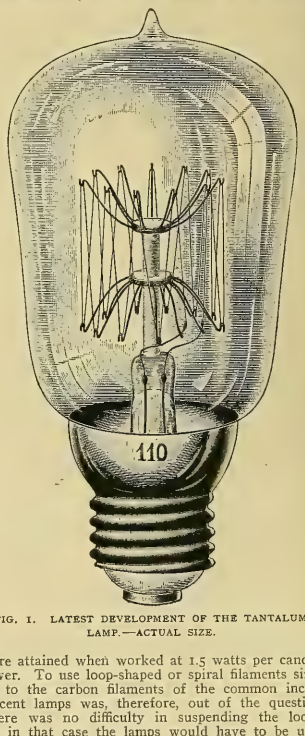


FIG. 1. LATEST DEVELOPMENT OF THE TANTALUM LAMP.—ACTUAL SIZE.

After this first practical success we redoubled our efforts to improve the lamp further. As far back as about the middle of October, 1903, we succeeded in making the first 200-volt tantalum lamp, which was of a design similar to the lamp just described, but with 18 arms on each disk and with a greater

1. Translation of a paper read before the Elektrotechnischer Verein of Berlin, January 17, 1905. From the London Electrician.

distance between the two disks. I may add at once that it is of interest only as a curiosity, for it has served no practical purpose. The length of its filament was 1,350 millimeters and the illuminating value about 60 Hefner candlepower. In the course of further development the form of the frame of wire filament for the 110-volt lamp went through different stages, the principle of subdivision being always followed. Among other constructions we tried some in which, instead of one long filament, a number of short pieces of wire were fixed on a supporting frame; these pieces, connected in series, made up the total length required, the wire being fixed obliquely in 16 straight pieces between two insulated supporting stars. Such lamps offer the advantage that short pieces of filament can be used in the manufacture. But they are only reliable if the wires used in the same lamp are absolutely uniform in diameter and quality. In the end we arrived at the shape represented in Fig. 1, which is for 110 volts, 25 candlepower and 1.5 watts per Hefner candlepower. In this form, differing from

Fig. 2. Filament Before and After 1000 Hours' Service.

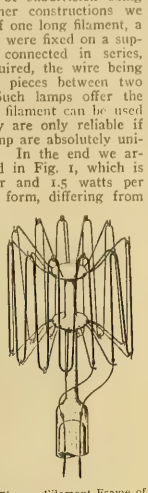

Fig. 3. Filament Frame of New Lamp.

TANTALUM LAMP.

most of the previous constructions, the central support consists of a short glass rod carrying two disks, into which the arms, bent upward and downward in the shape of an umbrella, are cast. The upper star has 11, the lower 12 arms, each upper arm being in a vertical plane midway between the vertical planes in which two adjacent lower arms lie. Between these 11 and 12 arms, which are bent into hooks at their ends, the entire length of the filament is drawn in a zig-zag fashion. Its extremities, held by two of the lower arms, are connected with the foot of the lamp by means of platinum strips.

The standard type for 110 volts 25 Hefner candlepower and 1.5 watts per candlepower has a filament 650 millimeters long and 0.05 millimeter in diameter. The weight of this filament is 0.022 gramme, so that about 45,000 lamps contain together one kilogram of tantalum. The shape of the glass globe is adapted to the frame described above. Care has been taken to make it of a size not exceeding the usual maximum dimensions of common incandescent lamps of the same candlepower (25 Hefner candlepower 110 volts). This shape offers a number of noticeable advantages. In the first instance it is very stable and will stand strong shocks without damage to the lamp. A considerable number of such lamps sent across the sea to test their ability to withstand the hardships of transport came back unhurt, although they had been packed just like common glow lamps, and no special care in any respect had been taken in their handling. The lamp burns, of course, in any position, and can therefore be held in any kind of fitting. The light is rather white and agreeable, and its effect is particularly uniform if the lamp is provided with a ground-glass globe.

We shall now proceed to describe the electric and photometric properties of the lamp and its behavior in actual use. Numerous trials for lengthy periods of time at one to three watts per candlepower have proved the vast superiority of the tantalum lamp over the carbon-filament lamp under equal electric and photometric conditions. Expressing this fact in figures, we can state that the tantalum lamp consumes about 50 per cent. less current at the same voltage, with the same intensity of light and the same useful life; or that, at the same economy, its life is several times that of the carbon type. Moreover, at an initial efficiency of 1.5 volts per Hefner candlepower the tantalum lamp has an average life quite sufficient for all practical requirements, so that this rating has been standardized for the 110-volt lamp. Trials have also proved that the lamps have a life of several hundred hours at one watt per Hefner candlepower, but in that case they were very sensitive to variations of pressure and often showed an early decrease of illuminating power. The useful life of the tantalum lamp—i. e., the time within which it loses 20 per cent. of its initial illuminating power—averages between 400 and 600 hours at 1.5 watts per Hefner candlepower. Some specimens have proved to have a useful life of as much as 1,200 hours. The absolute life, in general, amounts to 800 to 1,000 hours under normal working conditions. Further, we have to remark that the tantalum lamp blackens but little unless it has been strongly overheated during work in consequence of partial short-circuiting of the filament.

It is very interesting to observe the behavior of the tantalum lamp during the whole course of its life. The first fact worthy of note is that, like some carbon lamps, the illuminating value increases at the beginning, generally after a few hours, by 15 to 20 per cent. In the same way the consumption of current rises by about three to six per cent., while the consumption of energy drops to 1.3 to 1.4 watts per candlepower. After that the illuminating value gradually decreases, while the corresponding increase of the consumption of energy occurs. The average behavior of the 25-candlepower lamp at 110 volts with reference to its various periods of life is shown in the following table:

| Life in Hours. | Intensity of Light in Hefner Candlepower. | Consumption of Current in Amperes. | Watt per Hefner Candlepower. |
|---|---|---|---|
| 0 | 25 27 | 0.36-0.38 | 1.[illegible] |
| 5 | 28 31 | 0.37-0.39 | 1.[illegible] |
| 100 | 25 27 | 0.36-0.38 | 1.5-1.6 |
| 300 | 22 23 | 0.36-0.38 | 1.6-1.[illegible] |
| 500 | 20 22 | 0.36-0.38 | 1.7-2.0 |
| 1,000 | 18 20 | 0.37-0.[illegible] | 2.1 2.2 |

The initial increase of illuminating value and of current consumed is doubtless caused by a change in the structure of the tantalum wire, this change being accompanied by a reduction of resistance and, consequently, of the phenomena resulting therefrom. We may say at once that after a certain amount of use the filament presents a radical change in appearance when viewed with the naked eye. While the fresh filament has a perfectly smooth and cylindrical surface, it acquires a peculiarly glistening aspect as it grows old, so that a lamp having served for some time can be readily distinguished from a new lamp. When looked at under the microscope the filament that has burned for a length of time shows a clear tendency toward contraction and formation of drops or beads. Fig. 2 is an illustration of a piece of filament in its fresh state and of the same piece after 1,000 hours of service, the specimen in each case being magnified 100 times. This gradual shortening of the filament can also be observed in the lamps themselves and offers a further indication of the age of a lamp.

Fig. 3 represents the filament frame of a new lamp. It will be noticed that the tantalum wire is led up and down and hangs loose on the supporting frame in easy wide arches, without sharp bends. But after being used for some time the aspect of the lamp is quite different. As shown in Fig. 4, the wire has contracted, the wide arches have disappeared and sharp-pointed angles have taken their place.

The behavior of these lamps is most peculiar when the filament has burnt through. While with all other incandescent lamps the burning through of the filament is tantamount to the economical death of the lamp, it may happen with tantalum lamps that they burn through several times without being rendered useless; on the contrary, each burning through is followed by an increase, often con-

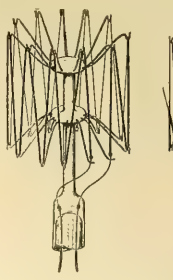

Fig. 4. Filament Frame After Burning.

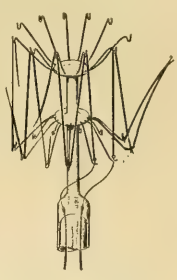

Fig. 5. Filaments Burned Through.

TANTALUM LAMP.

siderable, of the illuminating power. This peculiar result is due to the fact that in many cases a broken wire comes in contact with its neighbor, so that the circuit is again established. A part of the filament is thus cut out of the circuit and the lamp consequently burns more intensely, and sometimes even too intensely, in which case, of course, only a short span of life is left to it. Yet we have had more than one lamp under observation, the filament of which broke for a first time after a short period of service and then broke repeatedly, but notwithstanding this the lamp lived more than 1,000 hours. We have often succeeded in rendering a lamp with a broken filament serviceable again by tapping it to bring the broken piece into contact with its neighbor. Fig. 5 represents the frame of a lamp in which the filament was burnt through in three places and yet continued to do service. For the sake of clearness the back spans of the filament have been omitted in the drawing, while the front spans which were carrying the current are drawn in specially heavy lines.

It must further be mentioned that after serving for some time, say 200 to 300 hours, the tantalum filament loses a great deal of its mechanical resist-

this alteration in the filament has occurred it is well to preserve them from shocks.

[illegible] great increase of voltage is of special interest to the [illegible] the trials made in this respect have also shown the superiority of this lamp over the carbon lamp. It has been ascertained that tantalum lamps for 110 volts, 25 Hefner candlepower and 1.5 watts per candlepower only burn through at 260 to 300 volts if the pressure is increased slowly and gradually, while with carbon lamps designed to work under the same conditions nothing like that figure can be obtained. The superiority of the tantalum lamp over the carbon lamp with regard to blackening of the glass globe can also be proved in a few hours by means of comparative burning tests at about 30-per cent. overload.

Another advantage of the tantalum lamp over the carbon lamp is that the resistance of tantalum, like

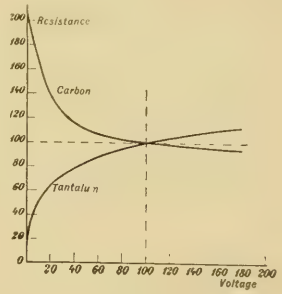


FIG. 6. RESISTANCE CURVES OF CARBON AND TANTALUM FILAMENTS.

that of all other metals, strongly increases with the rise of temperature, while carbon is known to diminish in resistance when it is hot. In Fig. 6 the variation of the resistance of tantalum and of carbon as a function of the voltage is graphically represented, the pressure being assumed as 100 volts and the resistance at 100 arbitrary units when the efficiency is 1.5 watts per Hefner candlepower, so that for each per cent. of variation of voltage the respective percentage of variation of resistance is shown. It will be seen in the first instance that the resistance of the tantalum increases to more than five times its original value from the cold state to 1.5 watts per Hefner candlepower, while the resistance of the carbon decreases to about one-half of its initial value. It will further be noticed that even afterward the resistance of tantalum goes on rising while the resistance of carbon keeps dropping. Therefore the increase or decrease of pressure causes the strength of current, and with it the illuminating value, to rise or fall at a quicker rate in the carbon lamp than in the tantalum lamp, and consequently the latter is less sensitive to variations of pressure than the former.

Having thus related the whole history of the development of the tantalum lamp and fully entered into a critical comparison between it and the carbon filament lamp, we need scarcely add that we do not intend, of course, to be satisfied with what we have already obtained. For the time being, however, and until a larger building has been erected for the production of tantalum our firm has resolved to keep to the type for which there is an immediate practical demand. That is the lamp for 100 to 120 volts, which supplies 25 Hefner candlepower at 110 volts, or will have a higher or lower illuminating value if worked at corresponding higher or lower voltages. In conclusion I would recapitulate the properties which we claim as peculiar characteristics of our invention as follows:

1. The tantalum lamp has a filament made of a metallic conductor and burns at once on being connected without any previous heating.

2. The light-giving wire is prepared by melting in a vacuum and drawing; it is tough even in the cold state and can therefore be coiled and fixed in the lamp when cold.

3. A relatively great length of wire can be placed in a simple manner within a bulb of ordinary dimensions.

4. Tantalum ore exists in considerable quantities and can be easily procured.

5. Similar principles of treatment can be adhibited to other metals of a very high melting point.

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The January gross earnings of the Chicago and Milwaukee electric railway amounted to $24,826, an increase of $5,839 over the preceding January. Operating expenses were $14,653.

## The Work of the Signal Corps Officer.[1]

By Gen. A. W. Greely.

I commenced the study of electricity before the majority of the people in this room were born, back some 38 years ago, under Prof. Joseph Henry in Washington, and after a year or two of study it was said of me—and it was not saying very much in those days—that I was one of a dozen best electricians in the United States; but today I know nothing of it, not even the A B C, the rudiments of electricity as applied today; I have no knowledge which entitles me to claim to be an electrician, or even a scientific man in this twentieth century; but I do have, and the officers and men under me have, a desire to do whatever the day and the hour calls for.

From 1898 up to this time I have had no disposition to lay thousands of miles of cable or build up several systems of wireless telegraphy, but as from day to day the duty came to me I have done it. It has been my fortune, within the last six or eight years, for strictly military uses, to lay a series of submarine cables, land lines and wireless systems, and, thank God! they are all American from beginning to end. They would reach around the world. There has been laid, under my direction, within the last year in Alaska a cable long enough to reach from Newfoundland to Ireland. Further, there is today working across Norton Sound a system of wireless telegraphy that is in its seventh month and has worked over the 107 miles without a moment of interruption, and over which system thousands of words are sent to and fro each day. On one occasion, not less than 25 messages passed across this intervening space of 107 miles without there being a call for a "repeat." You telegraph men know what kind of service that is. This work has excited a great deal of interest in Alaska, on account of our continuing to work during the present winter over the 107 miles of ice. We were told we could work in summer, but that when the winter came we could not work, yet when the winter came we continued the work.

I will only speak briefly on what the American army has done in the way of applying electricity to the art of war—that art which levies tribute on all other arts and sciences. The first cable that was laid in Cuba was put down by the American Signal Corps. The south coast of Cuba was hitched up through an electrical system, with branches from all parts of the island, so that it brought Santiago within five minutes of the White House. From San Juan there was stretched a telephone line along the outposts of the American army, so that the telephone brought down the news from the San Juan Hill, sending the instructions which enabled the American navy to fire effectively on Santiago. They told me a telegraph line could not be built or maintained on the island of Cuba from one end to the other. We said we would try it, and we put up 1,300 miles of line on that island, two lines east and west, with 11 lines running north and south, and we established a system of telegraphic communication all over the island.

When we went into Porto Rico the same thing was done on that island. When the American people decided to hold the Philippines there came into my office a request by cable from Hongkong asking for 100 miles of telegraph wire. The message was brought into me, and I wrote on the back, "Ship 1,000 miles." My disbursing officer came to me and said, "Did you not make a mistake; did you not put on one naught too much?" I said to him, "Did I say 10,000 miles? I meant to have said 1,000 miles." I was looking ahead, and eventually we built and established a system of 10,500 miles in the Philippine Islands. This indicates what the American soldier can do, because he is an American man. The same spirit of resourcefulness and energy and determination to do the best, which has built up this splendid Institute, and which is doing so much for the world, is what has done the work for the American army, and what I have been able to do, beyond selecting the men for these places, putting a round man in a round hole and a square man in a square hole, has been in a way to keep in touch with you gentlemen in knowing what you were doing and seeing how far your systems were applicable to the army of the United States, whether in our own country or in foreign lands.

In listening to some of the recitals of criticism and hardship which were encountered by electrical inventors, which have been referred to this evening, it recalled vividly to my mind the difficulty many men have in passing on matters which are outside of their limited line of action. The great difficulty which inventors have to contend with is in submitting their ideas to others—to the judgment of individuals who are not by their training capable of passing a correct decision upon them, and when such a situation confronts a man he must have that spirit of adaptability which is the strength of the American engineer. It oftentimes happens that these criticisms are correct, and the man of universal utility is the man who is able so to modify his plans as to make practical that which under certain circumstances seems to be impractical—just give the thing a little turn or twist.

Take the wireless system established across Norton Sound. Everyone said it could not be done. I had a contract with the Marconi company in Alaska and also the other company, but these contracts were not fulfilled. I put in a cable, which cost $60,000, across Norton Sound; I carried out the cable scheme, and it was up to me to do something with the wireless telegraph. Many people said it could not be done. I said, This is my work to do. I put the work in the charge of a graduate of Stevens Institute, one of the officers in my corps, and gave him all the instruments and information which I had, which was available, and we started in to erect a wireless system on Long Island Sound, and eventually had a system working between Fort Schuyler and Fort Wright, a distance of 97 miles. When the thing was in working order I went up to the station to see what could be done, and when I listened for the sound it was with great difficulty I could hear it, but I knew what to listen for. Someone asked me what it sounded like. I said: "It is not like the ghost of a voice; it is like the ghost of a ghost of a voice." That is all we could get for the first month or two. After a great deal of adaptation and maneuvering and modifications, we were able to send messages 97 miles and take them off by typewriter.

And then we proceeded with the system in Alaska. When you go to Nome, you can only get in there three months in the year. During the other nine months of the year everything is frozen up; but on the barren shores of Nome today and on the shores of St. Michael stand four of the highest poles ever erected on the Pacific Coast. They are 210 feet in the clear. I suppose we could have worked across with less than that height. Someone wanted to know why I spent $15,000 in doing that work, when it might have been done for $8,000 or $10,000, and I told him that that was a case of what you engineers called the "factor of safety"—that when a thing is done you know that no efforts have been left undone to make it a success.

I will not undertake to say how much the army owes to bodies of this kind, nor how much we feel that you do for the world. I feel that the work you have done in the railroad line is most important. I have observed the progress of the railroads in this country, both steam and electric, for a great many years. I am now in my forty-fourth year of army service, and when I first went West to Utah there was only one railway to the Missouri River, and that had been there only three months; and now, having seen the dawn of this very remarkable twentieth century, I feel that in the hands of you young men, with your energy and your devotion to yourselves and to your country, this American republic will never have cause to fear, whether it be in the field of invention or in any of the arts or sciences, when it compares itself with the other countries of the world.

1. General Greely is chief signal officer of the United States Army. At the annual dinner of the American Institute of Electrical Engineers on February 8th he responded to a toast, and his speech contained so much of general interest that the greater part of it is presented to the readers of the Western Electrician in the present form.

## Three and Four-cent Fares a Failure in Cleveland.

The Cleveland Electric Railway Company has made a report of its experiments with the three-cent zone fare and the four-cent general fare on which no transfers were given. Both show a decrease in gross income, with little stimulation in travel. The 12 days of the three-cent zone test, compared with the 17 week days of January preceding, when the low-fare cars were operated but 13 hours a day, show a decrease of 5.74 per cent., or $764.47 a day. This decrease was shown when the three-cent fares were 18½ per cent. of the fares collected on the entire system.

The only lines operated wholly on a three-cent fare were those on Wilson and Fairfield avenues. On the Wilson Avenue line the percentage of transfers has been 81, and on the Fairfield line, 42. The normal percentage on the entire system is 30, but during the tests it was reduced to 23. The Wilson Avenue line showed a decrease in earnings of 13.4 per cent. The Fairfield line showed a loss of 16.25 per cent. The results of the test on the Wilson Avenue line, applied to the entire system, assuming that the transfers are as stated above, would show a loss of 29.05 per cent., or $3,600 a day. The actual stimulation of traffic during the three-cent test was one per cent, and during the four-cent test it was 1.38 per cent.

The decrease in earnings during the four-cent test was 10.87 per cent., or $1,375.74 a day, which would amount to $502,145.10 a year. The four-cent fare was good on all lines, but five cents was charged when a transfer was desired. This test continued for eight days, and the results were compared with the 20 days in January from the 3d to the 22d. The company states that the tests cost in the neighborhood of $25,000, but that it is well worth the money to know just what such plans would produce. The officers state that they are willing to make any other reasonable test that may be suggested. It is possible that they may try the plan of selling six tickets for 25 cents, with one transfer. A year or more ago this rate of fare was tried, but the universal-transfer system was in effect then, and it was so abused that the plan was abandoned, together with some of the transfer privileges.

It is declared that the three-cent-fare plan cannot be satisfactory, either to the company or the public, and the figures indicate that the four-cent plan is not much better. Had there been a stimulation of traffic, as occurred at Columbus, when the lower fare went into effect, the story would probably be different. The size of Cleveland had a great deal to do with it, however, as those who would use a car at three or four cents will do so at five cents, because the distances are so great. These things were not brought out in the report, other than a mention of the dissatisfaction that had resulted from the three-cent-fare plan. The report appears to be a clear, frank statement of facts, and the assertion is made that the figures in detail are on file and may be seen by all who desire to make a more thorough investigation.

## American Street Railway Association.

An important step toward the reorganization of the American Street Railway Association and its allied associations was taken at the meetings of the executive committees of the various organizations held in New York city recently. Preliminary meetings of the American Railway Mechanical and Electrical Association and Street Railway Accountants' executive committees were held on February 3d, which were adjourned to attend a joint meeting with that of the parent body, which was presided over by President Caryl Ely. President Ely at this meeting stated briefly the line of action which had shaped itself in his mind. He believed that a committee should be appointed, made up of representative men from the various organizations, to decide upon some method of procedure. After free discussion by this committee the real work should then be committed to a small sub-committee to be put in form to lay before the members at the next regular meeting. To facilitate its work this sub-committee should have the assistance of some person of high standing, technical education, a ready writer and one of good address.

Having thus outlined a method of going about the work which seemed to him practicable, Mr. Ely then mentioned a suggestion of Mr. Richard McCulloch of St. Louis for a reorganization, which, to him (Mr. Ely) seemed a good one and worthy of careful consideration by those whose duty it might be to devise the plan of reorganization. To prevent the breaking up of the association into a number of associations of specialists, which seems to be the present tendency, Mr. McCulloch recommended that "the annual conventions shall combine general meetings of the American Street Railway Association, together with meetings of certain sections to which the consideration and discussion of papers and technical questions shall be allotted." The plan is based upon that followed by the American Society for the Advancement of Science. Mr. McCulloch also suggested the names of a number of sections and a specimen programme.

After considerable discussion, in which it appeared that the members of the committee were generally in accord, a sub-committee was appointed to do the work as outlined, consisting of the following-named gentlemen:

For the American Street Railway Association—E. C. Foster, New Orleans; Richard McCulloch, St. Louis; C. G. Goodrich, St. Paul; W. E. Harrington, Camden, N. J.

For the Accountants' Association—W. G. Ross, Montreal, and Frank R. Henry, St. Louis, alternate.

For the Mechanical Association—H. H. Adams, Baltimore, and E. W. Olds, Milwaukee, alternate.

For the Claim Agents' Association—W. A. Dibbs, New York, and W. H. Renaud, New Orleans, alternate.

For the Manufacturers' Association—W. H. Heulings, Jr., Philadelphia, and William Wharton, Jr., Philadelphia, alternate.

On motion, Mr. Ely was requested to act as chairman of the joint committee, ex-officio, and to him was left the matter of making arrangements for expert assistance, to serve the committee.

At the meetings of the executive committee of the American Railway Mechanical and Electrical Association the following papers were assigned for the next convention: "Power Transmission," by C. H. Hile, superintendent of wires, Boston elevated railway; "Maintenance and Inspection of Electrical Equipment," by William Pestell, of J. G. White & Co., New York city; "Way Department Matters," by F. G. Simmons, Milwaukee Electric Railway and Light Company; "Power Stations," by Fred Bushnell, chief engineer, the Rhode Island Company, Providence.

The date and place of the next convention of the Street Railway Association were decided upon by the executive committee. It will be held in Philadelphia during the week beginning September 24th, at the Bellevue-Stratford Hotel.

## New York Subway Traffic.

The first quarter's report of the Interborough Rapid Transit Company since the opening of the subway branch has been received by the New York State Railroad Commission. Contrary to expectation, the elevated division shows an increase in gross earnings for the quarter ended December 31, 1904, over the corresponding quarter in 1903. The increase is about $7,000. Comparing the returns of the whole system with those for the corresponding quarter in 1903, when the subway was not in operation, it appears that the increase in passengers amounted to 16,245,582, a daily average for 90 days of 180,506.

## Closing Bulkhead Doors on Warships by Electricity.

After several years of costly experimentation with pneumatic and hydraulic systems for operating bulkhead doors and armored hatches aboard warships both systems have been abandoned by the American navy in favor of an electrical system. The first electrical installations are now in working order on the Colorado and Pennsylvania, the new 13,500-ton armored cruisers. Thirteen other cruisers and battleships, now building, will be similarly equipped.

The defects developed in the hydraulic and pneumatic systems—due mainly to the practical impossibility of keeping their valves and packings in working order—have been overcome in the electric system, and naval authorities, including many who have heretofore opposed, as necessarily ineffective, all power doors for bulkheads, have given the electrical system unqualified approval.

The bad repute into which distantly controlled bulkhead doors fell at one time was brought about

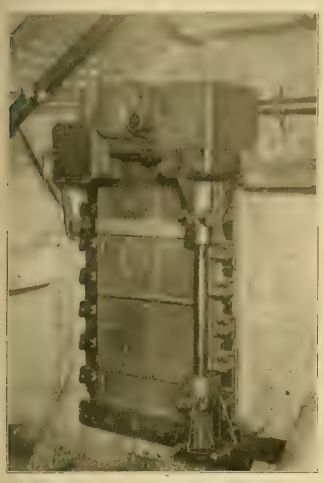


FIG. 1. BULKHEAD DOOR EQUIPPED WITH ELECTRICAL SYSTEM.

by the members of the crew who were likely to suffer from the operation of the power system. The first idea was to drop the heavy doors like so many guillotines; then followed the idea of closing doors slowly by air or water pressure. But in both cases it was found that the doors could not be depended upon to shut at the right moment, nor to stay open when so required, because the pneumatic and hydraulic pressure could not be perfectly maintained.

The electrical system, however, is not subject to these defects. It complies in every way with the specifications of the Navy Department, providing that doors or armor hatches "must be capable of permitting operation on the spot by power or by hand from either side of the bulkhead or deck," and "be capable of being closed by power simultaneously from an emergency station." It is further provided that when the doors are closed and the "emergency" is on, any door may be opened by a man at the door to allow him to pass through in performing his duties, but after he has passed through and released the controller handle the door will again close by the emergency action. Fig. 1 shows a closed bulkhead door equipped with the electrical system on the U. S. S. Colorado.

The mechanism of the new system may be outlined as follows:

(1) An emergency station, located usually in the pilot house or some convenient place above the deck.

(2) The power doors or hatch-gears, supplied with three independent mechanisms.

(3) The switch by which a man at any door can open and close it at will from either side.

(4) The switch, operated from the emergency station, by which the door is closed upon the approach of danger. This emergency switch, although permitting absolute control, may have its operation suspended temporarily by the hand switch just mentioned. In such a case the emergency station switch will close the door as soon as the hand controller is released.

(5) The limit switch, by means of which the current supplying the motor which provides the power for closing and opening the doors, is cut off when the door has closed and locked, or has encountered an obstacle to full closure. This switch has mechanical connection with the door or hatchplate and is so arranged that it will cut off the current from the motor and thus prevent blowing out of the fuses. An interesting improvement of this part of the mechanism is one by which the switch is made to again close the circuit to the motor and thus start the door toward its grooves after an obstruction is removed, e. g., when an inflow of water [illegible] stunting a bunker opening.

The door and hatch-gear motors are direct-current, reversible, [illegible] of light and compact construction for intermittent [illegible] entirely enclosed in water-tight [illegible] and [illegible] ble of carrying large overloads without heating or injury.

The emergency station consists of two parts: the a watertight case containing the mechanism for controlling the circuit running to each door or hatch-gear for closing it and the lamps to indicate the closure. The other case contains the fusebox, in which each wire is supplied with the proper fuse. Fig. 2 shows the station from which 28 doors are controlled on the U. S. S. Colorado.

The wiring required for a complete installation of the system is very simple. It comprises one twin conductor by which the emergency station is connected with the ship's mains; one twin conductor by which the controller on each door and hatch-gear is connected with the emergency station and one twin conductor connecting the controller on each hatch-gear or door with the ship's mains. Here, as in other parts of the system, great simplications have been worked by replacing pneumatic and hydraulic power by electricity. The latter added another set of complicated machinery to the ship's equipment, while the electric system calls for nothing more complicated than connection with the electrical mains necessary for other purposes.

To explain the operation of the system it is perhaps best to imagine an actual instance in which it would be called into play. Suppose that the Colorado is in danger of being rammed, or that her hull has been punctured by a torpedo. The officer of the deck or the one first aware of the danger will press the button of the emergency station, immediately releasing the gearing driven by a spring and controlled by an adequate escapement. This gearing then closes the circuit operating the emergency switch in the controller of each door or hatch-gear. It does not start all the motors at the same time, thus avoiding the necessity for a large supply of current. It starts the doors one after the other at intervals of about three seconds, so that 25 doors and hatch-gears can be closed in 75 seconds from each emergency station without more than six motors being in operation at any one time.

As each door makes a complete closure it automatically completes the circuit running to the emergency station and is there connected with a small incandescent lamp located back of each of the disks around the edge of the emergency station. Each disk is numbered to correspond to a door, so that the officer in charge can tell by a glance at the station whether or not all the doors have closed. If any one door or hatchplate has not closed the fact is immediately observable and the location of the trouble is known by reference to a diagram at hand

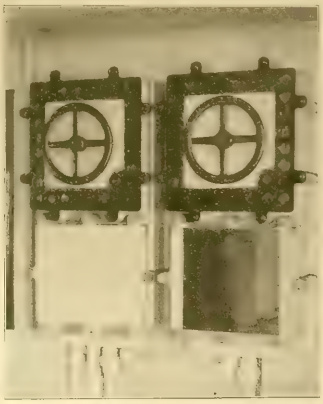


FIG. 2. CONTROLLING STATION FOR ELECTRICALLY CLOSING BULKHEAD DOORS.

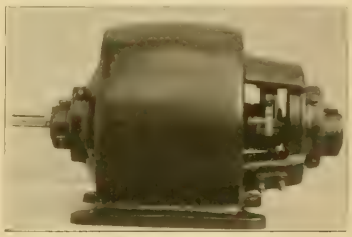
showing the location of all the power doors and hatchways. Whether the emergency is "on" or "off" is indicated by a red light shining through one of the lower disks of the station.

The Navy Department has subjected this system to the severest possible tests before approving it. The results of these tests are shown in the fact that similar equipment is called for in the specifications for all three of the men-of-war just authorized by the United States government. The principal feature which has excited the approval of practical naval officers is that this device secures the confidence of the members of the crew stationed in the immediate vicinity of the power doors. The men had so little confidence in the hydraulic and pneumatic systems that they invariably tampered with the mechanism in such a way as to defeat its purpose completely. The combination of perfect local control with the certainty which the electrical system gives that the doors will not suddenly drop mainly accounts for this confidence.

## Westinghouse Direct-current Bipolar Motor.

A line of direct-current [illegible] the type R has been produced by the Westinghouse Electric and Manufacturing Company to meet the demand for thoroughly reliable and highly efficient machines of small power which shall be easy to install, convenient to operate, require a minimum of attention and give continuous service throughout a long life. They are constructed in sizes from one-sixth to 1¼ horsepower and are wound for 110 and 220 volts. The fields are shunt-wound. The motors are built with graceful outlines, as shown in the accompanying picture, and a baked enamel finish presents a smooth and lustrous surface.

The yoke, brackets and poles of the motors are



WESTINGHOUSE DIRECT-CURRENT BIPOLAR MOTOR.

cast in one piece, a construction which gives a compact machine and provides a rigidity between the support and the driving pulley or pinion. The bearings are of the ring self-oiling type, with linings of phosphor bronze, mounted in separate housings, which may be adjusted in any position so that the oil reservoirs hang vertical whether the motor be set upon the floor or suspended from the wall or ceiling. The housings are so designed as to entirely prevent the leakage of oil.

Armatures are of the slotted drum type and are used with imbedded coils which are retained in the slots by hard fiber wedges without band wires of any kind. The value of this construction has been repeatedly demonstrated in machines of larger capacity, but is seldom found in very small machines, which run at high speeds and in which, therefore, the absence of band wires is of great importance. The armature cores are formed of circular punchings of carefully annealed soft steel, treated to secure high magnetic quality and freedom from aging. The armature cores are mounted upon shafts of unusual strength, which are so designed that pulleys or pinions may be secured with keys—a construction far superior to that of a flat which is often employed to hold the pulley of a small motor to its shaft. The leads to the commutator are adequately protected by a covering of treated cloth and tape and are thus tied down and so firmly held in place that there is practically no danger of a broken lead.

The brush-holder arms are mounted upon rings which are supported at three points inside the motor frame. The individual holders are of the sliding type, with the rod construction, and possess many features of especial merit. Pressure on the brush is exerted by a coiled spring in such a manner as to give the carbon a uniform pressure throughout its width. The carbons are held radial at all times, there being no swivel action during the operation of the machine. A quick-action spring takes up any vibration that might otherwise occur and thus insures continual contact between brush and commutator and obviates jumping or chattering of the brushes. The commutators are made without necks, a construction which provides a maximum wearing surface and eliminates the possibility of the holders riding against the neck.

Brass bolt and nut terminals are located on the two lower arms of the front end brackets. The bolt or stud is threaded on both ends and is brought through insulated bushings and clamped into position by a nut on either side of the arm. These nuts are properly insulated by Vulcabeston washers. Another nut on either end of the stud serves to fasten the leads. They are easily accessible and are largely protected from accidental short-circuit or other injury by their position.

The starting rheostats furnished with the motors are of the most approved design, with automatic no-voltage release, exceedingly small and compact and of the best possible construction, fireproof throughout. The resistance is of the bar-wound type, with porcelain insulation to ground, and is thoroughly ventilated. The adjustment is such that the motor starts without jar or abnormal rush of current.

## Galesburg Company Wins in Automatic Telephone-signaling Case.

In the case of the Western Electric Company, complainant, against the Galesburg (Ill.) Union Telephone Company and another, defendants, Judge Seaman of the United States Circuit Court has handed down a decision in favor of the defendants. The suit was brought for alleged infringement of patent No. 669,708, issued March 12, 1901 (on application filed February 28, 1895), to Charles E. Scribner for "Apparatus for Telephone Switchboards." This patent is owned by the Western Electric Company. The defendant company operates an exchange in Galesburg and employs a form of signaling apparatus, made by the Sterling Electric Company, which was alleged to embody the invention of the patent in suit. The case was regarded as of some importance, because the patent was alleged to be the pioneer patent relating to common-battery automatic signaling boards. Edward Rector and George P. Barton were the counsel for the complainant and Charles A. Brown argued the case for the defendants. The patent contains 17 claims, and infringement was alleged on the sixth, seventh, eighth and eleventh of these claims.

Three defenses were urged upon the attention of the court by Mr. Brown—want of patentable novelty, double-patenting (referring to prior patent No. 574,006) and non-infringement. As to the first contention, Judge Seaman decided that there was sufficient invention to sustain the patent in suit, though narrow in scope. Considering the second ground of defense, the judge held that the patent in suit could not be upheld under the rule against double-patenting. But (passing to the third branch of defendants' argument), even if the patent is valid, the defense of non-infringement is sufficient. From this point the reasoning of the court may be presented in the language of Judge Seaman's opinion:

"I am satisfied that the defense of non-infringement is well asserted under the interpretation which must be given to the claims of the patent. That signaling and tests in the prior art had progressed to the extent of furnishing both audible and visible tests at the telephone exchange prior to the invention in controversy and by means closely approaching it plainly appears.

"The broad construction for the system of the patent which is claimed in support of the charge of infringement would bar means and uses which were clearly within the rights of the public when this inventor entered upon the improvement. Of course the claim cannot be thus construed. As before stated, the invention is of narrow scope, however beneficial for exchange operation, and must be limited accordingly so that the prior art remains free.

"The patent thus described the invention:

> My invention consists in arranging two such signals in parallel branches of a local circuit and in controlling the continuity of one of the branches by a relay responding to currents in the telephone lines. The signal in the branch controlled by the relay is designed to act as an individual signal and is permanently associated with a particular line. The other signal may be associated with one of the plug-circuits provided for uniting different telephone lines, and the branch including it may be normally open, terminating in a contact-piece in the connecting-plug adapted to complete the branch while the plug is in use in a spring-jack.

"The feature of the structure in which invention is found, in my understanding of it, is the introduction of the resistance coil (m) for its special function in the system—well known in the general art for like effect, but novel in this application for telephone signaling. As described in the brief for the complainant, it is 'of such character as to limit the flow of current through the circuit, permitting a sufficient amount to flow to illuminate the lamp, but not sufficient to illuminate it if the flow of current be materially reduced.' Thus signal lamps identical in kind—supervisory and line—are controlled and reciprocally control each other. When one lamp is alone connected in circuit the current will light it, but when both are connected in parallel both are extinguished, as the distributed current is then insufficient to light them—a result being the desirable so-called 'visual busy test' of the patent. While the general effect of one lamp on the other was novel, I am satisfied that this feature is absent from and foreign to the defendants' system and structure. While two resistance coils are used therein, they have a different function in the system; and the introduction of a resistance means by the patentee exclude other uses of that well-known provision in the art. The supervisory lamp is not lighted by the opening of the line-lamp circuit and the lamps do not reciprocally control each other. The means set forth in the patent, which is the sole feature of novelty in the combination, is not thus used in the defendants' device for the control of the supervisory signal; nor does the defendants' structure furnish the 'visual busy test,' which is the distinguishing feature of the patent over the prior art. It was well demonstrated at the hearing, if not clear from the nature of the elements, that the supervisory lamp of the defendants' device was not adapted to be lighted by the full current through the resistance there provided, and was not so lighted. In other words, the particular function of the patentee's resistance coil is not performed by the resistance used by the defendants and is not within the purview of its structure or system. The contention that the visual busy test was not only obtainable therein but was in fact used in the operation of the defendants' exchange is, in my opinion, not established by the testimony introduced to that end and is inconsistent (for practical purposes) with the demonstrations and recognized principles of the structure.

"Other and minor features of difference do not require mention, as the distinctions referred to are deemed sufficient. Analysis of the systems respectively is deemed unnecessary for this summary of my views.

"Decree will follow dismissing the bill for want of equity."

## Ohio District Telephone Meetings.

Representatives of the 56 telephone companies operating in the counties comprising district No. 1 of the Ohio Independent Telephone Association met last week in the Electric Building, Cleveland. The meeting was called to order by Vice-president J. B. Hoge and the discussion upon topics of importance to telephone men was participated in by M. B. Overly and W. B. Woodbury, Cleveland; G. W. Verner, Finley; C. M. Grauel, Painsville; C. Y. McVey, Cleveland; O. P. French, Cleveland; E. L. Coen, Vermilion; J. B. Rhodes, Zanesville; E. C. Branson, Wellington; J. B. Hoge, Cleveland; A. S. Hillhouse, Canton; E. G. Miller, Warren; C. R. Callaghan, Belleview; B. H. Lang, Washington Hyde and others.

James B. Hoge, who has been vice-president of the district for the last year, declined a renomination, as his duties as president of the national association take up his entire time. E. G. Miller of Warren was elected to succeed Mr. Hoge. Mr. Miller is one of the pioneer Independent operating men of the state, with large holdings of telephone properties. C. N. Grauel of Painesville was elected delegate to the national convention and 36 delegates to the state convention were chosen.

Vice-president R. E. Hamblin presided at the meeting of District No. 2 of the association, which was held in Toledo on February 15th. Interchange of business was discussed and the managers of the various companies decided to attend the state meeting in a body.

## Bell Telephone Conference in Indianapolis.

Independents are not to have a monopoly of telephone conventions. As the Western Electrician goes to press, an important conference or convention of high officials and engineers of various Bell telephone companies of the United States is in session in the Claypool Hotel in Indianapolis, the dates being February 21st, 22d and 23d. At this writing the indications are that the convention will be attended by a hundred or more of prominent telephone men. The Central Union Telephone Company is the host. Several papers are on the programme, but for the most part the deliberations will be confined to the exchange of ideas, experiences and results obtained from methods employed. On Thursday night the visitors are scheduled to attend a banquet given by the local officials of the Central Union company at the Columbia Club. Among those who are expected to attend are F. P. Fish, president of the American Telephone and Telegraph Company, E. J. Hall of New York, Henry M. Watson of Buffalo, George F. Durant of St. Louis, T. Spencer of Philadelphia, Arthur D. Wheeler of Chicago, B. L. Kilgour of Cincinnati, J. E. Caldwell of Nashville, W. A. Jackson of Detroit, U. N. Bethell of New York, L. G. Richardson of Indianapolis and many others.

## Bell Telephone Output.

The first month of 1905 was a record-breaker for the American Telephone and Telegraph Company. The total telephone output figures, both gross and net, are larger than ever before in a single month. The best previous record was made in March of last year. The figures given out by the company are:

| | January. | | |
|---|---|---|---|
| | 1905. | 1901. | Increase. |
| Gross output | 130,634 | 90,644 | 39,990 |
| Returned | 37,700 | 36,854 | 846 |
| Net output | 92,934 | 53,790 | 39,144 |
| Total outstanding | 4,573,498 | 3,833,307 | 740,191 |

## Boston-New York Underground Service Proposed.

Reports are current, said to be substantiated by Secretary Victor M. Tyler of the Southern New England Telephone Company, that within three years New York and Boston will be connected by underground-telephone service. The New York Telephone Company already has a conduit system in operation from New York to Portchester, and there are two other such lines in operation, one from Boston to Brockton and Taunton and the other from Boston to Worcester, so that a part of the distance is already covered by conduits.

## Ohio Telephone Notes.

At the stockholders' meeting of the Citizens' Telephone Company, Columbus, a few days ago, H. D. Critchfield of Chicago retired from the board of directors and C. C. Griswold was chosen to take his place. The same officers that have served in the past will be re-elected, it is said. Frank L. Beam is the general manager of the company.

The Hamilton Home Telephone Company of Hamilton is arranging to issue additional stock for the purpose of extending the service into the country. As soon as the Independent company at Middletown has installed a plant arrangements will be made for an interchange of service.

C. P. Bradford, the new manager of the Bell interests at Akron, is engaged in the construction of a number of country lines and it is stated that 300 farmers will be connected up within a short time. Lines are being built from Akron to Thomastown, Cuyahoga Falls to Montrose and Ghent, and from Akron to Uniontown. The Independents also have a strong hold in that territory.

An increase of capital stock from $4,000,000 to $5,000,000 was decided upon at the annual meeting of stockholders of the City and Suburban Telephone Company of Cincinnati at a meeting of the stockholders last week. Directors were elected who organized as follows: President, John Kilgour; vice-president, Charles H. Kilgour; general manager, Bayard L. Kilgour. It is stated that the money secured from the additional stock will be used for purchasing a number of small plants in the vicinity of Cincinnati.

Officers of the Champion Telephone Company elected at a meeting at Warren a few days ago are as follows: President, C. J. Chinnock; vice-president, H. A. Grubbs; secretary and treasurer, L. W. Pierce.

The New Citizens' Telephone Company of Batavia has been incorporated with a capital stock of $150,000 by B. W. Gilfillin, W. H. Baum, W. F. Fee, J. C. Wood, W. G. Jones and G. H. Eveland.

Officers of the Farmers' Telephone Company, recently organized at Medina, with a capital stock of $125,000, are as follows: President, H. F. Rickert; vice-president, J. C. Fixler; secretary and treasurer, E. R. Culver. The company will build lines through the southern portion of Medina County. The exchange and office will be located at River Styx.

A committee of bankers and brokers interested in the Cuyahoga Telephone Company has been appointed to raise money for a loan of $850,000 to pay off the floating indebtedness of the company and increase the capacity of the plant to 22,000. C.

## Indiana Telephone Items.

The Salamonia Telephone Company has increased its capital stock to $10,000 for the purpose of extending the line and increasing the capacity of the switchboard. J. J. Kidder is president and J. W. Cull secretary.

The Elizaville Telephone Company has issued 100 additional shares of stock. Anthony Kincade, general manager, says this was made necessary in order to install new equipments to take care of the rapidly increasing business.

The Central Union Telephone Company is preparing to establish an exchange in the city of Huntington.

The South Bend Home Telephone Company, which began business two years ago, now has 3,500 telephones, and has just decided to put in an automatic system.

At a recent meeting of the stockholders of the Laporte Telephone Company a resolution was passed to increase the capital stock from $30,000 to $60,000. Future requirements, extensions and betterments made this step necessary, while it was shown by the plant account the capital invested already exceeded the amount of the original stock. J. V. Dorland is president of the company.

The Central Union Telephone Company is reaching out for a division of the country-district business and has effected reciprocal arrangements with a number of co-operative lines in Montgomery and Boone counties. The company has a trunk line running directly from Crawfordsville to Shannondale. The contracts made with these companies are for a period of 11 years.

A quiet meeting of the telephone men from Eastern Indiana was held in Richmond, February 15th. The principal subject discussed was the hope of devising some plan to lessen the privileges of the so-called "sponger." This term applies to the large and increasing class who rarely ever pay a cent for telephone service but constantly use other people's telephones for gossiping and unimportant conversations to the detriment of the regular subscriber. It was argued that some plan should be devised to eliminate the large amount of free service now being given and which often crowds the lines to the exclusion of regular patrons. The introduction of the slot attachment was advocated and it was stated that a few had already been installed, but as yet made to apply only to outside toll business. Those present insisted that the plan should be adopted for local business as well. The plan advocated is to provide the subscribers with metal checks similar in size and weight to a nickel, which could be sold to the subscribers at the rate of $1 per hundred. These

could be used by the subscribers, while the non-subscribers would be compelled to pay a nickel to call up central, and thus divide the cost of the service among those who use a telephone. S.

## Telephone News from the Northwest.

L. F. Clark and others have incorporated as the Bellingham (Minn.) Telephone Company, with a capital of $25,000.

W. M. Priest and others have organized the South Creek Telephone Company at Guckeen, Minn., and will build a rural line.

The telephone franchise recently granted to K. D. Chase at Faribault, Minn., will be turned over to the Rice County Telephone Company.

There is talk of forming a local telephone company at Morgan, Minn.

The Cass County Telephone Company has been organized at Pequot, Minn., to build rural lines.

The Hudson Prairie Telephone Company has applied for a franchise for a local exchange at Hudson, Wis.

The annual report of the Minnesota Central Telephone Company, at a meeting in Willmar, Minn., showed an increase of carnings in the last year of $17,813. The company expended $52,035 in additions, extensions and betterments. Dividends of $29,800 were paid during the year.

The German Mutual Telephone Company will extend its lines from Dixon, Iowa, to New Liberty, via Round Grove.

The Midway Switchboard and Telephone Company of Swisher, Iowa, has been incorporated with $10,000 capital. S. A. Dean is president and M. H. Eaton, secretary.

An election will be held at Council Bluffs, Iowa, on March 27th to vote on the proposed new franchise for the Independent Telephone Company. R.

## Telephones in Rocky Mountain Region.

A stock company has been formed at Livingston, Mont., with the project in view of extending a telephone system from that city through various portions of Shields Valley.

The Empire Bell Telephone Company is the name of a new incorporation organized at Pocatello, Ida., which proposes the construction of a telephone system connecting Gentile Valley with the towns of Chesterfield and Bancroft.

A franchise has been granted to J. E. Edwards to operate and maintain a telephone system in Forsythe, Mont.

Within the next few weeks the Rocky Mountain Bell Telephone Company will install two new branch exchanges, one at Plain City and one at North Ogden, Utah.

The Walker River Electrical Company has been incorporated at Yerington, Nev., with a capital stock of $20,000. The object of the company is to construct and operate a telephone line from Wellington to Carson, where connection may be had with the Sunset company's long-distance line. A line will also be constructed from Wellington to Yerington.

## British Government to Buy National Telephone.

It is announced by a London dispatch that the British postmaster-general has come to an agreement with the National Telephone Company to take over its business and buy its plant as from December 31, 1911. The price to be paid for the business is to be settled by arbitration. All that is to be paid, it is said, is the fair market value of the plant and the works of the company. During the present owners' continuance in possession they are bound by agreement to allow intercommunication without additional charge between the systems of the postmaster-general and the company, and are precluded from showing favor or preference as between subscribers, while the minimum and maximum rates they are to charge are fixed. When in April, 1896, the Postoffice took over the trunk lines the cost was $2,295,570, but the purchase of the whole business is a more serious matter from the fact that the company has a share capital of nearly $22,500,000, with debentures amounting to nearly $20,000,000.

## TELEPHONE MEN.

Buford Adams, manager of the Missouri and Kansas Telephone Company at St. Joseph, Mo., has resigned and will become field manager of the Wisconsin Telephone Company.

J. D. Houseman has resigned as general manager of the Suburban Telephone Company operating in the vicinity of St. Louis. Mr. Houseman accepted the position with the understanding that when certain construction work, under way at the time, was completed he was to be relieved. He will now turn his attention to electric-railway work.

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The Southern Bell Telephone and Telegraph Company has been chartered at Lynchburg, Va., with a capital of $200,000, to take over the two local systems. A new exchange will be built and the system will be put underground and otherwise improved. W. T. Gentry and F. E. Montague are in charge.

## GENERAL TELEPHONE NEWS.

In a recent fire in Manning, Iowa, the Manning Telephone Company sustained a considerable [illegible]

A telephone exchange is to be installed at Logan Court House, W. Va., by a company organized by men in Williamson, W. Va.

The Bangor Automatic Telephone Company has been granted the right to do business in Bangor, Me. Hon. Charles F. Bragg is president of the company.

The Stannard bill, before the Legislature of Kansas, provides a maximum price of 50 cents a month for a rural telephone, where the patron constructs the line.

There are now in service in Manhattan and the Bronx, New York city, 154,934 telephones and the number continues to increase at the rate of about 2,000 a month.

The Concordia Telephone Company of Concordia, Kan., has passed into new hands. F. W. Daugherty is now general manager, and F. J. Hannum is secretary and treasurer.

The report of the New York and New Jersey Telephone Company for the year ended December 31, 1904, shows a surplus, after charges, taxes and dividends, of $514,863, an increase of $76,945.

The annual report for 1904 of the Southern New England Telephone Company, which operates chiefly in Connecticut, shows gross earnings amounting to $1,317,528, an increase of $203,314. The year was a record-breaker, with a gain of 6,589 stations, making a total of 33,208.

The supervisors of Los Angeles County, Cal., have granted a permit for a private telephone line to the Lowell and California Mining Company to construct a line along the public roads from Palmdale to Little Rock, from which point the line will pass to the company's lands at a point 25 miles east.

The Independent Telephone Securities Company of Utica, N. Y., has purchased a controlling interest in the Black River Telephone Company, the largest and most important Independent toll system connecting with Utica. Contracts have been made by the Independent Telephone Securities Company to purchase other systems and to expend a large sum of money to meet competition by other concerns.

The Northwest Telephone Company's bill for incorporation has been reported on favorably to the Dominion Parliament by the railway committee of the House. The company seeks power to operate in Ontario, Manitoba and the Northwest Territories. The capital stock is placed at $500,000. The head office is to be located in the city of Winnipeg, Man. The bill was amended preventing the company from amalgamating with any other company.

The Chicago express which left Buffalo at 2:15 p. m. on the Erie railroad February 17th was stalled in snowdrifts near Eden Centre, N. Y., about an hour later, and up to nine o'clock the next day had not moved, notwithstanding the efforts of four locomotives. The passengers were made comfortable, however, and for their convenience a telephone was installed in one of the cars, thus allowing them to communicate with friends in different places.

At Albany, N. Y., on February 16th the crusade against alleged exorbitant prices charged by public-service corporations was extended by the introduction of a resolution by Senator Keenan providing for an investigation by a legislative committee of telephone conditions in New York. The subject was referred to the committee on finance, which was authorized to recommend legislation to compel reduction if the charges are found to be excessive.

The Michigan Independent telephone convention is being held at Battle Creek as the Western Electrician goes to press. A number of papers are to be read, including those of President E. B. Fisher, Edmond Land and F. V. Newman. Representatives of the Independent Telephone Traffic Association are in attendance at the meeting. The latter organization was formed at the last annual convention as a clearing house for the handling of toll-line business between the various Independent telephone companies of the state.

The ninth annual meeting of the Iowa Telephone Association will be held at the Chamberlain Hotel, Des Moines, on March 14th to 16th. The meeting will be held in one of the private dining rooms on the parlor floor, and the telephone manufacturers and supply men will have their exhibits on the fourth floor. A good programme has been prepared. The association banquet will be held on Wednesday night, March 15th. J. C. Sullivan is president, S. S. Lichty, vice-president, and Charles C. Deering of Boone, Iowa, secretary and treasurer of the association.

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The Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., reports that it is just completing one of the finest toll boards that it has ever turned out, for the United States Telephone Company of Toledo, Ohio. The board consists of five sections of three operators' positions each, and is equipped with the most modern apparatus.

## NEW COMPANIES.

[illegible]

The Mulvane (Kan.) Mutual Telephone Company [illegible]

[illegible]

The [illegible] Company of [illegible] with a capital stock of $1,000.

The Bruning (Neb.) Home Telephone Company has been incorporated [illegible] by C. M. McNeill and others.

Philip King, W. H. Reid and T. B. Mitchell have incorporated as the Edwards County Mutual Telephone Company [illegible]

The White Telephone and Telegraph Company of Tyler, Texas, has been incorporated with a capital of $10,000, to construct rural telephone lines. Charles N. White and others are interested.

The Prairie Hall Telephone Company of Lexington, Ill., has been incorporated by G. H. Elder, J. A. Moon and G. C. Elder. The capital is $4,900 and the company proposes to operate a telephone system.

The Santa Clara Valley Home Telephone Company has filed articles of incorporation at Los Angeles with a capital stock of $75,000. The directors are C. F. Guthridge, C. L. Zahn, D. F. Boyce and others, all of Los Angeles.

The Winfield, Buffalo and Galipolis Telephone Company of Winfield, W. Va., has been incorporated with a capital stock of $15,000 to build a line as indicated in the name. E. B. Hensen, S. C. Handley, Charles Harris and M. V. Brown are the incorporators.

The Nashville Home Telephone Company of Nashville, Tenn., has been incorporated by E. L. Barber, R. E. Cooper, Luke Rea, R. J. Lyles and G. S. Parkes. The same interests, it is said, are organizing a long-distance telephone system, and it is understood that about $1,500,000 will be expended in the establishment and extension of lines.

## New York Electrical Society.

The New York Electrical Society held a meeting on February 15th in the assembly room of the Metropolitan Street Railway Association. The address of the evening was made by Mr. H. H. Vreeland of New York, the president of the New York City Railway Company. Mr. Vreeland was introduced by Mr. Frank J. Sprague and his topic was "Electrical Railway Operation in a Great City." Following the address an interesting demonstration was given of the methods employed by the New York City Railway Company to train its motormen. Novices were set to operate a controller and their work was contrasted with that of men who had been a day and a half in the company's training school. Another item was the putting of a trolley car "out of business" and its speedy readjustment by an expert motorman.

Mr. Vreeland said that since the railways of New York city were consolidated into the Metropolitan system and electricity had become the motive power three times the number of men are employed that formerly were employed upon the same mileage. The rule of seniority will be invoked, and in response to its operation it is necessary to exact of the men a certain standard of efficiency and their retirement from the service when their capacities fall below the necessary point of skill. Competition of the superannuated will not be endured and the employer will not endure the service of the incompetent.

## Professor Collin Talks on Transfers.

At Albany, N. Y., a few days ago there was much discussion on transit matters. Professor Collin, counsel for the Brooklyn Rapid Transit Company, declared that it was impossible to carry a passenger between Jamaica and the Brooklyn bridges—a distance of 10 or 12 miles—for five cents except at a loss. On the subject of transfers, Professor Collin made the alarming statement that all Americans are thieves. He said that while they would not steal the upholstered cushion nor take any of the company's physical property, everyone seemed to think he had a right to steal a railroad ride. If it meant, he said, in giving a transfer, that the transfer would be honestly used, it would be all right, but the establishment of a new transfer station meant simply the establishment of a new station for stealing. He asserted that the Metropolitan Railroad Company had recently discovered in one system of transfer stealings alone whereby the company lost $1,000,000 in revenue annually.

## Modern Large Gas Engines.[1]

By Max Rotter.

Those who have watched developments in the means for power generation as described in current technical literature cannot doubt that large gas engines—that is, gas engines in units between 500 and 5,000 horsepower—have come, and come to stay. It is true that their introduction into this country has made slow headway, this being a direct result of the generally low price of our coal and our prosperous condition with less economical appliances. To these causes may perhaps be added the doubt which exists in the minds of many engineers regarding the possibility of satisfactorily generating power gas from bituminous coal and the general and natural inclination to adhere to familiar appliances, demanding comparatively little attention so long as such appliances earn ample profits in spite of their lower efficiency. In Europe conditions are different; coal is expensive, labor is cheap, and as a result the large gas engine has there ceased to be a novelty and has taken its place among the regular products of many shops formerly devoted to steam-engine building. In fact, it is noticeable that by far the majority of manufacturers of large gas engines are concerns which were noted for their large steam engines and had never built small gas engines.

It is true that up to date most of the large gas engines in Europe have been installed to operate with waste gases, such as blast-furnace gas, formerly burnt under boilers, and coke-oven gas, formerly generally wasted; but they have proven so satisfactory when running with these widely different gases—the former exceedingly lean, the latter unusually hard in gas engines because of its high hydrogen contents—that they have already been installed in central power stations, as, for instance, in the city of Scheveningen, in Holland, where four 350-horsepower Nuremberg tandem gas engines, each direct connected to a direct-current generator, are in regular operation with suction producer gas, and in Madrid, Spain, where six units, each consisting of a 2,000-horsepower Nuremberg tandem gas engine, direct connected to a 3,000-volt, three-phase alternator, will soon be running with Mond gas. In Europe there are in continuous and satisfactory operation gas engines aggregating nearly one-half million horsepower, in units ranging from 200 to 3,200 horsepower; and one firm alone has on its books orders for such units aggregating 70,000 horsepower. It is clear, therefore, that the gas engine has ceased to be considered a makeshift of small power.

Certain undesirable characteristics were for a long time ascribed to gas engines with such persistency that they came to be considered irradicable and essential attributes, and it will be well to look into these briefly. As to reliability in operation: Ten years ago a gas engine which would run throughout a day without some sudden and inexplicable stop was a rarity; today large gas engines are uninterruptedly running day and night, furnishing draft for blast furnaces, than which no class of work demands more reliability—a stoppage would involve most serious and expensive consequences. Again, as to regulation: We are all familiar with the gas engine with its old hit-and-miss regulation, its impulse every eighth stroke or so, its flywheel weighing twice as much as the balance of the machine, and a regularity of speed and rotation so poor that its variations could be seen and heard; today, large gas engines with an impulse at every stroke are driving alternators in parallel with absolute freedom from trouble. For instance, at the plant of the Phœnix Iron Works, in Ruhrort, Germany, three 1,000-horsepower Nuremberg tandem gas engines, direct connected to alternators of a frequency of 47½ cycles per second, are operating without the least trouble in parallel and with an extremely variable load, supplying current for motors around a rolling mill. These engines are merely two-cylinder tandems, the effort upon the crank shaft of which is the same as in a single-cylinder steam engine, while large gas engines are also built as four-cylinder twin tandems, with cranks at 90 degrees, the regularity of which for 60-cycle work is therefore beyond a doubt; but, as this frequency is not used in Europe, no such plant can be referred to.

The noisy operation of the gas engine has also been eliminated by the substitution of eccentrics for the old-time cams, and the arrangement of proper dampening apparatus for the exhaust, so that the modern large gas engine makes no more noise than does the Corliss steam engine.

Nor does the starting up of a large gas engine involve the time, manual labor and uncertainty which characterized the old small machines. Compressed air, for the production and storage of which means are provided in conjunction with the gas engine, permits the prompt, easy and reliable starting of the largest unit.

Yet, though the modern large gas engine be as reliable and desirable, mechanically, as the Corliss steam engine, this alone is not sufficient to warrant its being considered as a substitute. Its future supremacy must be based upon its high thermal efficiency, and in this it stands so far above any known steam-power generator that circumstances which would justify its being ignored are rather the exception than the rule.

Before presenting any figures regarding the comparative economy of gas and steam plants, it will be well to call attention to the effect which conditions of operation exercise upon the efficiency of the gas engine, and the considerations which must be kept in view in the selection of this prime mover. There is much misapprehension regarding overload capacity of gas engines, and a lack of such capacity is frequently emphasized as a fundamental disadvantage of this type of power generator. The question of overload is generally viewed from the standpoint of steam-engine and electric-generator operation and rating, and this is not quite right. There is for each steam engine a certain amount of power which it will, under specified conditions, develop with the greatest economy in steam consumption, and this power is customarily the "rated" power of such engine, used to designate it. But this steam engine is capable of developing power far in excess of this amount, although at a sacrifice in efficiency. Likewise, an electric generator will generate continuously, without danger of overheating, a certain maximum amount of current, and is rated at this; nevertheless, this same machine can, for shorter periods, generate an amount of current far in excess of its rating. This excess power or current, known as "overload," can easily mount to 50 per cent. over the rated capacity of a steam engine and electric generator, and is always reckoned with when the size of such machine is to be determined for given conditions of operation. The fact that the steam engine operates at best economy at a load considerably below its maximum, is a distinct advantage, as almost all power plants, especially central power stations, must have at all times sufficient power capacity in operation to safely meet a known sudden maximum demand, and the engines, are, therefore, during a major portion of the time, developing an amount of power far below their maximum capacity, and yet at or near their best economy. In brief, such engines are operating the greater portion of the time under the most favorable economic conditions. With steam turbines these conditions do not quite hold good, but are more closely approached than with gas engines. In the gas engine the maximum capacity in power development is at the same time the condition of maximum economy; that is, when the cylinder of a gas engine is completely filled with a mixture carrying the largest proportion of gas compatible with perfect combustion it will simultaneously develop its maximum power and attain its maximum economy. Beyond this point its power cannot be increased, and below this point its efficiency steadily decreases. Consequently, if sufficient power capacity is to be held ready to meet an instantaneous peak load, the gas engines in a central station will, during the major part of the time, be operating at efficiencies below their best. It would, however, be manifestly improper to rate a gas engine at 66 per cent. of the power it can develop with the highest economy—that is, at 66 per cent. of its maximum power—nor would it be wise to commercially designate an engine by the very maximum it can do; so a proper allowance has been made and the gas engine is, by tacit agreement, rated at 15 per cent. to 20 per cent. below its maximum capacity. This has led to the acceptance of the loose statement that the overload capacity of a gas engine is only 15 per cent.

The whole question for the selection of steam as well as gas engines for a power plant, resolves itself into this: "What is the maximum power the plant will be required to develop?" The sizes of its units would then be so determined that, with the given load curve, the fewest possible number of machines would, during as long periods as practicable, be operating as nearly as possible at their best economy, and yet be able at any moment to meet the maximum demand for power as indicated by the load curve for such periods. Broadly speaking, this would mean that when, during the longest period it would be practicable to run without throwing in more units, the maximum overload does not exceed 50 per cent. of the average load during such period, it would be proper to select steam engines and generators whose aggregate rated power would be equal to the average load; but gas engines whose aggregate rated power would be equal to about 30 per cent. above this average load, coupled to generators whose aggregate rated power would be equal to the average load.

These altered relations between engine and generator seem, at first glance, slightly confusing, but are, in fact, quite simple when everything is based upon the maximum, instead of the rated capacities of engine and generator, respectively. For instance, a generator having a rated capacity of 1,000 kilowatts and a maximum overload capacity of 1,500 kilowatts, would naturally be connected to a steam engine having a rated capacity of 1,460 effective horsepower and a maximum overload capacity of 2,190 effective horsepower; but to a gas engine having a rated capacity of 1,830 effective horsepower, and the same maximum overload capacity as the steam engine, namely, 2,190 effective horsepower. Such unit would be operating at its maximum efficiency: if steam, when developing 1,000 kilowatts; if gas, when developing 1,500 kilowatts.

It is clear, therefore, that comparisons between steam and gas-engine plants must not be made on the basis of the best efficiency which each can attain under most favorable circumstances, but must be made on the basis of the known or assumed actual running conditions of the plant under consideration, with naturally a little bias in favor of familiar appliances.

Leaving out of consideration, for a moment, the relative efficiencies of steam boilers as against gas producers, and dealing with the engines alone, the approximate comparative thermal efficiencies, based on effective, and not on indicated power, are as follows (the steam engine being assumed as compound condensing, consuming 14½ pounds of steam of 150 pounds pressure, per indicated horsepower per hour, at rated capacity; all loadings are stated as percentages of rating):

Generator load, 150 per cent.; steam engine load, 150 per cent.; thermal efficiency, 13 per cent.
Generator load, 150 per cent.; gas engine load, 115 per cent.; thermal efficiency, 29 per cent.
Generator load, 100 per cent.; steam engine load, 100 per cent.; thermal efficiency, 13½ per cent.
Generator load, 100 per cent.; gas engine load, 77 per cent.; thermal efficiency, 24½ per cent.
Generator load, 75 per cent.; steam engine load, 75 per cent.; thermal efficiency, 12½ per cent.
Generator load, 75 per cent.; gas engine load, 58 per cent.; thermal efficiency, 21 per cent.
Generator load, 50 per cent.; steam engine load, 50 per cent.; thermal efficiency, 10 per cent.
Generator load, 50 per cent.; gas engine load, 38 per cent.; thermal efficiency, 16 per cent.

As will be noted, the advantage of the gas engine over the steam engine is greatest at the maximum load of the unit, namely, about 2¼ to 1, and decreases to about 1.6 to 1 at half load.

But the efficiencies of steam boilers and gas producers are not identical; 70 per cent. is usually good practice with steam boilers, while 75 per cent. is ordinarily attained with gas producers. Moreover, the losses due to condensation in the steam line, are greater than the losses due to reduction in temperature in the gas line; and the auxiliaries of a steam plant absorb more power than do those of an equivalent gas plant.

Making due allowances for these conditions, as well as the advantage attained by the use of feed-water heaters in the steam plant, the efficiencies of the complete plants would be reduced to the following proportions of that of the engines alone: Steam plant, 65 per cent.; gas plant, 70 per cent.; that is, the steam plant would use the following amount of coal in comparison to the gas plant, when the generator is developing the stated percentages of its rated capacity:

150 per cent.—Coal consumption of steam plant 2¼ times that of gas.
100 per cent.—Coal consumption of steam plant 1.95 times that of gas.
75 per cent.—Coal consumption of steam plant 1¾ times that of gas.
50 per cent.—Coal consumption of steam plant 1.2 times that of gas.

These are fair average comparisons, rather inclined to favor the steam plant, and sufficient to show the vital importance of considering the exact operating conditions of a plant as a factor in determining the type of prime mover.

In spite of its mechanical suitability and high efficiency, it would be folly to make any sweeping statement to the effect that the gas engine will, at any time in the near or distant future, drive the steam engine and steam turbine out of central-power stations. While it has been established that the gas engine will consume less fuel than the steam engine, it is also true that the gas engine requires more floor space and foundation, is considerably heavier and costs more, power for power. Technically, the field of power generation is open to the gas engine, but commercially it has its limitations. Generalizations are entirely misleading; each particular plant must be carefully figured out on its own merits, giving due consideration to its conditions of operation, running hours, load factor, load curve, price of fuel, cost of water, value of real estate, and cost and facilities of transportation. For this reason figures are, perhaps, a little dangerous, as liable to call out contradictory discussion; we will, therefore, confine ourselves to a few general calculations, covering average conditions, mainly to indicate the figures which should govern the selection of one type of prime mover in preference to another. Let us take, for example, a plant having a total rated capacity of 3,000 kilowatts and a maximum total overload capacity of 4,500 kilowatts, and a comparison between a compound condensing Corliss steam-engine plant and a gas-engine plant. The cost of the station installation, as shown by the capital account, would be about as follows:

Site and buildings, steam $75,000, gas $90,000.
Foundations and equipment, installed, steam, $225,000, gas $360,000.
Total, steam $300,000, gas $450,000.

As running conditions, a station factor of 40 per cent. of the rated electrical capacity of the plant, and a unit factor of 75 per cent. of the rated electrical capacity of the units, will serve as a basis, these being near the average for railroad, light and power plants of this size. To avoid involved calculations, based on load curves, we will assume that the plants, whether steam or gas, would be divided up into the same number and size of units. Running 24 hours per day and 365 days in the year, the annual output of this plant would be 10,500,000 kilowatt-hours; or, if running 10 hours per day, 310 days in the year, 3,800,000 kilowatt-hours.

The coal consumption of the steam plant, under these assumed operating conditions, would average about four pounds per kilowatt-hour, and that of

1. A paper (read by H. L. Woolfenden) presented to the meeting of the Colorado Electric Light, Power and Railway Association at Colorado Springs, September 21-23, 1904.

the gas plant, 2¼ pounds per kilowatt hour. The operating wages and repairs would be slightly lower in the gas than in the steam plant, there being less coal and ash to be handled for the producers than for the boilers, and the maintenance of the former being less costly than that of the latter. The supply charges are, however, in favor of steam, as the gas engine requires about double the quantity of lubricating oil. If water must be pumped or purchased, the cost of this must be added. Assuming that in the steam plant the condensed steam will be returned to the boilers, but the condensing water run to waste, the quantity to be charged against the plant would be 100 gallons per kilowatt-hour. The quantity of water required for the gas producer plant and for cooling purposes in the gas engine, which is also assumed to run to waste, would be 25 gallons per kilowatt-hour. This water we will charge at a low cost of pumping, say, one-tenth cent per 100 gallons. If purchased it would cost about six-tenths cent per 100 gallons, and water-saving apparatus, such as cooling towers or reservoirs, would be expedient. These would add to the capital, fixed charge, and maintenance accounts, and about 10 per cent. of the water would be lost, which would bring the cost of the water to more than the assumed one-tenth cent per 100 gallons.

The accounts for the stations would stand as follows:

| Fixed Charges— | Steam. | Gas. |
|---|---|---|
| Capital investment: Steam, $300,000; gas, $150,000. | | |
| Taxes, etc., 1½ per cent. on valuation | $ 4,500 | $ 0,750 |
| Amortization of buildings, 3 per cent. on valuation | 2,250 | 2,700 |
| Depreciation of equipment, 10 per cent. on valuation | 22,500 | 36,000 |
| Total | $29,250 | $45,450 |

Operating costs, at 10,500,000 kilowatt hours per annum, per kilowatt-hour:

| | | |
|---|---|---|
| Fixed charges | Steam, 0.278 cent | Gas, 0.432 cent |
| Water | " 0.100 " | " 0.025 " |
| Supplies | " 0.025 " | " 0.055 " |
| Repairs | " 0.050 " | " 0.035 " |
| Wages | " 0.175 " | " 0.160 " |
| Salaries | " 0.065 " | " 0.065 " |
| Total | Steam, 0.693 cent | Gas, 0.772 cent |

This gas plant thus shows operating costs 0.079 cent per kilowatt-hour higher than the steam plant, but a saving in coal of 1¾ pounds per kilowatt-hour. The two plants would, therefore, be operating with equal economy when 1¾ pounds of coal cost 0.079 cent; that is, when coal costs 90 cents per short ton.

With the shorter running hours, however, the conditions would be materially different, as shown by the following:

Operating cost, at 3,800,000 kilowatt-hours per annum, per kilowatt-hour:

| | | |
|---|---|---|
| Fixed charges | Steam, 0.772 cent | Gas, 1.197 cents |
| Water | " 0.100 " | " 0.025 " |
| Supplies | " 0.025 " | " 0.055 " |
| Repairs | " 0.050 " | " 0.035 " |
| Wages | " 0.265 " | " 0.240 " |
| Salaries | " 0.120 " | " 0.120 " |
| Total | Steam, 1.332 cents | Gas, 1.672 cents |

Here this gas plant shows operating costs 0.340 cent per kilowatt-hour higher than the steam plant, with the same saving of 1¾ pounds of coal per kilowatt-hour. The two plants would, therefore, be operating with equal economy when 1¾ pounds of coal cost 0.34 cent; that is, when coal cost $3.90 per short ton.

These typical calculations indicate the vital influence of conditions of operation upon the cost of running the same plant.

In the foregoing comparisons it has been assumed that the same coal would be used, whether under boilers or in gas producers; but this is not always expedient. Sometimes a coal high in sulphur and with bad slagging characteristics may be obtained at a price so low as to warrant its use for steam generation, and yet be so undesirable for gas generation that a more expensive coal would have to be substituted for use in gas producers. Such conditions would again modify the comparison. Low-priced anthracite or gas coke are doubly favorable to the gas plant, reducing the labor charges, while increasing the efficiency of the producer.

Although it is not the intention to extend this paper into the domain of power-gas generation, it would be incomplete without a few words concerning this subject, more particularly with reference to the use of bituminous coal in gas producers. The perfect bituminous-gas producer, that is, one which will continuously generate from bituminous coal a fixed gas of constant quality, with as little attention and little loss in heat values as does an anthracite-gas producer from anthracite, has yet to be designed; but entirely practical, simple and efficient bituminous gas producers are today obtainable, and means for eliminating the tar and other undesirable vapors have been brought to a practical state, and, although not ideal, are generally less costly than the other types with reversing valves and other complications with their attendant uncertainty as to the quality of gas and their demand for constant watchfulness on the part of the operators.

Where the plant is of sufficient magnitude, say, over 2,000 kilowatts rated capacity, the proper quality of coal available, and the market favorable, it will unquestionably pay to install by-product gas producers, such as the Mond, to furnish the gas for the gas engines. And in connection with still larger power installations, a retort coking plant, the waste gases from which would be [illegible] tion, will prove a most [illegible] latter combination [illegible] into frequent use than the Mond gas plant, which has proved itself [illegible] gas producer. The open [illegible] can be obtained in Colorado at a price [illegible] $1.75 and $2 at the mine, or well [illegible] gas generation, and will yield per ton, in addition to 130,000 cubic feet of [illegible] value of 135 British thermal units per cubic foot and sufficient to develop about 1,000 kilowatt-hours, 70 pounds of sulphate of ammonia valued at $3 per ton and 50 pounds of tar valued at $5 per ton. The net profits derived from the sale of these by-products would cover fully one-half of the fuel bill at the above rates.

## Mass Analysis of Muntz's Metal by Electrolysis.

At a meeting of the Faraday Society in London on January 30th John G. A. Rhodin read an interesting paper upon mass analysis by electrolysis. The first portion of the paper describes an apparatus which was specially designed by the author for the purpose of the accurate and rapid determination of the copper content (which should lie between 60.5 and 61.5 per cent.) of Muntz's metal. As about 40 to 60 "heats" of metal are cast every day, and it being necessary to obtain the results within 12 hours of the time of casting, the apparatus had to be such as to enable 100 analyses to be made in 24 hours—with a mean probable error of not more than ± 0.1 per cent. The author decided that an electrolytic method would best fit in with these stringent requirements.

The electrodes employed consist of concentric cylinders of very fine platinum gauze, supported by stout frameworks in order to ensure even current distribution. The anode rests on a ring at the bottom of the containing vessel, so that the cathode can easily be slipped away and removed, and both electrodes are held in modified Classen stands. The present installation consists of 30 such unit cells, and current is supplied to them from six pairs of accumulators, each of which supplies current to five pairs of electrodes, through suitable nickelin resistances.

One gramme of the alloy dissolved in nitric acid is used for an analysis and a current either of 0.5 amperes or else of 2.0 amperes is employed for the deposition. In the former case deposition is complete in 12 to 15 hours, in the latter in three hours. Electrolysis proceeds in three phases: (1) copper deposition and ammoniacal reduction of nitric acid; (2) ammoniacal reduction only; (3) deposition of zinc. A perfect separation takes place if phase (2) occupies a long time and is unaccompanied by metal deposition. If certain impurities, such as arsenic or nickel, be present they must be removed chemically.

## The Baltimore Merger.

The Consolidated Gas, Electric Light and Power Company has been organized in Baltimore, being a merger of the Consolidated Gas Company and the United Electric Light and Power Company and acquiring the rights and properties of the Wenstrom Electric Company, maker of electrical apparatus. The new company has a capitalization (stock and bonds) of $27,700,000, and will continue the policies of the old companies for the steady development of the several plants for supplying electricity for heat, light and power and gas for lighting, heating and power, etc. S. Davies Warfield has been elected chairman (president to be chosen later); vice-president, Alten S. Miller; manager, Douglas Burnett; secretary-treasurer, W. S. Symington, and engineer, P. O. Keilholtz. The offices are in the Continental Building, Calvert and Baltimore streets.

## Big Electric Locomotive Burned.

A Schenectady dispatch is to the effect that the big electric locomotive built for the New York Central terminal service, and which was recently described in the Western Electrician, was nearly totally destroyed by fire at the sub-station at Hoffman's Ferry, N. Y., on February 19th. The fire started from an overheated stove in an adjoining shed and the flames spread rapidly, destroying everything inflammable in the locomotive. The big machine will be overhauled and put into running shape at once. The accident to the locomotive will delay the final tests, which were to be held this week.

It is rumored that the Everett-Moore syndicate is trying to purchase the Toledo and Western railroad to be used as a part of a proposed system of electric lines running from Buffalo to Chicago. This line extends from Toledo to Pioneer, Ohio, and has the right-of-way and expects to have the line completed soon to Goshen, Ind., at which point the connection can be made with electric lines now in operation, reaching Chicago. It is said that this through line will be 34 miles shorter than the Lake Shore and Michigan Southern steam line.

# CORRESPONDENCE.

## Great Britain.

[illegible]

the undertaking has now been re[illegible]

the consulting engineer, Mr. A. R. B[illegible]

ing taken this advice the corporation [illegible] quite determined to adhere to it. At [illegible] change was contemplated was given [illegible] ago when a circular was addressed t[illegible] ers, asking their opinions as to the efficiency of the service. Since then Mr. Bennett resigned the managership of the undertaking. At the meeting of the [illegible] was proposed and carried:

"That the present telephone call-wire system should be gradually superseded and that in lieu thereof the automatic calling and clearing-lamp system should be adopted; that in the first place the new system should be applied to the Hendhead exchange, the probable cost being estimated at $7,500, and that offers be invited for carrying out the necessary works."

At Glasgow on the municipal system there are now 12,097 subscribers, of whom 96 per cent. subscribe to the "unlimited" message system. There are many reasons put forward for the change, among them being the statement that the "lamp" system was not an established success four years ago when the corporation first put its system into operation. Another member of the corporation pointed out that the total cost of changing over the whole of the system would be $120,000, and that if they had any regard for their reputation as business men they would ask for further information. Despite this, however, the proposal was sanctioned.

The London County Council in a recent publication gives particulars of the loans which it has granted to London borough councils for electric-lighting purposes since 1889-1890, when the council first came into existence. In that year no loans were made, while in the following year $50,000 was granted, followed by $300,000 in the following year. In 1892-1893 no sums were applied for and the amounts granted up to 1898-1899 varied in no regular proportion, alternating most irregularly. In 1898-1899 the amount reached over $1,500,000, and during the next five years was well over $2,500,000 in each case. In 1903-1904 over $1,000,000 was granted in such loans, and the total amount, representing 216 loans, now granted by the London County Council, exceeds $15,000,000.

The low-maximum speeds at which the majority of electric tramways are forced to run in this country has been the subject of unfavorable comment on many occasions. The Tramways and Light Railways Association recently made an application to the Board of Trade for the formulation of general regulations which would place electric tram cars under the same rules as motor cars under the motor-car act, 1903, viz., allow a speed of some 20 miles an hour outside certain defined areas, to wit, crowded towns. The reply of the Board of Trade, however, was unfavorable, the most that was promised being a careful consideration of any applications for increased speeds. In a somewhat sharp answer to this communication the association refers to the several electric tramway systems in and around London upon which the maximum speeds allowed varied from four miles an hour to 10 miles in contrast with which motor cars in the center of London had been traveling at the rate of 14 miles an hour. As a final appeal the association asks that even if the Board of Trade refuses to proceed by general regulations it should not refuse any request for an increase of speed except on the written report of a responsible officer after a local inquiry.

The keen competition of electrical tramways in London is having an effect upon the railway companies almost unexpected. It is not unnatural that the slow and cumbersome local steam railways should be adversely affected as they all have been, especially in the south; but that the electric railway in that district has also been somewhat hard hit is evidence of the almost vanishing point to which the London County Council has reduced its fares. Unfortunately for the railway company, the tramway lines run directly overhead, and consequently in fine weather the trams capture all the traffic. An extension of the tube railway to Euston is about to be put in hand at once, and when it is completed it will connect up with three of the largest main-line railway termini in London, and the results should indeed be satisfactory to the company. The same condition of affairs has been experienced at Liverpool by the Overhead Electric railway there, due to the Liverpool and Southport corporations' electric tramways.

As a result of the decision of the postoffice authorities to accept space-telegraph messages for transmission to ships at sea, the Marconi Wireless Telegraph Company announces that a special telegraphic code is about to be issued for the use of senders of wireless messages and also a register containing the names and telegraphic addresses of all

persons using the Marconi code. Very satisfactory business is said to have resulted from the agreement with the postoffice.

The Durham County Council is still pursuing its scheme for the inauguration of a huge municipal electric-power supply in the county. At present the thing is not much more than an idea, a special committee having reported and made certain recommendations. The committee has recommended that a bill be presented to Parliament for the necessary powers and that an expert be appointed to formulate a scheme and also to advise as to the feasibility of utilizing waterpower. The area of the county is 638,037 acres, of which 125,921 acres are already occupied by electric-supply and tramway companies. Naturally the companies have picked the "dense" areas, and the possibility of profitable supply being carried on in the remainder, at any rate in the immediate future, would appear somewhat remote. However, the County Council has not yet committed itself to any definite proposals. G.

## New York.

New York, February 18.—The New York, New Haven and Hartford Railroad Company has awarded a contract at $6,000,000 to the New York Contracting and Trucking Company for the proposed six-track improvement of its road from New York to New Rochelle, which is to be finally operated by electricity.

F. K. Hunter, speaking for August Belmont on Thursday, declared that there would be no forthcoming combination between the Belmont interests and the New York, New Haven and Hartford Railroad Company. It was only true that there would be a business agreement whereby certain electric lines controlled by Belmont would be placed in a traffic relationship with the railroad as feeders.

The State Railroad Commissioners on Wednesday issued an important document calling upon the Brooklyn Rapid Transit Company for large improvements previously outlined in these columns. Briefly put, the board's requirements are for several structural improvements in the way of loops and for an immediate increase of car service at all hours of the day, especially during the non-rush hours. A representative of the Brooklyn Rapid Transit Company said that the requirements of the board will be fully and frankly complied with at the earliest opportunity and that an increased schedule of operation is nearly ready.

A new bill being discussed at Albany provides for the removal of disused trolley tracks in this city by mutual consent of the city and the traction corporation. A similar bill last year met with much opposition, but the present measure does not provide for any relocation of the tracks, nor does it say anything about forfeiting the franchise. It is presumed, however, that if the tracks are removed by such mutual consent the franchise privilege will remain in abeyance.

Protests are being made against the new regulation of the building department requiring all elevators to be fitted with automatic speed governors. It is proposed to appropriate a sum of $130,000 as salaries for inspectors to enforce this regulation.

Secretary Morton has approved of the plans to consolidate the power plants at the Brooklyn and other navy yards, but no actual steps affecting Brooklyn are to be taken for some time.

Last Sunday at Sayville, L. I., when the street mains and fire hydrants were frozen in sections of village, the water company employed the Sayville Electric Light Company to thaw them by electricity, which was promptly and effectively done.

James Beesley of Brooklyn, Louis F. Benn of Bayonne, N. J., and Joseph A. Lehmann of Roselle, N. J., have incorporated their business interests as a mechanical and electrical manufacturing company under the laws of New York state, with a capital of $40,000 and headquarters in New York city.

D. W. W.

## Dominion of Canada.

Ottawa, Ont., February 18.—The Ontario and Minnesota Power Company of Toronto, Ont., has been incorporated, capitalized at $3,000,000. E. W. Backus of Minneapolis, Minn., and R. A. Grant and A. McKenzie of Toronto are the provisional directors. This concern will undertake the development of power at Fort Frances, Ont.

The Monterey Electric and Gas Company is applying to the Dominion Parliament for the right to operate outside of Canada with a view of utilizing light and power rights which the company holds in Mexico and to acquire and operate railways, tramways and telegraph and telephone lines there.

A proposition is on foot to construct a water course and feeder at Dunnville and a raceway northerly from the Grand River to Jordan on Lake Ontario for the purpose of developing electrical and hydraulic energy. It is also proposed to construct lines of wire, poles, tunnels and conduits for the transmission of light, heat and power. The Grand River and Western Power Company is the name of the company now applying to the Parliament of Canada for a charter.

E. W. B. Snyder, chairman of the Ontario Power Commission, has notified the Toronto City Council of the resignation of R. A. Ross of Montreal as electrical commissioner and the appointment of Prof. R. A. Fessenden of Washington, D. C., as his successor. The commission awarded the contract for the field work to the firm of Ross & Hollgate, but the civic board of control objected to Mr. Ross being the expert adviser of the board and likewise the contractor, and accordingly refused further contribution from Toronto unless a change was made.

At the annual meeting of the Toronto Electric Light Company the report of the president showed that the income of the company for the last year was $752,315 and the expenses, including interest on debentures, amounted to $450,273, which left a balance of profit of $302,041, out of which were paid four quarterly dividends at the rate of seven per cent. per annum, amounting to $187,965, leaving a balance of $114,076 to be carried forward to the credit of profit and loss. Considerable expenditures have been made looking toward the utilization of power from Niagara Falls, including underground conduits and cables.

At the second annual meeting of the Electrical Development Company of Ontario, held in Toronto, Vice-president Nicholls said that there was nothing to indicate that the work would not be completed and in operation by the summer of 1906. The outlook for the sale of power was steadily improving and already a larger initial output than originally contemplated was being arranged for the demands of the Toronto Railway Company and the Toronto Electric Light Company. There are now about 400 shareholders. In the company's statement as assets the rights and privileges are placed at $6,000,000, the expenditure on plant $1,737,267 and other capital assets $920,310. There is cash on deposit amounting to $974,693.

The council for the city of Quebec has appointed a commission to enquire into the lighting situation in the city and endeavor to induce both the gas and electric companies to reduce rates, failing which, action will be recommended looking to municipal ownership. There are two electric companies in Quebec, the Quebec Light, Heat and Power Company and the Jacques Cartier Company, but these two companies have combined for the supply of light and have raised rates. An agitation also threatens against the present street-car service in Quebec. The company says that the poor service is owing to lack of power due to a shortage of water in the Montmorency River. Before another winter the company expects to get over the difficulty by building a second dam higher up the Montmorency River. The work is estimated to cost $120,000. W.

## Southeastern States.

Charlotte, N. C., February 18.—The American Gas and Electric Company of Providence, R. I., has closed a contract for $150,000 of bonds of the Salisbury and Spencer (N. C.) Electric Railway Company, and, it is said, will complete the line under construction between the towns named and will install an electric-light system at Spencer.

The Manassas (Va.) Illuminating Company has been incorporated with a capital of $5,000. W. N. Lipscomb is president. The company will furnish light by gas or electricity.

It is given out that nearly all of the stock of the proposed electric railway from West Burlington, N. C., to River Falls and other points has been taken up and the construction of the line is well-nigh assured.

The Birmingham (Ala.) Railway, Light and Power Company, in accordance with a recent ordinance of the City Council, is making ready to display an extensive line of electric signs, and it is estimated that about 50 of these signs will be placed in the business section of the city during the next few months. L.

## Michigan.

Detroit, February 18.—The employes of the Detroit United Railway are asking for an increase in wages, to 25 cents an hour. They are now paid 23½ cents an hour, with no extra rate for overtime. The company, it is said, will refuse the request.

The interurban lines throughout the state have been handicapped owing to the severe weather this week. The street-railway officials say they have more snow to contend with now than at any time last winter. Much trouble is experienced from the cold weather rendering the air brakes inoperative.

A through parlor-car service will be inaugurated on the Detroit, Monroe and Toledo Short Line, between Toledo and Detroit, on May 1st. These cars will make but two stops en route and will be equipped with easy chairs and carpeted floors. The running time will be reduced to two hours.

The Alpena Power Company, with a capital of $90,000, has absorbed the Alpena water and electric-light companies and also valuable rights on the Thunder Bay River. Senator Alger is vice-president of the new company.

The use of electric power in Michigan lumber operations has been begun by John Torrent, a veteran lumberman of Muskegon. A new mill is being located about three miles from Muskegon and power will be furnished by tapping the Ottawa Street extension of the Muskegon street-railway feed wires.

The Detroit automobile show, which is being held in the Light Guard Armory, surpasses any ever held in Detroit. Cars were transferred from the Chicago show by two special express trains. The show terminates today. The attendance has been satisfactory, considering the very cold weather.

The city of Grand Rapids appropriated $5,000 last year to cover the purchase of necessary machinery to enable the municipal lighting plant to furnish light to the city hall, engine house, police station, library, museum and other city buildings. The purchase of an engine is now being held up because of a dispute between the Common Council, Board of Public Works and the mayor. An order had been given for an engine, but now the whole matter has been tabled, and new bids will probably be advertised.

S. E. Jarvis of Lansing, who represents capitalists to the extent of $1,250,000, has purchased the Hathaway furniture plant at Portland, to be used as a nucelus for power stations on the Grand River. Two 23-foot dams will be put in.

A bill has been introduced in the Michigan Legislature providing for the taxation of street-railway property when owned and operated by a municipality the same as if it were a private corporation. This bill is to pave the way for the one giving the cities power to own and operate street railways.

C. G. W.

## Ohio.

Cleveland, February 18.—The Cleveland syndicate which has held a large block of Northern Texas traction bonds sold $1,000,000 of them a few days ago at 90 and has received the cash, which will probably be partially invested in the Washington, Baltimore and Annapolis line.

The Miami Transit, Light and Power Company of Lebanon has been incorporated with a capital stock of $600,000 for the purpose of building an electric railway from Lebanon and Xenia. It will also construct and operate light and power plants. F. C. Richards, M. D. Burke, John S. Storrs, C. A. Culbertson and Charles A. Hough are the incorporators.

At a meeting in Newark, N. J., a few days ago all the old members of the board of directors of the Columbus Public Service Company were re-elected and L. M. Ferguson and Ferdinand Baumann were added, making 11 in all. A. W. Field will retire as general manager on March 1st and will be succeeded by W. H. Sharp.

An increase of capital stock from $20,000 to $50,000 has been made by the Electric Railroad Improvement Company of Cleveland.

E. B. Gunn has succeeded Frank Patterson as general manager of the Springfield, Charleston, Washington Court House and Chillicothe Traction Company. Mr. Gunn was formerly superintendent of the Dayton, Springfield and Urbana road.

The Jeffrey Manufacturing Company of Columbus has placed an order for a number of Crocker-Wheeler motors, which will be used to furnish power for machine tools in its new shop.

A lot has been purchased at Bowling Green by the Toledo, Bowling Green and Southern Traction Company on which a modern freight and passenger station will be erected.

A report was sent to Ohio a few days ago that the creditors and bondholders of the Appleyard properties would probably hold a meeting at Boston Saturday of this week to consult on plans for the reorganization of the companies. Some arrangement will have to be made for lifting the receivership before a reorganization can be effected. William McKinley of Champaign, Ill., S. L. Nelson of Fort Wayne, Ind., the Sun Insurance Company of Montreal and the General Electric Company are reported to be at the head of the movement to secure a reorganization. The case against Arthur E. Appleyard at Boston, charged by the New York authorities with being a fugitive from justice, has been continued to February 23d pending the decision of the governor on the question of requisition.

The Northern Ohio Traction and Light Company has planned some important improvements in the Akron, Bedford and Cleveland division. The line will be straightened and many cuts and fills will be made to level it up, with the idea of making better time. In some places the track will be moved a mile from its present location and placed on a private right-of-way as far as possible. Five new cars have been purchased to replace old ones. In all about $100,000 will be spent for improvements.

New engines and generators will be placed in the viaduct power house of the Cleveland Electric Railway Company sufficient to increase the capacity 2,000 horsepower. Fifty new convertible cars have been ordered and it is expected they will be in use by April 1st. The officers of the road believe that the people want better service rather than a material reduction in fare.

An order has been placed with the Allis-Chalmers Company through the Cleveland office for a complete power equipment by the Toledo Interurban Construction Company for the Toledo, Port Clinton and Lakeside Railway Company.

The plan of operating trolley mail cars is still being discussed as a result of an inspector's recommendation that a car be provided to run over the Cleveland and Southwestern to Elyria, thence to Lorain and back to Cleveland over the Lake Shore

Electric. The plan is to supplement the service of the steam roads and provide a rapid delivery on the suburban routes. The revenue for the road would be small at first because of the comparatively light weight of the mail carried, but it is believed that it would increase in volume gradually. The rural-carrier system could probably be greatly improved by a universal system of electric mail service.

Col. C. V. Hard of Wooster is interested in a proposed electric railway to connect Ashland with Medina, connecting at the latter point with the Cleveland and Southwestern. O. M. C.

## Indiana.

Indianapolis, February 18.—The Ridgeville Electric Light, Heat and Power Company has been incorporated for the purpose of establishing a plant to furnish light, heat, power and water to the citizens of Ridgeville. Joseph Lay, Samuel C. Lay and Arthur Lay are the incorporators.

The Indiana Union Traction Company is experimenting with the Sprague multiple-unit control system for use on the interurban line.

An official electric railway guide will soon be distributed from the city of Muncie. Time tables will be published in a new magazine to be edited by Paul H. Richey, formerly assistant engineer of the Indiana Union Traction Company. The first number will be issued April 1st.

Interurban railway men are still concerned about what the Legislature may do. A bill has been introduced requiring air brakes on double-truck street and interurban cars. The Branch bill, compelling interurban companies to erect waiting sheds each mile along their roads, has been passed to engrossment, but was amended to leave the location of these three-sided sheds to the companies instead of the county commissioners. The joint legislative committee on the affairs of Indianapolis has agreed upon a division of costs for track elevation and the same has been incorporated in the bill before the Legislature. It was determined that the steam railroad companies should pay 75 per cent. of the cost, while the remaining 25 per cent. shall be borne by the city and county. In cases where the tracks of the street-railway company cross those of the steam road, it was decided that the street-railway company should bear five per cent. of the costs, the county six per cent. and the city 14 per cent.

James Murdock & Son of Lafayette, who own a large part of the stock in the Fort Wayne and Wabash Valley Traction Company, have made the announcement that the line will be greatly improved by straightening all the curves during the early part of the summer. Engineers estimate the cost at $200,000. Work will also be pushed during the same time in the construction of the line from Logansport to Lafayette by way of Delphi, paralleling the Wabash steam road.

W. L. Sontag announces that the Evansville and Eastern Traction line has been financed in the East, and the line will now be speedily completed. Most of the grading has already been done and the officers of the company say it is their purpose to have cars running over the 52 miles between Evansville and Rockport by October 1st.

The manager of the Indianapolis and Northwestern Traction Company has issued an order that trainmen in the employ of the company must have eight hours rest with each 10 hours of work, and that if under an emergency 12 hours is required the period of rest must be 10 hours. If by any reason 14 hours are required, 12 hours of rest must follow. While this will prevent trainmen from earning overtime, it will contribute largely to the safety of the traveling public, the manager says. S. S.

## Northwestern States.

Minneapolis, February 18.—The new power plant for the Sheboygan-Elkhart Lake Railway and Electric Company at Elkhart, Wis., has been completed. The total cost was about $200,000. Work on the construction of the line will be started early in the spring.

The Rockford and Interurban Company has announced that work will be begun at once on a trolley line from Janesville, Wis., to connect into Chicago and that the road will be in operation within 15 months.

Surveys have been completed for the proposed trolley line from Clintonville, Wis., to Antigo, which will be built by the Red River Valley Electric Railway Company, of which F. C. Delano of Philadelphia is chairman of the board of directors.

E. R. Bradley has applied for a franchise to build a trolley line at Valley City, N. D., to connect with the Soo line at North Valley City, two miles away. It is rumored that he is backed by the Soo interests.

The Fargo (N. D.) and Moorhead (Minn.) Street Car Company contemplates the construction of a line from Fargo to Wheatland, N. D.

The Thilmany Pulp and Paper Company of Kaukauna, Wis., has decided to install an electric plant with which to furnish power for the machinery of its entire plant. The project for linking the towns along the Wisconsin River with an interurban line is again being agitated.

Thomas B. Clement of Faribault, Minn., has resigned his trusteeship of the Polar Star Electric Company to place its bonds. The Minnesota Loan and Trust Company of Minneapolis was appointed his successor.

The Village Council at Excelsior, Minn., has rescinded its action granting an electric-railway franchise to F. E. Kenaston of Minneapolis and associates. The traction men will however, resist the action, contending that the contract had already been completed. The reconsideration of the matter was brought about by the work of the Twin City Rapid Transit Company, which is also desirous of building a suburban line from Minneapolis to Excelsior, and it will submit a proposition shortly, agreeing to have such a road completed by fall if granted a franchise.

Traffic throughout the Northwest has been greatly hampered on the different electric lines by the heavy snows and the extreme cold weather for the last two weeks. The storms have resulted in an immense loss to most of the roads. R.

## North Dakota.

Rugby, N. D., February 18.—The Tomkins Electric Company of this place has installed a new Northern 220-volt, 75-kilowatt dynamo, to replace the 30-kilowatt machine, which was too small for the growing business. Ernest Heinrich is chief engineer, having come to Rugby recently from Deaddood, S. D.

A 200-drop switchboard has just been installed in the Rugby telephone exchange by R. S. Anderson. The old board was cut out at 9 p. m. and the new one was ready for business the next morning at 7 a. m. The company has 125 subscribers and long-distance connections.

Sherwood, N. D., is to have an electric-light plant and telephone exchange.

A new boiler has been put in at the Devils Lake (N. D.) electric-light plant; the old one bagged over the fire and came nearly giving away. H.

## Rocky Mountain States.

Salt Lake City, February 18.—W. E. Pierce and others have petitioned the City Council at Boise, Ida., for a franchise for an electric street railway, the line, as at present planned, to extend for several miles into the suburbs.

A franchise for an electric street-railroad system to be constructed at Logan, Utah, has been asked for by David Eccles of Ogden, and it is stated that favorable action will be taken on the petition by the City Council in the near future.

The Southern Pacific Railway Company has under contemplation the early establishment of an electric power plant at Carlin, Nev., and will later establish similar plants at other points along the route, where the best advantages for the establishment of power plants are available. Among the projects of the company is the construction of an electric road from Sacramento, Cal., to Sparks, Nev.

Manager D. C. Jackling has awarded to the General Electric Company the contract for the electric haulage system to be installed at the mines of the Utah Copper Company at Bingham, Utah. The contract provides for a 1,400-cubic-foot condenser and a vacuum pump and also a 25-horsepower electric locomotive and generator.

A syndicate of Baker City (Ore.) men, headed by George F. Wright of Washington Gulch and Dr. Carlton Faull and Alf Curry of Baker City have been negotiating for the purchase of the Prairie City electric-light plant at Prairie City, Ore. If the deal goes through the capacity of the plant will be increased. G.

## Pacific Slope.

San Francisco, February 17.—The National Electric Contracting Company has been incorporated at San Francisco with a capital stock of $50,000 by J. H. Whitney, E. L. Randolph, Joseph Knowland and others.

The trustees of Bakersfield, Cal., will receive sealed proposals up to March 13th for an electric-railroad franchise as applied for by the Bakersfield and Kern Electric Railway Company.

The Consolidated Heat, Light and Power Company has been incorporated at Visalia, Cal., with a capital stock of $300,000. Clarence M. Smith of San Francisco is now making arrangements for the installation of the system.

The Eureka Brewing Company, Eureka, Cal., has contracted with the Cheney, Kelley & Reid Company of Eureka for the installation of a 200-light electric plant.

E. S. Isaacs, F. E. Smith, Grant Copeland and William O'Donnell have reincorporated the Walla Walla Railway Company with a capital stock of $500,000. The company will build an electric railway in Walla Walla, Wash.; and suburbs, and an interurban line in Oregon and Washington.

The California Gas and Electric Corporation of San Francisco will install three gas holders having a total capacity of 1,400,000 cubic feet in the new gas-engine generating station, which will furnish power for the United Railroads of San Francisco. Two additional three-phase generators are being installed at its power plant at Electra, Cal.

G. S. Cutler has awarded a contract for two engines and dynamos for the electric-light plant at Calistoga, Cal., to the Fairbanks-Morse Company. The San Francisco Electrical Construction Company [illegible] power lines.

[illegible] installing a complete electric fire-alarm system in Bakersfield.

A [illegible] in Ventura, Cal., for voting on an issue of $25,000 bonds for an electric-lighting plant, $100,000 for a municipal water plant and $10,000 for a sewer system.

A proposition to have electric lights in Millville, Cal., is now being considered by business men of that place.

The Merchants' Mutual Light and Power Company has filed articles of incorporation at Santa Barbara, Cal. The company proposes to furnish light and power in competition with the Edison Company. The directors are W. H. R. Weldon, W. C. Show, C. H. Frink and others. The capital stock is $250,000.

J. M. Eitner and A. P. Leonard are interested in a project to erect an electric-light plant at South Bend, Wash. The plant will be modern and will be of sufficient capacity to supply the city with light and power.

The Eel River Power and Irrigation Company has been incorporated at Ukiah, Cal., by F. D. Madison, H. B. Quinn, R. E. Donohue and others. The capital stock is $500,000. Work will be commenced immediately upon a power plant in Potter Valley.

The Board of Supervisors of Santa Barbara County, Cal., has accepted the bid of the Pacific Coast Railway Company for a franchise for an electric road from Santa Maria to Guadalupe, Cal.

Sealed proposals will be received by H. T. Batchelder, county clerk of Butte County, Cal., until 10 a. m., March 10th, for a franchise to construct an electric railway in Butte County as applied for by A. F. Jones and others.

E. H. Harriman and Julius Kruttschnitt are giving final consideration to the proposition of changing the Southern Pacific Company lines in Oakland, Alameda and Berkeley, Cal., to electric roads and also the South Pacific Coast narrow-gauge road as far south as San Jose. Their electrical engineer has submitted a lengthy report on the subject, which they are said to look upon with favor. A.

## PERSONAL.

The death is announced of Victor Serrin of Neuilly-en-Tel, France, on January 22d, aged 75 years. Mr. Serrin is declared to have been the inventor of the first automatic regulator for arc lamps.

Timothy Donoghue of Rockland, Mass., who has been acting superintendent of the Old Colony Street Railway Company's Rockland division during the illness of Superintendent Dorsey, has been installed in the superintendency of the company's Weymouth and Braintree division, succeeding Superintendent Edward French.

Frederick H. Miles of Atlanta, Ga., has succeeded T. J. Harper as city electrician. Mr. Miles has recently been with Carter & Gillespie and previous to that he was with the Georgia Railway and Electric Company, being in charge of one of the company's power houses. He has also filled important positions outside of Atlanta and has had wide experience in electrical work.

Mr. T. A. Martin, superintendent of the White-Atkinson Light Company, writing from Williamson, W. Va., calls attention to the fact that the lighting plant at Logan, W. Va., is under his own supervision. The announcement is due to the fact that the Western Electrician recently—erroneously, as Mr. Martin says—ascribed the installation of the plant to another person.

There are three men in New York—and well-known men at that—who were the cipher operators of the War Department telegraph office under Lincoln, from the outbreak of the Civil War until the death of the president. Their names are Charles A. Tinker, David Homer Bates and Albert B. Chandler. At the recent Lincoln Day dinner they enjoyed a reunion and, recalled how Lincoln used to visit the telegraph office three times a day. In the same room also many conferences took place between the president and members of his cabinet and military commanders, including General Halleck. The three men used to report to Colonel Thomas A. Scott, general manager of roads and telegraphs, in Washington, and all dispatches from the front, as well as all dispatches to the front, went through their hands.

Mr. Harry L. Monroe, formerly in charge of the Dallas office of the General Electric Company, has succeeded Mr. T. P. Bailey in charge of the railway department of the Chicago office of the same company. Mr. Monroe is well known and well liked in Chicago, where he resided at a former period in his career. He has been connected with the General Electric Company and the Thomson-Houston Electric Company, its predecessor, for 17 years, and has a wide and valuable acquaintance among electrical men. He has the undefinable quality known as personal magnetism, and is popular with all who know him. Citizens of Dallas made him the guest of honor at a complimentary dinner just before his departure from that city. He is succeeded at Dallas by Mr.

Otis E. Turner, who has been in charge of the Oklahoma branch.

John I. Beggs of Milwaukee, a director of the North American Company, and former vice-president and general manager of the company's St. Louis lighting properties, has been elected president of the Laclede Gas Light Company of St. Louis, to succeed C. W. Wetmore of New York. The latter is president of the North American Company. Mr. Beggs has also been elected president of the Union Electric Light and Power Company.

Mr. Walter Fairchild has been placed in charge of the New York office of the National Electric Company, 135 Broadway. Mr. Fairchild formerly represented the Bullock Electric Manufacturing Company, and prior to that represented the Stanley Electric Company in New York. Mr. Robert S. Hopkins has been appointed city sales agent, with headquarters at 135 Broadway, New York. Mr. Hopkins obtained his engineering experience with the Bullock Electric Manufacturing Company, and while with it had charge of installing many of its alternating and direct-current plants. Mr. J. Frank Perry has just been appointed sales engineer. Mr. Perry's field of operation has been largely through New England, but he has been connected with large power installations in all parts of the world. Mr. Perry is at the present time in California representing the interests of the National Electric Company.

## ELECTRIC LIGHTING.

The Okeene Ice and Light Company of Okeene, Okla., has been incorporated with a capital stock of $50,000.

The bursting of a flywheel in the electric-light plant at Shreveport, Iowa, partially wrecked the establishment.

Plans have been completed for the construction of a lighting and heating plant by Union College, at Barboursville, Ky.

Thomas & McTier of Winona, Wash., are about to establish a light plant to furnish light for Winona, Endicott and La Crosse.

The City Council of Lake Charles, La., is considering plans for the construction of the new lighting plant to be built at a cost of $60,000.

The city trustees of Anaheim, Cal., favor voting bonds in the sum of $15,000 to enlarge and improve the city electric-light and waterworks plants.

The city of Sylacauga, Ala., is arranging for the construction of an electric-light plant and system of waterworks, for which bonds were recently issued.

An electric-light plant, it is reported, is to be built at once by the city of McKinney, Texas. J. Shain, J. D. Bass and G. L. McKinney are in charge of the project.

The Union Light and Power Company of El Reno, Okla., has been given the contract to put in an electric-light plant for the city of Anadark, Okla. The plant is to be in operation within 90 days.

The Gas and Electric Company of Bergen County, N. J., has been considering the matter of leasing its property and franchises to the Public Service Corporation of New Jersey for a period of 99 years.

It is reported that the Higbee (Mo.) Electric Light, Heat and Power Company has engaged W. K. Palmer of Kansas City to supervise the construction of its proposed electric-light plant at Higbee.

The United Railways and Electric Company of Baltimore will erect a power house on East Pratt Street after plans and specifications by P. O. Keilholtz, consulting engineer. The structure is to be command of its customers one of the largest stocks construction throughout.

A large electric power plant to operate the street railways and furnish light for the city is planned by the Sedalia (Mo.) Water, Gas and Electric Company. The plant will cost $145,000. Joseph McWilliams & Co. of Louisville, Ky., it is said, will prepare the plans, build the plant and install the machinery.

In the course of a lecture on "Improvements in Lighting" delivered recently before the Electrotechnical Society of Cologne, Prof. W. Wedding exhibited some 500-volt Nernst glowers. He stated that these glowers passed a current of 0.25 ampere, giving 97 candlepower (Hefner units), the efficiency, therefore, being 1.3 watts per Hefner candlepower.

Fire broke out in the plant of the Mexican Gas and Electric Light Company, City of Mexico, on the night of February 4th and the city was plunged in darkness. A new and costly switchboard was totally destroyed and two Mexican employes on a platform were barely able to escape from the fierce flames which in a short time destroyed property to the value of $150,000. In two or three days, however, three dynamos were running and light and power were being served to a number of factories and private establishments. Current for lighting the streets was temporarily supplied by the San Ildefonso company.

## ELECTRIC RAILWAYS.

A street-railway franchise good for 20 years will be offered for sale by the City Council of Somerset, Ky., on February 27th.

The San Marcos Valley (Texas) Interurban Railway Company has been incorporated with A. L. Davis of San Marcos as president.

A new franchise has been granted the Fayette Traction Company by the Fiscal Court of Woodford County, Ky. The company is planning to build a road from Lexington to Versailles and Frankfort. Louis Descognets is president of the company.

The council of Sharon, Pa., has refused to grant a franchise to the Shenango Traction Company, although reimbursement was offered by the road in the way of a bonus of $5,000, the same amount toward building the Budd Avenue viaduct, three per cent. of the gross receipts after three years and 22 tickets for $1.

Senator Grady is introducing a bill at Albany, N. Y., which, if passed, will permit any electric-railway passenger who has paid his fare and who is not furnished with a seat on a car to recover $50 damages, unless the company can prove that it was operating all the cars possible under the circumstances. Should the company not operate all possible cars, it shall be fined $1,000 a day.

The railroad commissioners of Massachusetts, in spite of the strong opposition of the Boston and Maine steam railroad and Boston and Northern street-railway companies, which will be paralleled by the new line, have granted the petition of the promoters of the Maplewood and Danvers and Haverhill and Boxford street-railway companies for approval of locations in Malden, Melrose, Saugus, Lynnfield, Peabody, Danvers, Middleton, Haverhill and Boxford. The project has been opposed at every stage by the powerful interests now furnishing transportation in that territory.

The McKinley syndicate, which is constructing the interurban electric railway between Springfield, Ill., and St. Louis, has secured a 50-year franchise from the City Council of Venice, Ill., to construct an electric railway on State Street in that city, and, it is said, will ask for a similar franchise at the meeting of the Madison council. The syndicate also contemplates applying to the council of Edwardsville for a franchise to construct and operate an electric-light and power plant, also a plant for the manufacture of gas, and to furnish hot water or steam for heating purposes, with the right to lay pipes in the streets and alleys of the city.

Owing to greatly increased traffic, the Los Angeles-Pacific Railroad Company has decided to increase the capacity of the central power house at Vineyard and to install an additional sub-station in Los Angeles. The new electrical equipment has recently been contracted for with the Crocker-Wheeler Company, through its Pacific Coast manager, the Abner Doble Company of San Francisco. The interurban railway system of the Los Angeles-Pacific Railroad Company is one of the most extensive in the country, embracing as it does, nearly 200 miles of up-to-date lines. The company owes its growth largely to the energetic and untiring work of the president and manager, Mr. E. P. Clark, who was one of the pioneer railway men of Southern California.

## POWER TRANSMISSION.

The Eel River Power and Irrigation Company, with a capital of $500,000, has been incorporated by W. W. Van Arsdale of San Francisco, F. D. Madison of San Rafael and others.

The Mexican-American Power Company has been incorporated with a capital stock of $150,000 by J. H. De Victor, G. S. Simons and B. H. Wolen. The company will manufacture and sell electric light and power in Mexico. The office of the company is in the City of Mexico.

## PUBLICATIONS.

The Nagel-Collins Manufacturing Company of Chicago, dealer in electrical and mechanical specialties, has issued a neat wall calendar for 1905.

The F. Bissell Company of Toledo, Ohio, is mailing a small folder devoted to the Jandus interchangeable arc lamp, which was fortunate enough to secure the highest award for electric arc lamps at the Louisiana Purchase Exposition.

John L. Gleason of Jamaica Plain, Mass., has issued a circular concerning Gleason's molding boxes which are designed primarily as junction boxes for wooden moldings at the junctions of walls and ceilings. They are made for all standard sizes of wire moldings, sections of which are shown in the circular.

A neat catalogue is that of the National Battery Company of Buffalo, N. Y., describing a line of vehicle batteries. The catalogue deals with the pasted type of battery. The positive grid is of the staggered form and has a large conducting surface which reduces the internal resistance to a minimum and gives a sustained high voltage during discharge. The negative grid is of the corrugated punched and clinched type.

Bulletins Nos. 61 and 62, issued by the Wesco Supply Company of St. Louis describe the product of the company's telephone factory, including the switchboards and their parts, and the subscribers' apparatus. The bulletins are well illustrated.

The Arnold Electric Power Station Company of Chicago has issued a bulletin devoted to the Chicago and Milwaukee Electric Railroad Company's extensions, describing the present equipment of the road, with special reference to the single-phase high-tension station and rotary-converter sub-stations.

Monthly bulletins are now being issued by the Nernst Lamp Company of Pittsburg, the first two having appeared. The title of the publication is the "N. L. C. Central Station Bulletin." The publication will be issued regularly and will be devoted to central-station companies. It is the intention of the company to improve it as fast as conditions will warrant, with the aim to make it of real value to managers of lighting companies.

Those interested in multiphase induction integrating wattmeters will find the latest bulletin of the Fort Wayne Electric Works, Fort Wayne, Ind., of particular value, as it gives a complete description of this apparatus as manufactured by the company, fully illustrated to show the details of the meters. The instruments described are known as the type K and have, through long use, established their reputation for single-phase work.

"Wattmeters and How to Read Them;" here is a chance for many to learn how to do this seemingly easy but oftentimes puzzling trick. The little booklet of the above title is from the Westinghouse Electric and Manufacturing Company of Pittsburg, and it contains valuable information. It also gives descriptive matter concerning Westinghouse integrating wattmeter and "inserts" describing a few types of Sawyer-Man incandescent lamps.

Interest seems to have been renewed in the paper entitled "Tactful Relations with Customers," read by Mr. John W. Ferguson at the twenty-sixth convention of the National Electric Light Association. The paper had a wide circulation at the time, thousands of copies being purchased for distribution among employes of different companies. Fresh demands are now being made for the paper, which is one of the most practical in its line ever published.

Telpherage systems electrically operated find wide application at docks and in factories for transporting machinery and general merchandise from one part of the works to another. This class of apparatus is manufactured extensively by the United Telpherage Company of Bayonne, N. J., and the company has issued a new circular describing it. The circular contains nearly 30 pictures of telpherage systems now installed, illustrating nearly every phase of its application.

Many interesting experiments and the apparatus with which they are performed are described in a catalogue issued by C. H. Thorardson of Chicago, manufacturer of electrical experimental apparatus, high-potential transformers, impedance coils, permeameters, etc. The pictures, which are scattered plentifully throughout the catalogue, are of an attractive sort, especially some showing discharges from a high-potential transformer reproduced from photographs, some of the discharges taking place at 1,000,000 volts from transformers of as high as 100-kilowatt capacity. The catalogue is quite out of the ordinary and will be found to contain much interesting reading matter.

## SOCIETIES AND SCHOOLS.

The Merchants and Manufacturers' Exposition will be held in the Exposition Building, Milwaukee, April 15th to May 21st inclusive, under the auspices of the Interstate Exhibition Association, of which Edward H. Allen is president, in conjunction with the Milwaukee Industrial Exposition Association. The exposition will afford an opportunity for the practical demonstration of mechanical devices of all kinds and the display of merchandise.

The San Francisco branch of the American Institute of Electrical Engineers, recently organized, will hold meetings at stated intervals for the discussion of Institute papers and the presentation of original contributions. The officers of the San Francisco branch are: Chairman, George O. Squier; vice-chairman, C. L. Cory; secretary, A. H. Babcock; executive committee, George O. Squier, C. L. Cory, F. V. T. Lee, J. A. Lighthipe, A. H. Babcock.

The telegraphers of St. Louis have organized the Mound City Telegraphers' Club, a social organization. The officers are: President, James B. Finnan; vice-president, George A. Smith; secretary and treasurer, G. D. Jones. H. A. Mansfield, A. L. Ewing, F. W. Hequembourg, A. J. Roach and A. L. Boyer constitute the board of directors. A committee will be appointed to secure permanent quarters for the club. It is said that there are 3,000 telegraph operators within a radius of 10 miles of St. Louis and the most of them will join. Union and non-union members will be admitted.

## TELEGRAPH.

Another Atlantic cable is to be laid by the Commercial Cable Company, and bids for its laying have already been received. The route has been determined and it is expected that the new cable will be in operation during the coming summer. The new cable will be of high speed and will embody the latest discoveries in this branch of electrical work.

Judge G. L. Bunn, in the state District Court at St. Paul, Minn., decided that the state of Minnesota has not the right to tax the franchise of a telegraph company. The decision was the result of a suit brought by the state against the Western Union Telegraph Company to recover $18,360, claimed to be the balance due on unpaid taxes for 1899 and 1900. Telegraph companies in Minnesota are taxed under a specific law applying to such companies, and in that law there is no provision for taxing their franchises.

## SPACE TELEGRAPHY.

The space-telegraph operator at Cape Hatteras reports that on February 15th he successfully communicated with the station at Key West, 800 miles away, and that he also talked with the station at Cape Cod, about the same distance from Hatteras. A powerful current was used.

Reports from San Francisco state that an effort is being made to secure a site in that city for the installation of a space-telegraph plant for communication with Panama by a direct coast route and by way of the East via Denver, Kansas City, Chicago, New York, Key West, Porto Rico and Cuba. The idea is to establish direct communication between San Francisco, the Philippines, the Orient and the Hawaiian Islands.

## MISCELLANEOUS.

Two wildcats threw every town and hundreds of homes in the San Bernardino Valley into darkness for two hours recently. Between Ontario and Azusa the romping beasts sped up a pole carrying 15,000-volt high-tension wires of the Pacific Lighting Company, got mixed among the lines and caused a short-circuit. It took a long time to locate the trouble and turn the current on the reserve wires. The animals were killed by the electric shock.

A perforated metal box mounted upon a standard and supplied with 110-volt continuous current constitutes a new cigar lighter. Inside the box are two carbon pencils which are brought in contact by the depression of a thumb-piece or button on the outside, and then separated by a spring mechanism which holds the carbons just far enough apart for an arc to be formed. By inserting a cigar in an orifice in the front a unlighted end becomes ignited by contact with the arc, the whole operation taking scarcely five second. Five hundred cigars may be lighted for about one cent.

## TRADE NEWS.

M. B. Fish has purchased the business of the Weiser Electric Supply Company at Weiser, Idaho.

Reports state that T. J. Galloway will erect and equip a building at Johnson City, Tenn., for the manufacture of insulator pins.

The Adams Storage Battery Company has been incorporated at Camden, N. J., with a capital of $4,000,000. The incorporators are E. G. C. Bleakley, Joseph Tyler and Henry F. Stockwell.

The Trumbull Electric Manufacturing Company of Plainville, Conn., increased its capital stock to $100,000 on February 7th. It is the intention of the company to build a new four-story brick factory during the coming year, its present quarters being too small. The intention is also to make a specialty of the panel and switchboard business. A new No. 5 catalogue is now ready for delivery and the company will take pleasure in sending it upon request.

The Columbian Electrical Company of St. Joseph, Mo., announces to its patrons and friends that it now occupies its new building, located at 820 Frederick Street. The company has thus obtained a larger floor space and is prepared to place at the command of its customers one of the largest stocks of electric-light and telephone supplies and construction materials west of Chicago.

## BUSINESS.

Carbonizing coating as manufactured by the Goheen Manufacturing Company of Canton, Ohio, is made for preventing corrosion of iron and steel. It is asserted by the company that the coating hermetically seals the pores of the iron and will preserve the metal longer than ordinary paint.

The Northern Electrical Manufacturing Company, Madison, Wis., has marketed a compact, self-contained type of electric forge-blower which meets with ready acceptance by operators of metal-working shops. Leaflet No. 145, as issued by the company, shows the general type and sizes supplied.

The Barney & Smith Car Works of Dayton, Ohio, have commenced purchase of the materials necessary to the doubling of the capacity of their present plant. The first contracts for machinery have been placed and include the new engines and electric generators for the extension of the main power plant. The Buckeye Engine Company of Salem, Ohio, was awarded the contract for two 400-horsepower en-

[redacted]

in Indiana, Ohio and Michigan, where it is re-

ing with much favor. The company has lately increased its floor space and has better facilities to turn out work than ever.

The Gillette Electro-automatic clock is described in a circular issued by the Gillette Electric Clock Company, of Chicago, [illegible] having a life of from eight to 14 months and which can be replaced by sliding a new one into the back of the clock, no attaching of wires being required. The clock is asserted to be reliable in every way and a good timekeeper.

A number of Detroit capitalists recently formed the Canadian Klondike Mining Company. A visit was made to the works of the Westinghouse interests at East Pittsburg to ascertain if electrical machinery could be used in the gold-mining plant. After considering various plans, it was decided to install a 400-kilowatt turbo-generator in the power house, to be driven by a 600-horsepower Westinghouse-Parsons steam turbine. Dredge boats are to be built, and on them will be installed induction motors, aggregating a total of about 500 horsepower, and varying in size from 7½ to 100 horsepower.

The Fres-Ko Chemical Company of Fort Wayne, Ind., is now energetically pushing two electrical specialties, its soldering paste and soldering stick, that are worthy of attention. A particular point about these specialties is that they are non-corrosive and guaranteed to be so, a feature of decided advantage where a great deal of soldering is done on delicate apparatus, as, for instance, in a telephone switchboard. Another point of merit in the paste is that in its application, for instance, to soldering a bunch of wires into a socket, the contact of the hot iron on the paste that has been applied to the point to be soldered causes the paste to creep in ahead of the solder, with the result that the solder follows and runs into all crevices about the wires. This feature of the operation of the paste is one upon which the manufacturer lays great stress, and it will doubtless be greatly appreciated by those doing a great deal of heavy as well as fine soldering. The Fres-Ko company will send free samples to those interested in soldering work.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued (United States Patent Office) February 14, 1905.*

782,254. Telegraph Relay. Joseph W. Larish, Bridgeport, Conn., assignor to the United Press, New York, N. Y. Application filed August 18, 1904.

A polarized relay controls a local circuit and an induction coil has its secondary in circuit with the polarized relay and the primary in the line. A neutral armature, operated by the magnetism of the core of the induction coil, is adjusted to respond to increased currents only, a local circuit being controlled by the armature. A resistance is adapted to be included in the secondary circuit by the movement of the neutral armature.

782,285. Signal Lamp. Howell W. Souder, Tamaqua, Pa., assignor of one-half to W. D. Zehner, Lansford, Pa. Application filed May 16, 1904.

A casing contains an electric signaling lamp and resistance. The casing comprises a tapering reflector, a cylindrical upper extension having circumferential perforations near its upper end and a flaring cap surrounding the circumferential perforations.

782,308. Electrolytic Apparatus. Arthur Wright, Brighton, England. Application filed March 23, 1903.

Electrolytic apparatus with a mercury anode embodies also a support or receptacle for the mercury, consisting of a corrugated support, receiving mercury in its depressions only and made of a material that is not wetted by mercury. Passages are provided which are too small to permit mercury to flow through, but which are wide enough to permit the free flow through them of an electrolyte. (See cut.)

782,311. Electric Display Apparatus. Edmund L. Zalinski, New York, N. Y. Application filed September 6, 1904.

Electric display apparatus embodies a suitable trackway, a traveling lamp socket and suitable electrical supply conductors, one of the conductors being located below the traveling lamp socket, the track acting as the other conductor.

782,312. Electric Traction Apparatus. Alfred Zehden, Charlottenburg, Germany. Application filed June 21, 1902.

A rail-like armature is located between the rails. A traveling field magnet is provided, the armature being located between the poles of the magnet, so that by the co-operation of these parts the carriage is not only moved forward, but also its weight, namely, wheel pressure, is diminished.

782,323. Telephone System. Daniel W. Campbell, La Crosse, Wis., assignor to the Vought-Berger Company. Application filed June 21, 1904.

Call and disconnect signaling means at the switchboard are associated with a system of impedance and relay coils connected with the circuit for controlling the operation of the signaling means. A main impedance coil is connected with the line and equal in resistance to the combined resistance of the system of impedance and relay coils.

782,340. Means for Regulation of Dynamo-electric Machines. Albert S. Hubbard, Greenwich, Conn. Application filed February 20, 1902.

The field of a dynamo electric machine is responsive to electrical changes in its external circuit. Induction means responsive only to variations in load in the circuit and influencing the field of the machine to stimulate or quicken its responsive action are also a part of the invention.

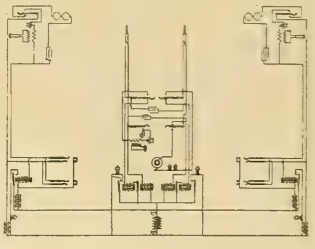
NO. 782,308.—ELECTROLYTIC APPARATUS.

782,376. Four-party-line Telephone System. Garrison Babcock, Chicago, Ill., assignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed November 14, 1903.

A signal bell at one sub-station is connected between one line limb and a third conductor and a signal bell at a second sub-station is connected between the second line limb and the third conductor. An electrically operated signal device at the central exchange is normally connected between the line limbs, while a source of current at the first sub-station when connected in bridge of the line limbs causes an actuation of the central-station signal device. Automatic means close a low-resistance path between the third conductor and the second line limb when the source supplies current to the line. (See cut.)

782,382. Telephone-exchange System. William M. Davis, Chicago, Ill., asignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed May 20, 1903.

Combined with a high-resistance and high-impedance test relay are a test contact and switching means to connect the test relay with the test contact. Means are provided whereby an actuation of the switching means causes a break in the telephonic continuity of the cord circuit, other means independent of the switching means restoring the continuity when broken.



NO. 782,376.—FOUR-PARTY-LINE SIGNALING SYSTEM.

782,386. Fraud Detector for Electric Meters. Wallace W. Fuller, Charleston, S. C. Application filed May 20, 1904.

Associated with a circuit containing a meter are a switch on each side of the meter, balancing solenoids in each side of the circuit and means controlled by the solenoids to open the switches when the balance is destroyed.

782,387. Electric Time Switch. William H. Gerhard, Austin, Texas. Application filed September 15, 1904.

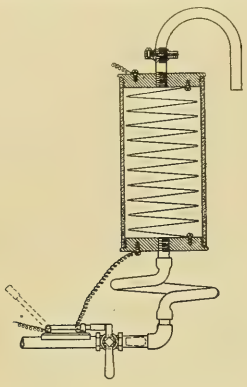
A switch bar is so pivoted to an alarm clock that upon the alarm key turning as the alarm goes off the switch bar is turned and the electric circuit opened or closed as the case may be.

782,391. Electric Cable. Albert P. Hanson, Charlottenburg, Germany. Application filed March 19, 1904.

An electric cable comprises a series of main conductors and a series of tap conductors, the conductors of the two series being disposed in substantially parallel planes. A ribbon of insulating material is placed between the two series, cut away at the crossing points of the different conductors.

782,400. Apparatus for Hygienic and Therapeutical Purposes. Jean M. A. Lacomme, New York, N. Y., assignor of one-half to Walter Lauder, New York, N. Y. Application filed September 3, 1903.

Combined with a frame having two disks supported therein and located one above the other are one or more pairs of electrodes movably supported in the upper disk and adjustable toward each other. Receptacles supported by the lower disk immediately below the ends of the electrodes are adapted to contain liquids into which the lower ends of the electrodes may be lowered.



NO. 782,525.—ELECTRIC WATER HEATER.

782,405. Trolley. John Martland, Detroit, Mich. Application filed January 2, 1903. Renewed November 25, 1904.

A vertically movable frame is mounted on the vehicle and means yieldingly support the frame in an elevated position. A trolley stand pivoted on the frame, a trolley fork pivoted on the stand and means for returning the stand and fork to their normal position after a movement upon their pivots in either direction are other features.

782,419. Intercommunicating Telephone Switch. William H. Rose, Catonsville, Md. Application filed November 21, 1904.

Each station switch comprises a pivoted lever, a neutral contact piece and two battery terminal contact pieces concentrically arranged around the pivotal axis of the lever. A bridge piece, movable with the lever, connects the neutral contact piece with one of the battery terminals in the normal position of the lever. It is adapted to connect the other battery terminal to the neutral contact piece when the lever is moved from normal position. A series of line contact terminals are arranged at one or both sides of the lever when the latter is in normal position.

782,422. Receiving Apparatus. Harry Shoemaker, Jersey City, N. J., assignor to the International Telegraph Construction Company, New York, N. Y. Application filed September 1, 1904.

Groups of elements, each group adapted to constitute a wave responsive device, are associated with a local circuit. A potentiometer is included in the circuit. Means for inserting into or removing from the circuit each group of elements, and means controlled simultaneously with each group of elements for interrupting the current in the potentiometer are supplied.

782,450. Electric Controller. Hans von Kramer, Bath, England. Application filed January 21, 1904.

Several collector bars, each having a series of teeth, are adapted to engage a series of contacts connected with resistance steps. A second set of collector bars is adapted to engage consecutively with another set of resistance steps by means of contacts. Several auxiliary bars are adapted to place the first-mentioned steps in series with the last-mentioned steps.

782,453. Thermostat. John I. Linler, Aiken, S. C. Application filed February 13, 1904.

A fixed electric contact has a co-operating electric spring contact normally tending to close against the fixed contact. A plate projects from the electric spring contact and has a sleeve. A standard is provided with a sleeve, and a fusible restrainer of approximately U-form is adapted to have its legs fitted into the two sleeves.

782,454. Car or Train Signal. William Lintern, West Park, Ohio. Application filed August 4, 1904.

A pair of lamps, one of which is arranged to produce a differently colored light effect from the other, are provided with means whereby one of the lamps is caused to glow upon the application of power to the traction wheels of the car, and means for causing the other lamp to glow upon the shutting off of power to the traction wheels.

782,455. Car-signal System. William Lintern, West Park, Ohio. Application filed November 28, 1904.

Motor circuits, signal devices and electrical conductors so connected as to affect the operation of the signal devices by reason of the differences of potential occurring at the points of connection of the conductors to the motor circuits, are the characteristic features of the device.

782,456. System of Electrical Distribution and Control. Edward Lyndon, New York, N. Y. Application filed March 24, 1904. Renewed January 16, 1905.

A system of electrical distribution and control comprises a main battery, one or more end or reserve cells, main-line conductors common to the several end cells and means whereby each of the end cells is connected with one of the common main-line conductors successively through a resistance and directly.

782,463. Conductor for the Armature Windings of Dynamo-electric Machines. Charles A. Parsons, Newcastle-upon-Tyne, England. Application filed October 1, 1902.

A surface-wound armature has conductors made of strands spirally wound or plaited around a solid core for a complete number of turns in the length of the armature.

782,502. Attachment for Explosive Engines. William B. Hayden, New York, N. Y. Application filed February 15, 1904.

A spring coupling device between the engine and generator operates the latter when the engine is operated. Means intermittently disconnect the generator from the engine when the engine is racing so that the speed of the generator will not rise above a certain maximum.

782,514. Electric Braking System. Charles A. Mudge, Berlin, Germany. Application filed February 2, 1904.

In an electric brake are an electromagnet, a brake shoe connected to it, hydraulic means for locking the brake, hydraulic means for releasing and electric devices and valves for controlling the hydraulic means.

782,524. Universal Fixture, Tap and Receptacle Holder. Charles S. Ryerson, New York, N. Y. Application filed May 25, 1904.

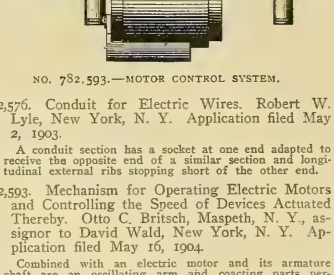
Combined with a base comprising an insulating body containing openings in its surface portion are circuit contacts carried by the body interiorly with respect to the openings and embodying leaf springs having their free portions bent. A plug independent of the base and provided with studs is adapted for insertion through the base openings to engage between the contacts and be embraced by the bent free portions of the leaf springs.

782,525. Electrical Water Heater. Milton H. Shoenberg, San Francisco, Cal., assignor to the Shoenberg Electric Appliance Company, San Francisco, Cal. Application filed June 30, 1904.

In an electrical water heater are a casing formed of insulating material and having supply and discharge pipes, a resistance coil extending through the casing, supply and discharge pipes connecting with the chamber and connections whereby an electrical current is passed through the coil. (See cut.)

782,550. Electric System. Horace Dowie, Brooklyn, N. Y. Application filed April 19, 1904.

An alternating direct electric machine has main lines connected with it to extend throughout the system. Equipments to be connected with the main lines comprise direct circuits and alternating circuits, a storage battery connected to the direct circuit, a load circuit to be operated and automatic means comprising a control switch connected to the alternating circuit to throw the load circuit into connection with the direct circuit or with the alternating circuit.



NO. 782,593.—MOTOR CONTROL SYSTEM.

782,576. Conduit for Electric Wires. Robert W. Lyle, New York, N. Y. Application filed May 2, 1903.

A conduit section has a socket at one end adapted to receive the opposite end of a similar section and longitudinal external ribs stopping short of the other end.

782,593. Mechanism for Operating Electric Motors and Controlling the Speed of Devices Actuated Thereby. Otto C. Britsch, Maspeth, N. Y., assignor to David Wald, New York, N. Y. Application filed May 16, 1904.

Combined with an electric motor and its armature shaft are an oscillating arm and coacting parts performing the functions of a switch to make and break the electric circuit to the motor. A lever pivoted in the motor frame and adapted to be operated by foot power actuates the arm, a clutch on the armature shaft and means actuated by the movement of the lever for engaging and disengaging the clutch are other parts. (See cut.)

782,646. Electrical Drive for Hydro Extractors. William L. D'Olier, Philadelphia, Pa. Application filed July 25, 1903.

The rotatable element of the motor is directly connected with the centrifugal basket. A vertically extending shaft carries the motor element and basket.

782,652. Insulated Rail Joint. George L. Hall, New York, N. Y., assignor to the Continuous Rail Joint Company of America, Newark, N. J. Application filed January 9, 1904.

The supporting plate of a rail joint comprises a metallic piece longitudinally bent outward at the top and bottom and adapted to lie between the top of the connecting plate and the bottom of the head of the rail and between the connecting plate and the base flange of the rail.

782,656. Process of Manufacturing Storage-battery or Accumulator Electrodes. Heinrich F. Hobel, Berlin, Germany. Application filed October 29, 1904.

A process for the manufacture of accumulator electrodes consists in forming recesses in the metallic body, filling the recesses with a material adapted to furnish resistance to pressure and then forcing the body through the die of a reducing press.

782,676. Arrangement for Securing Wires on Insulators. Johann Macek, St. Pölten, Austria-Hungary. Application filed March 19, 1904.

A wire surrounds the insulator. A second wire is pivotally connected to the first and also surrounds the insulator, the line wire being held between the two wires on the side of the insulator adjacent the pivot connection between the wires. Means draw together the portions of the two wires lying on the side of the insulator opposite to the pivot connection between them. (See cut.)

782,731. Magnetic Controlling Mechanism. Arthur C. Eastwood, Cleveland, Ohio. Application filed August 27, 1904.

A circuit-controlling device includes a magnet, mechanism to be operated, including a piece of magnetic material, and a pole piece for the magnet, movable relatively to the piece of magnetic material and to the magnet winding.

NO. 782,676.—WIRE FASTENING.

782,732. Controller for Electric Motors. Arthur C. Eastwood, Cleveland, Ohio. Application filed September 14, 1904.

In a controlling system for electric motors operated on a multi-voltage circuit are means actuated by the electromotive force of the armature for cutting resistance into circuit when the voltage across the terminals of the armature is higher than the voltage of the supply circuit. Means short-circuit the resistance when the voltage across the terminals of the armature is substantially equal to or lower than the voltage of the supply circuit.

782,749. Incandescent Electric Lamp. John H. Guest, Brooklyn, N. Y. Application filed May 14, 1904.

The principal feature of novelty in the lamp is a leading-in wire, which, within the glass seal, is of reduced cross section, the reduced portion and contiguous unreduced portion being integral with one another and being both sealed in the glass of the lamp.

782,751. Automatic Electric-railway Signal. William S. Jackson, Hoboken, N. J., assignor of one-half to David Young, Newark, N. J. Application filed January 9, 1904.

In an electric railway signal are a signal-controlling device having an inclined magazine, a runway inclined oppositely to the magazine and electrically controlled devices in co-operative relation to the magazine and the runway. Rolling weights are adapted to traverse the magazine and the runway and to be actuated by the electrically-controlled devices. A semaphore has means disposed in the path of the rolling weights for its actuation.

782,756. Trolley Guard. Edward R. North, Webster Groves, Mo. Application filed May 6, 1904.

A pair of arms pivoted in and projecting above the casing carrying the trolley wheel carry disks on their free ends adapted to hold the trolley in place.

782,786. Trolley-pole Controller. Joseph P. Magney, Los Angeles, Cal., assignor to the Magney Manufacturing Company, Los Angeles, Cal. Application filed July 11, 1904.

A swinging trolley-pole support is controlled by air pressure.

782,796. Trolley Switch. Alexander Palmros, Columbus, Ohio, assignor to Joseph A. Jeffrey, Columbus, Ohio. Original application filed September 24, 1897. Divided and this application filed June 6, 1901. Renewed June 13, 1903.

Details are described.

## EXPIRING PATENTS.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on February 21, 1905:

378,078. Conductor for Electrical Fire-alarm Systems. W. A. Barnes, Bridgeport, Conn.
378,107. Printing Telegraph. D. E. Pike, New York, N. Y.
378,113. System of Electrical Distribution by Secondary Batteries. J. S. Sellon, Hatton Gardens, County of Middlesex, England.
378,121. Galvanic Battery. H. Walter, Cincinnati, Ohio.
378,122. Galvanic Battery. H. Walter and W. E. H. Marsh, Cincinnati, Ohio.
378,124. Electromagnetic Bell. J. Weltzer and S. Weltzer, Hoboken, N. J.
378,175. Telegraph Cable. W. R. Patterson, Chicago, Ill.
378,181. Multiple Telegraphy. C. Selden, Baltimore, Md.
378,202. Electric Time, Temperature and Burglar Alarm and Call Bell. H. P. F. Jensen, B. W. Webb and J. Jensen, London, County of Middlesex, England.
378,250. Telephone Switch. J. R. H. Hinton, Baltimore, Md.
378,258. Manufacture of Incandescent Electric Lights. T. Shaw, New York, N. Y.
378,259. Electric Railway. C. T. Mason, Sumter, S. C.
378,298. Telephonic Transmitter. M. G. Farmer, Eliot, Me.
378,320. Alternating-current Transformer. R. Kennedy, Galvanic Battery. H. Walter and W. E. H. Marsh, Cincinnati, Ohio.
378,321. Transformation and Distribution of Electric Energy. R. Kennedy, Glasgow, Scotland.
378,332. Telegraph Key and Instrument. W. A. Melbourne, Swanwick, Ill.
378,358. Incandescent Electric Lamp Fixture. H. M. Doubleday, Columbus, Ohio.
378,375. Core for Dynamo Electric Machines. W. C. Rechniewski, Paris, France.
378,385. Telephone Receiver. A. W. Brown, Evanston, Wyo.

# WESTERN ELECTRICIAN

**EVERY SATURDAY**

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## Hydro-electric Light and Power Plant at Janesville, Wis.

By P. J. Kelley.

Janesville, Wis., is a city of about 17,000 inhabitants, located upon the Rock River, and is one of the most enterprising and progressive cities of that state. The Janesville Electric Company, which furnishes all of the electric light and power for the city and vicinity, has recently displaced an old centrally located hydro-electric plant by a new plant located on the same waterpower, but at a more satisfactory point for the hydraulic development.

The complete generating equipment for the city consists of three interconnected hydro-electric plants —one at Fulton on the Yahara River, 12 miles from Janesville; the second at Monterey, a suburb of Janesville, three miles down the Rock River; the third is the new central station already referred to.

The plant at Fulton consists of three 75-horsepower vertical waterwheels under a 14-foot head. These wheels are geared to a horizontal line shaft to which are belted two generators. One is a 60-kilowatt, single-phase generator, and is used as an auxiliary machine for the lighting system of the city of Edgerton. The other generator supplies power to Janesville and is a 150-kilowatt, 6,600-volt, three-phase, delta-connected, 60-cycle machine. The Fulton transmission line is of No. 4 bare copper wire until the line enters Janesville, and there insulated wire is used. The power from this circuit is normally used to help drive the direct-current generators in the central station, though it may be used for all or any of the alternating-current service which the Janesville company supplies.

The waterwheels in the Fulton station are hand controlled, as it is the intention to operate the plant in the evening to carry part of the peak of the load at the central station, so that its wheels may be set to carry a suitable steady load, while the governor at the central station takes care of the fluctuations.

The plant at Monterey consists of four vertical waterwheel units, having a total output of 350 horsepower under a 9½-foot head. Their speed is controlled by a Woodward waterwheel governor. These wheels are geared to a horizontal line shaft to which two generators are belted, one a small direct-current machine furnishing light and power for the Wisconsin School for the Blind. The school is located just across the river from the plant. The other generator is a 275-kilowatt, 2,200-volt, three-phase, Y-connected, 60-cycle machine.

This station is supplied with steam auxiliary in the form of a 350-horsepower, cross-compound, Corliss engine, which receives steam from a battery of three 100-horsepower return-tubular boilers. The engine may be connected to the generator drive by means of a jaw-clutch coupling, though it is seldom that the service of the steam auxiliary is required.

The Monterey station utilizes the hydraulic and steam equipment of a dismantled cotton mill. No material change was made in the old equipment further than the introduction of the necessary pulleys for driving the generators and governor.

The transmission line from the Monterey plant to the central station comprises three No. 2 insulated copper wires. It is tapped at several points for light and power between Monterey and the central distributing station. This is done only for large motors, or when distributing circuits from the latter station are not convenient.

The power from the Monterey circuit divides at the switchboard in the central station, a part being used for furnishing light and power for the outlying districts, another part to furnish current for the arc lamps in the city and the remainder to help drive the direct-current generators in the central station.

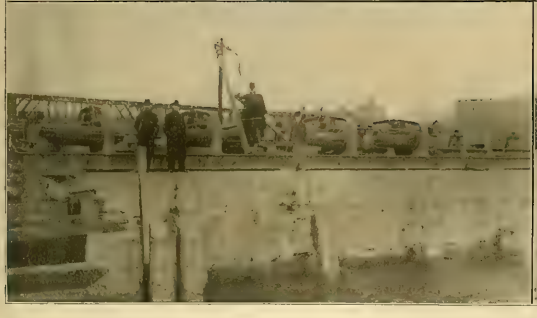
The central station at Janesville is located on a narrow neck of ground between the river and a power canal. This canal led to the old central station and fed several of the old waterpower developments of the city. The plant lays largely on made ground. This, together with the cramped condition for room, required much careful study to obtain a thoroughly suitable layout. The general arrangement of the plant can be seen from the accompanying drawing, which shows a plan of the station and forebay. In the construction of the foundations, [illegible] excluded. Although the temperature was frequently from 12 to 16 degrees below zero during the progress of the work, the concrete has proved exceptionally free from defects. After the forebay, penstock and retaining walls were completed the work was practically suspended for the rest of the winter. As soon as spring opened, piles were driven for the main building foundations, and the concrete foundations were put in. The walls of the building are made of hollow concrete blocks, laid in cement-lime mortar. These blocks give a handsome appearance, as shown in one of the pictures, and when properly made have all the qualities of a good building material. The concrete blocks were made by a Janesville company.

The dynamo room is 80 feet long, 54 feet wide with 18 feet clearance from the floor to the roof trusses. The boiler room is 45 feet long, 40 feet wide and 18 feet high in the clear. There are a large number of high windows in the building which furnish an abundance of light in all parts. Steel roof trusses are used. The roof sheathing is two-inch matched stock, covered with Johns-Manville standard asbestos roofing. The entire floor, with the engine, boiler and generator foundations, and the piers for the bearings of the line shaft, together with the smoke-flue connections from the boiler, are of concrete.

The new hydraulic equipment of the station con-

Exterior of Concrete-block Power House in Janesville.

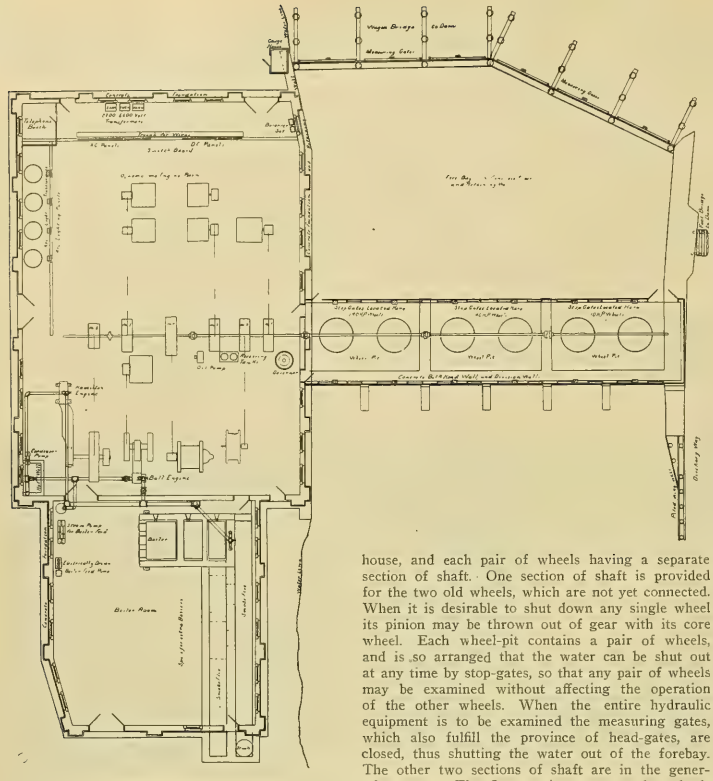
Generator Room in Janesville Power House.



Penstock Bulkhead Wall With Waterwheel Harness Partially Assembled.

View Across the Dam Showing Concrete Penstocks and Retaining Walls.

HYDRO-ELECTRIC LIGHT AND POWER PLANT AT JANESVILLE, WIS.



PLAN OF JANESVILLE CENTRAL STATION.

sists of four new-type Samson wheels of 145 horsepower each, under an eight-foot head. The wheels are geared to a horizontal line shaft. A continuation of this shaft which extends into the engine and dynamo room is suitably subdivided by jaw-clutch couplings, and carries pulleys for the several driving and driven elements in the plant. The harness for the wheels is of extra heavy construction throughout. The complete equipment consists of six wheels, there being two old-type 110-horsepower Samson wheels, placed in position in one of the wheel-pits, but these are not connected to the shaft, as it is calculated that the four new wheels will furnish ample power for the present. The speed of the wheels is controlled by the most improved type of a Lombard waterwheel governor.

The four new waterwheels, with two engines and the power received from the Fulton and Monterey plants, furnish the motive power for the central station. One of the engines is a 300-horsepower Hamilton-Corliss condensing engine belted to a pulley, which is carried on a quill on the line shaft. The other is a 150-horsepower Ball engine belted direct to a 110-kilowatt, 550-volt, direct-current generator. One 200-horsepower Bonus Kewanee water-tube boiler furnishes steam at 150 pounds pressure to the engines.

The line shaft is divided into five sections by jaw-clutch couplings, three sections being in the wheel house, and each pair of wheels having a separate section of shaft. One section of shaft is provided for the two old wheels, which are not yet connected. When it is desirable to shut down any single wheel its pinion may be thrown out of gear with its core wheel. Each wheel-pit contains a pair of wheels, and is so arranged that the water can be shut out at any time by stop-gates, so that any pair of wheels may be examined without affecting the operation of the other wheels. When the entire hydraulic equipment is to be examined the measuring gates, which also fulfill the province of head-gates, are closed, thus shutting the water out of the forebay. The other two sections of shaft are in the generating room. The first section next to the wheel-pit carries three friction-clutch pulleys; the clutches are operated by hand wheels on floor stands.

Referring to the plan: The first of these pulleys (No. 1) drives a 75-kilowatt, 250-volt, direct-current General Electric generator.

The second pulley (No. 2) is driven by an 85-kilowatt, 6,600-volt General Electric synchronous motor.

The third pulley (No. 3) drives two 75-kilowatt, 250-volt National Electric direct-current generators. The shaft between the third and fourth pulleys contains a jaw-clutch coupling.

Pulley No. 4 is driven by a 150-kilowatt, 2,200-volt, National Electric synchronous motor.

Pulley No. 5 drives two 75-kilowatt, 125-volt, direct-current General Electric generators.

The sixth pulley (No. 6) is driven by the Hamilton-Corliss engine.

It will be noted from the drawing that all the driving machines are on one side of the shaft, while the driven machines are on the opposite side. The arrangement makes it possible to have all the belts run tight on the lower side, and also gives ample room for all the apparatus.

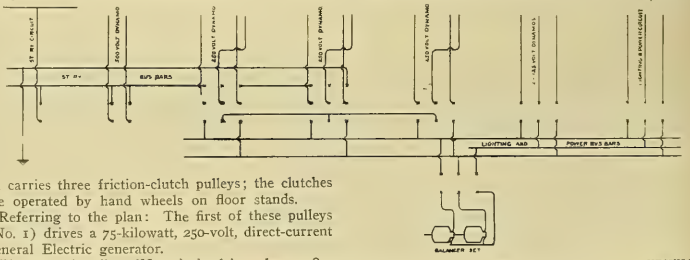
All of the generators and motors, with the exception of one National Electric 250-volt machine, were operated in the old station. While these machines are comparatively small, they are all in good condition, and are amply capable of satisfactorily fulfilling the requirements until the time arrives when material increase in the capacity of the plant is necessary. In arranging the electrical equipment for the plant it was only a question of making the switchboard connections so that the incandescent lighting, commercial power and street-railway loads could be properly taken care of with suitable reserves for each service.

The service to which the several units can be applied, together with the switchboard connections, will now be taken up.

The Ball engine, which is belted to the 110-kilowatt, 550-volt generator, is held as a reserve for the street-railway service, though it is sometimes used during time of peak loads. The Hamilton-Corliss engine is operated only at times of low water, or in case of emergency.

A three-wire 250-volt direct-current service forms the distribution system for both light and power in the center of the city, except for some large motors which are carried on the alternating-current circuits. This service is obtainable from the set of two 125-volt machines, and from any one or all of the three 250-volt machines, if operated in connection with the 125-volt machines, or with the balancer set. The direct-current lighting and power service is usually taken care of by the two 125-volt machines and the single 250-volt unit, while a set of two 250-volt machines are operated in series for the street-railway load. The interchangeable service of the 250-volt machines is accomplished by means of double-throw switches, which, when thrown one way, put the machines on the lighting service, and in the other, put them in series upon the street-railway service.

Transformers are supplied, so that by the proper manipulation of switches the 6,600-volt Fulton circuit may be connected in parallel with the 2,200-volt Monterey circuit, and the 6,600 and the 2,200-volt

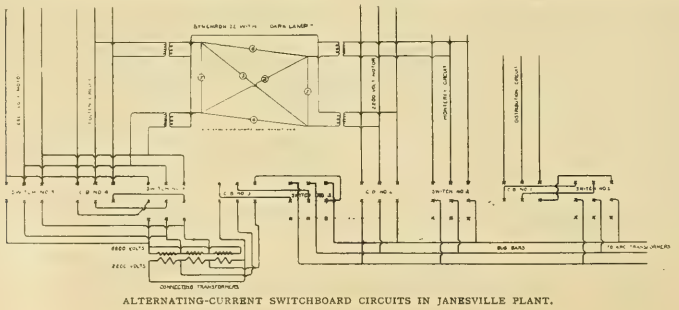



DIRECT-CURRENT SWITCHBOARD CIRCUITS IN JANESVILLE PLANT.

motors at the central station, may be operated in connection with either plant interchangeably. All the power required by the company for its several classes of service may be furnished by any one of the plants up to its capacity. As an example of this, the city arc-lighting system, which comprises four 50-light, 6.6-ampere General Electric constant-current transformers, with the requisite enclosed arc lamps, usually receives its current from the Monterey line. It may, however, be supplied with current (through the changing transformers) from the Fulton plant, or from either of the alternating-current machines in the central station, by using them as generators instead of in their usual capacity of motors. Such a change is sometimes found desirable, and the capacity of a synchronous machine to change from generator to motor and vice versa without alteration of connections or speed prompted the installation of this class of apparatus.

The Janesville Electric Company, which owns and operates the plants described, controls the major portion of the water supply of the waterpower company of Janesville. This furnishes a continuous and reliable source of power, notwithstanding that the desirability of ample steam auxiliary power is fully appreciated.

The direct-current incandescent-lighting load of the station consists of 12,000 incandescent lamps, together with nearly 200 motors of various sizes. These, with the 550-volt circuits, for the street-railway load, occupy five panels of the main switch-




ALTERNATING-CURRENT SWITCHBOARD CIRCUITS IN JANESVILLE PLANT.

board. There are five alternating-current panels, equipped with Westinghouse instruments and oil switches, for the control of the several circuits of alternating-current service. There are also four small panels for the arc distribution. The switchboard are so arranged that extra panels may be added as found necessary. The accompanying diagram shows the connections of the alternating and direct-current switchboards.

It will be noted that much of the apparatus of the old station has been utilized. This was done after due consideration, as it was believed that the actual net returns will be greater than if more modern and possibly slightly more efficient machinery were installed, with consequent increase of the fixed charges. The older apparatus gives reliable service and will for a number of years to come, and it is believed that an actual net saving will follow its retention in service.

The president of the Janesville Electric Company is M. G. Jeffris, the vice-president T. O. Howe, the treasurer S. B. Smith, and the secretary and manager, P. H. Korst. D. C. & William B. Jackson of Madison, Wis., are the consulting engineers for the company; they designed and superintended the construction of the central-station and hydraulic plant.

## A New Edison Three-wire Sub-station at Detroit.

The Edison Illuminating Company of Detroit has built a main generating station at Delray, 3½ miles from the city of Detroit. This station is very favorably located for fuel and water supply on the bank of the Detroit River. It will be equipped with four

FIG. 1. INTERIOR OF STATION "I" IN DETROIT.

Curtis steam turbines direct-connected to 3,000-kilowatt, 4,600-volt, 60-cycle, three-phase generators for supplying power to 10 sub-stations equipped with General Electric apparatus, which in turn will supply direct current on a three-wire interconnected network to the city of Detroit. Three of these turbines are already in operation.

The accompanying views show apparatus installed in one of the sub-stations, station "I," on Elizabeth Street, near Woodward Avenue. This is a handsome gray pressed-brick structure, located near the heart of the city. It is connected with the main generating station at Delray by two feeder lines and it is also connected with sub-station "A" by a tie line, through which it can be supplied with power from the main station in case of injury to the main feeders. Each of these three lines consists of a 200,000 circular-mil, three-conductor, paper-insulated, lead-covered cable.

In station "I" there are now installed two two-unit motor-generator sets (Figs. 1 and 2), each consisting of a 1,000-kilowatt, 270-volt, direct-current generator driven by a 1,000-kilowatt, 4,600-volt, 60-cycle, three-phase synchronous motor running at 257 revolutions per minute. These sets comprise half the ultimate equipment of the station. The generators of the two sets supply current to the outside wires of the Edison three-wire system.

To furnish a neutral for the system and to supply the unbalanced current there is installed a three-unit motor-generator set, consisting of two 200-kilowatt, 135-volt, direct-current generators driven by a 60-cycle, 600-horsepower, 4,600-volt, three-phase induction motor running at 450 revolutions per minute, all mounted on a common iron base. This set appears in the background of the general view (Fig. 1).

The switchboard for controlling the machinery in this sub-station is of white marble with panels seven feet six inches high, and was designed and built by the Edison Illuminating Company, using General Electric switches and General Electric and Weston instruments. Fig. 3 gives a good view of the board. Beginning at the left there are four direct-current feeder panels, a panel carrying switches for paralleling the two sets of bus bars, two blank panels, two panels controlling the direct-current ends of the

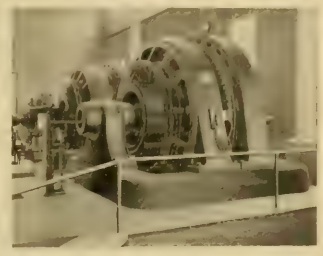


FIG. 2. 1,000-KILOWATT MOTOR-GENERATORS IN STATION "I," DETROIT.

on the gallery above the switchboard. The oil pots, motors and operating mechanism, which are of the latest type, are clearly shown in Fig. 3. To insure protection against contact with live parts it is customary to furnish cell doors of sheet iron or asbestos. In the present installation doors of plate wire glass have been used. These are polished so as to be transparent and the switch parts can therefore be readily inspected.

At the direct-current end of each large motor-generator set is located a starting panel containing a seven-point lever starting switch and also the main switch, of the laminated brush-toggle type, for the negative side of the machine.

On the frame of each of the 1,000-kilowatt generators is a laminated brush-lever switch (see Fig. 2) which is closed to short-circuit the series field when the motor-generator set is running off the alternating-current circuit and supplying direct current to the three-wire network. This switch is opened when the set is run inverted—i. e., with the direct-current end as a motor and the alternating-current end as a generator. The introduction of the series field on the motor, when two sets are run in multiple, is similar to the regulating action of a steam-engine governor; if the load increases unduly on one set the field strength of the motor increases and its speed tends to decrease, thus shifting a portion of the load to the other set.

The equipment of the station illustrates very well

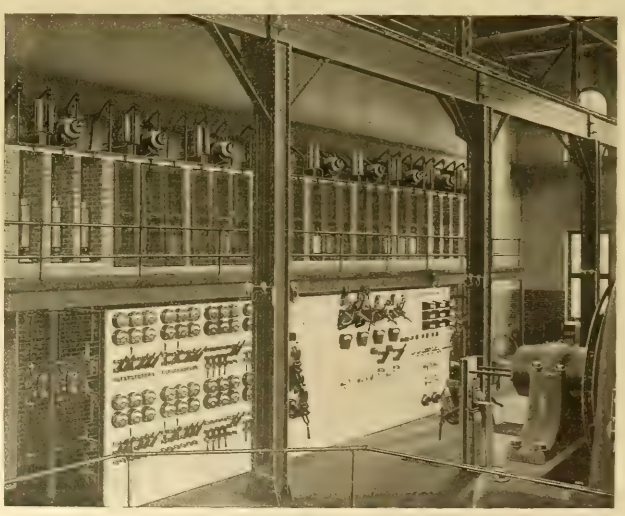


FIG. 3. SWITCHBOARD AND OIL-SWITCH GALLERY IN STATION "I," DETROIT.

the apparatus and controlling devices required under modern conditions for supplying current to the thickly settled portion of a large city.

Maneuvers of the United States squadron of evolution at Culebra during the remainder of this winter will include practice with relay space telegraphy. The ships will be arranged in column, distant from each other about 100 miles, and wireless messages will be transmitted from the flagship and repeated from ship to ship, the final recipient reporting to the flagship the exact message received from the penultimate ship.

## Elgin and La Grange Abandon Municipal Operation.

Traction Company into possession of the city lighting plant in Elgin, while the city has been lighting the streets and also doing some commercial lighting. By the terms of the agreement which the aldermen have voted to adopt the traction company gets the city's pole line and wires and will remove the machinery from the municipal plant to its own power house. The city is to pay $55 per lamp for lamps are light up to 245. Should the number of lamps used by the city be increased to 350 the price is to be reduced so that the average cost will be $55 a lamp. If the total number reaches 500 the average price per lamp will again be reduced to $52. The agreement is for 10 years, at the end of which time the city, if it chooses, can demand the return of the pole lines and wires and the restoration of the municipal plant to its condition at the time it was given over to the company, or it can enter into a new agreement.

The La Grange municipal electric-light and water plant has been sold outright to the North Shore Electric Company, and the deed has been executed. By the terms of the sale the North Shore company paid the city $1, and assumes the bonded indebtedness of $260,000 on the properties. Three years ago the properties controlled under the name of the La Grange Water, Light and Power Company were sold to the village under an agreement that the village should pay the interest and principal on $260,000 in bonds held by the stockholders. The plants have deteriorated, and the village is said to have no funds with which to rehabilitate them. After several meetings the Board of Trustees voted, five to one, to sell the properties. "The village has been staggering under its self-assumed load for three years, finding municipal ownership a greater burden each month, and the time has come to get rid of it," is the way the trustees expressed themselves.

Protests have been heard in both towns from certain citizens who oppose the action of the officials. In La Grange 100 citizens who feared that the rates would be raised if the plants were sold, protested, but the deal has been closed and the North Shore company took possession of the plants on March 1st.

In Elgin, citizens who oppose the leasing of the lighting plant have called a mass meeting to protest, and are awaiting the return of Mayor Hubbard, who for some time has been in Florida. It is declared, however, that the plan of leasing the plant to the traction company will be carried out. The Elgin, Aurora and Southern Traction Company is

in a position to operate the plant on an economical basis. Aldermen who favor discontinuing municipal operation say that the plant has been a losing investment for the city and they believe that by leasing it to the corporation the city will save money.

## Telephone Repeater with Compound Relay.

Thus far in the construction of telephone repeaters two obstacles have presented themselves which have worked most against the perfection of a satisfactory repeater, and these are the distortion of the voice currents and their attenuation. Apparatus which is delicate enough to prevent distortion does not seem to have the necessary power to transmit the current for long distances without its becoming weakened to such a degree that its functions are no longer performed. Likewise, where heavy local currents are used at the repeating stations in the attempt to "step up" the voice currents to a greater volume, the original waves become distorted and speech is unintelligible.

As the result of extended laboratory research of the variation of resistance of microphone contacts with pressure and of the magnification of telephone waves by microphones adjusted to various normal pressures, Mr. William W. Jacques of Boston has come to the conclusion that for very light normal pressures the microphonic resistance varies more than proportionately to the variation of pressure, so that the intensity of the waves is greatly magnified; but the shape of the waves is greatly distorted, because the high-pitch waves are much more magnified than are the low-pitch waves. On the other hand, with heavy normal pressures, there is comparatively little magnification; but the shape of the waves is again distorted, now in the other direction, because the low-pitch waves are now magnified more than the high-pitch waves. He has found that the range of normal pressure over which there is no distortion of the waves is very limited, and that within these limits the magnification is very small.

By the use of two relays, each consisting of a receiving telephone and a microphone of special construction, Mr. Jacques believes that he has discovered the correct principle and he has obtained a patent upon the device. The receiving telephone of the second relay is connected in circuit with the microphone of the first, the one relay having its parts delicately constructed and its normal pressure made exceedingly light, while the other relay has its parts more massive and its normal pressure heavier. The first relay is used, essentially, to magnify the telephone waves, while the essential function of the second relay is to correct the distortion of the first (though each multiplies the magnification and each corrects the distortion of the other).

The operation of the compound relay may be appropriately likened to the operation of a compound microscope, the strongly magnifying but distorting relay being analogous to the strongly magnifying but distorting "objective" of the microscope, while the more feebly magnifying but correcting relay is analogous to the correcting "eyepiece" of the microscope.

Fig. 1 is a diagram of a schematic nature showing the relation of the parts. Fig. 2 is a diagram of connections.

In Fig. 1 the relay is shown as inserted midway between two telephone stations, which may be assumed to be 2,000 miles apart. As shown, it is arranged to magnify the telephone waves, which, originating at ($T_1$), have passed 1,000 miles over the circuit to the compound relay ($R_3$) and, having been magnified and corrected by that relay, to send them along the circuit another 1,000 miles to the distant telephone station ($T_2$).

The magnifying relay ($Rm_3$) consists of the receiving telephone ($r_3$) and the transmitting telephone or microphone ($t_3$). The receiving telephone is essentially like that in general use, excepting that its diaphragm is preferably held between concentric annular knife edges, so that the spring of the diaphragm is opposed to the pull of the magnet. This method of supporting the diaphragm increases its sensitiveness and accuracy of vibration in a marked degree.

The transmitting telephone or microphone ($t_3$) (Fig. 1) of the relay ($Rm_3$) consists of a granular button microphone ($gb_3$), such as is in common use in the long-distance transmitters, which granular button is fixed in the lead ball ($lb_3$) on the side toward the diaphragm, and is counterbalanced by a weight. The lead ball possesses considerable inertia. It is supported from an adjustable support by bifilar suspension wires, so that it is free to move toward or from the diaphragm, but not in other directions. The suspending wires also serve as lead wires. The telephone ($r_3$) slides freely on an iron bedplate and may be adjusted to very delicate contact with the granular button, so as to produce an exceedingly delicate light-pressure multiple-contact microphone within the granular button. At the same time the lead ball presents a considerable inertia to the vibrations of the diaphragm.

The microphone circuit is completed by the battery ($B_3$), the primary of the induction coil ($Ic_3$) and the connecting wires, as shown. The secondary circuit of the coil ($Ic_3$) leads directly to the receiving telephone of the correcting relay.

The correcting relay ($Rc_3$) is, in general, like the magnifying relay, excepting that it is more massive in its construction and operation. The magnet is stronger, the diaphragm is larger and thicker, and the inertia of the granular button is much greater. When in operation, the pressure between its diaphragm and the granular button is also much greater than the light pressure of the magnifying relay.

The batteries ($B_3$) and ($B_5$) (Fig. 2) are preferably of the accumulator type, so as to present constant electromotive force and low internal resistance. The induction coils ($Ic_3$) and ($Ic_5$) should have low-resistance primaries, while the secondary of ($Ic_3$) should have many turns, as is customary with coils connected directly to long circuits.

The operation of the compound relay ($R_3$) as a whole is as follows: Telephone waves from station ($T_1$) having traveled, say, 1,000 miles, and having become attenuated, say, to one one-hundred-and-fiftieth of their original intensity, which still leaves them quite strong enough to actuate the relay telephone receiver, but far too feeble to continue unaided another 1,000 miles to operate the receiver of station ($T_2$), by actuating the receiving telephone of the magnifying relay, set its diaphragm in vibration. These vibrations are by means of the light pressure and heavy-inertia microphone reproduced greatly magnified and somewhat distorted in the circuit which leads to the receiving telephone of the correcting relay. In virtue of the heavy pressure and inertia of the microphone of the correcting relay the magnified and distorted waves are again magnified and this time corrected, so that they are now reproduced on the farther line circuit, restored to the original intensity, and corrected to the original shape with which they left the first station, and therefore ready to enter on the second stage of their long journey to the distant station.

By sliding the receiving telephones of the compound relay along the surface of the iron bedplate the respective microphone contacts may be each adjusted to the desired efficiency and each may be adjusted to best co-operate with the other to secure the desired magnification and correction of distortion. The bedplate is preferably supported by a springy pad, so that its weight, together with the springiness of the pad, protects the apparatus from extraneous mechanical vibrations. It should be enclosed by a reasonably sound-proof cover.

It is evident that while the compound relay as thus far described is capable of magnifying the sounds uttered into the telephone at station ($T_1$) so that they will be heard in the telephone at station ($T_2$), sounds uttered at ($T_2$) cannot be heard at ($T_1$).

If the wires ($w_1$ $w_2$) of the first 1,000 miles of circuit are connected directly with the wires ($w_2w_4$) of the second 1,000 miles of circuit, or, what is the same thing, bridge both the receiving telephone of the magnifying relay and the transmitting telephone of the correcting relay, both between the two main circuit wires, the magnified waves are not only sent to line, but also into the receiving telephone of the magnifier itself, where they are, of course, again magnified, and this cycle of reinforcements is kept up with increasing strength until the diaphragms are forced to their elastic limits, when they continue to vibrate violently and give out a loud roaring sound, determined by the normal times of vibration of the diaphragms and the associated circuits, which in no way resembles articulate speech. To obviate this difficulty it is possible to substitute for the half of each circuit beyond the relay an inexpensive artificial circuit having the same electrical properties as the actual line on the nearer side of the relay, and then connect the outgoing circuit of each compound relay differentially through the receiving telephone of the opposing relay. Thus a single metallic circuit extends between the stations, with a repeater composed of two opposing compound relays and two inexpensive artificial lines inserted midway of the circuit. Such an arrangement of circuits is shown diagrammatically in Fig. 2. Artificial lines having approximately the same distributed telephonic resistance, capacity, inductance and shuntage as the actual lines with which they are directly connected are represented by ($Al_1$) and ($Al_2$).

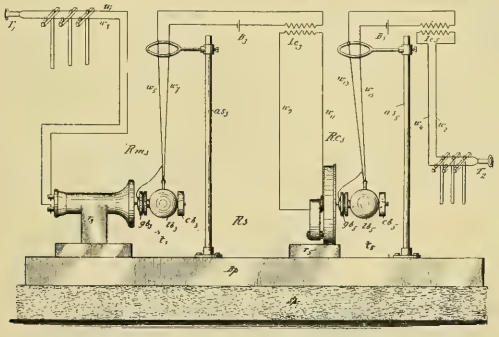


Fig. 1. Schematic Diagram of Repeater Parts.

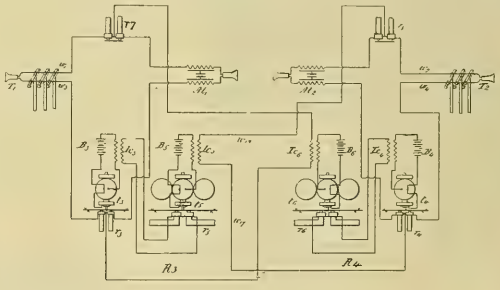


Fig. 2. Diagram of Connections.

TELEPHONE REPEATER WITH COMPOUND RELAY.

## Carnegie Technical Schools.

Building operations will be begun in the spring upon the new Carnegie Technical Schools in Pittsburg, the money for which was contributed by Andrew Carnegie. The aim of the school is to provide instruction first in those subjects which affect Pittsburg most directly, and it will be open to the students for courses in theoretical and practical application of the principles underlying the great iron and steel industries of the district. A fair proportion of the space will be allotted to women's work, giving instruction of a more or less practical nature.

The picture on the next page is reproduced from the Municipal Record of Pittsburg and represents an architect's drawing of the proposed buildings. It is probable that with so large a group of buildings and to provide the necessary power for instruction purposes, a power plant of considerable size will be required, though no such building appears to be in the picture.

The school is located on the northwest part of a tract of ground given by the city of Pittsburg and is of easy access to the nearest street-car lines. As soon as the winter breaks, foundations for the building will be laid. Simplicity is the character

of the group, and the treatment by the architect in this particular calls for favorable comment. Architecturally pleasing to the eye, the outline of the buildings is dignified, giving the effect of permanency and yet characteristic of the purpose of the structures. The style of architecture in these buildings may be called Neo Greek, a style which lends itself well to extension into a larger scheme from smaller distinctive units.

The future growth of the schools and the extensions of this scheme will depend entirely upon the interest manifested by those wishing to receive instruction. Should the number of students who actually apply when the schools are established be greatly in excess of the room provided, Mr. Carnegie stands ready to provide more room, but only when it has been clearly shown that Pittsburg really appreciates the magnificent opportunity which its generous donor has provided.

(From Architect's Drawing.) CARNEGIE TECHNICAL SCHOOLS.

## Oscillator for Space Telegraphy.

Peter Cooper Hewitt, inventor of the mercury lamp, has applied himself to the problems of space telegraphy and a patent has just been issued to him for an apparatus for producing oscillatory currents suitable for that purpose and to be employed at the same time to radiate more efficiently the energy thus produced.

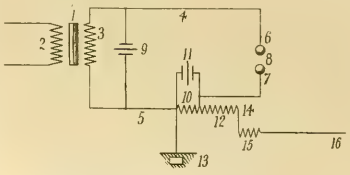
Oscillatory electrical currents of the kind referred to are commonly produced by the discharge through an inductance of a charged condenser or capacity. The condenser discharge may be oscillatory if $R^2$ is less than $4L/C$, R being the resistance, L the inductance and C the capacity. Where $R^2$ is greater than $4L/C$, no oscillations take place. In practice all losses, including those due to friction, induction, or radiation, may be included or reckoned as resistances. The oscillations are in the natural period of the system as determined by its inductance, capacity and resistance, and the persistence of the oscillations or wave-trains may be increased by minimizing the incidental frictional or other losses.

Losses by radiation are of course inevitable, since, in space telegraphy particularly, radiation represents the useful work to be performed. The internal frictional losses are detrimental and serve no useful purpose. Of these internal detrimental losses that which occurs at the spark-gap is of considerable importance. As ordinarily constructed, all of the energy stored in the condenser is forced to cross the spark-gap twice, first in one direction and then in the other, for each complete wave or oscillation. The object of the invention here described is to provide an auxiliary oscillator designed, proportioned and arranged in such relation to the prime oscillator that the prime oscillator will transfer to the auxiliary oscillator all, or at least a large fraction, of the energy of the prime discharge. The function of the auxiliary oscillator is to elastically absorb the energy in such manner that it will oscillate persistently in its own natural period.

The auxiliary oscillator has no spark-gap and oscillations once initiated will persist much longer than in the case where all the energy must cross a spark-gap twice for each complete oscillation. It is obvious that where a unidirectional-discharge device or arrangement, like the vapor-lamp interrupter, is substituted for the spark-gap the advantages of an auxiliary oscillator such as described are great, the auxiliary oscillator being excited or charged quite as efficiently by a single unidirectional discharge as it would be by several oscillations.

Referring to the accompanying diagram, (1) represent a transformer whose primary (2) is supplied with alternating currents of a suitable potential, say 60 cycles. The secondary (3) is wound to give the required potential, which may be in the neighborhood of, say, 10,000 or 20,000 volts. The terminals of the secondary coil are connected to the conductors, which constitute a portion of the secondary circuit.

The circuit (4) (5) (6) is completed through the inductance (10) and a condenser which are in series with the transformer winding and in parallel with each other. This is a well-known form of resonant circuit, sometimes called an "antiresonant" circuit, because of its peculiar properties. It is not necessary to enter into elaborate technical description of the internal reactions of such a circuit in order to understand the invention. It is sufficient to say that the inductance branch (10) and the condenser branch (11) together form a circuit resonant to one critical frequency, and that when the impressed current through the conductors (4) (5) is of that particular frequency the opposite reactancies of (10) and (11) balance each other in such manner as to produce a relatively great current flow through them. Under these conditions the current in (4) (5) is at a minimum. The whole circuit (4) (5) (10) (11) is called "antiresonant" because the conditions in (4) (5) are quite the opposite to what they would be if the inductance (10) and the condenser (10) were in series with each other as well as in series with (4) (5), instead of being, as they are, in parallel with each




OSCILLATOR FOR SPACE TELEGRAPHY.

other and in series with (4) (5). In such a circuit the branches (10) (11) together offer a great impedance to the passage of impressed currents of the one critical frequency to which they are resonant, whereas they offer much less impedance to impressed currents of all other frequencies.

The operation of the system of circuits involving the invention may be described somewhat as follows: The alternating current induced in the secondary being of a frequency of 60 cycles, the time period of a half cycle or pulsation in one direction is one one-hundred-and-twentieth of a second. It is evident, therefore, that the rate of charge of the condenser (9) from the secondary is enormously slower than the rate of discharge of the condenser through the circuit (4) (8) (10) (11) (5). It is so slow, in fact, that the potential rises uniformly through the circuit on each side of the spark gap and on the plates of the condenser (9) without the accumulation of any appreciable drop across the condenser (11) or across the coil (10). This slow rise of voltage continues until the spark gap or equivalent breaks down, permitting abrupt discharge of the condenser (9). As has been explained, the system is so constructed that the natural or free-discharge period of the condenser (9) across the spark gap is substantially the same as the period to which the circuit (10) (11) is resonant. The equilibrium of the circuit (10) (11) [illegible] its electrical equilibrium is disturbed either by sudden [illegible] equilibrium being restored by oscillatory reactions between the condenser and the coil, which continue until the energy of the disturbance has been absorbed or dissipated. The [illegible] closed circuit containing a condenser and a coil capable of such equilibrium disturbance by sudden charge or discharge, and when thus disturbed equilibrium is again restored.

From the above it will be evident that after the first violent discharge of the condenser (9) practically all of the energy is absorbed in the circuit (10) (11) and oscillates therein, after the manner described, and that thus the invention secures persistent oscillations which are not subject to the great losses incident to forcing a discharge path for the energy across a spark gap twice for each complete oscillation or double vibration. The spark-gap loss is practically limited to a single discharge in one direction following each charge of the condenser (9). These prime discharges of the condenser across the spark gap may be made to succeed each other with the greatest possible rapidity. Indeed, it would be desirable if they could be made to follow each other so closely as to supply fresh energy to oscillatory circuit before the oscillations caused therein by the preceding spark had been damped out.

The oscillatory circuit may be utilized as a source of high-frequency oscillatory energy in any desired way. For purposes of space telegraphy, for which it is more particularly designed, the ground connection is led from one terminal of the coil (10) and the aerial from the other terminal of the coil. As shown, additional coils or windings (12) are provided in inductive relation with the windings of the coil (10), the two coils together constituting what is known as an autotransformer. An additional coil (15) may be added either as a part of the winding (12) or as a separate coil, and this may be utilized for adjusting the emitting wire (13) (10) (12) (15) (16), so that its natural period of oscillation will be the same as that of the circuit (9) (4) (8) (10) (5). This condition may be approximated by making the entire length of the wire and windings of a physical length slightly less than one-quarter of the length of a wave having a time period equal to the time period of the oscillations in (9) (4) (8) (10) (5), or it may be an odd multiple of such quarter-wave length. Synchronism of the circuits may then be perfected by adjusting the inductance of (15) until the maximum effect is observed.

## Electrical Production of Hydrogen and Oxygen.

A subscriber of the Western Electrician in Iowa asks for some data upon the decomposition of water by electrolysis and desires to know what volume of both oxygen and hydrogen will be set free by a given unit or quantity of electricity.

The electrochemical equivalent of hydrogen—that is, the fraction of a gram of hydrogen set free by one coulomb (the quantity of electricity represented by one ampere flowing for one second)—is 0.0000-1038. The electrochemical equivalent of oxygen is 0.0000828. The weights of these two elements which will be liberated by one ampere-hour will, therefore, be 3,600 times as great, or 0.037368 gram of hydrogen and 0.29808 gram of oxygen.

The correspondent, however, wishes to know the volumes which will be liberated. This question cannot be answered without knowing the pressure, as the volume would depend entirely upon this factor. However, since the formula for water is $H_2O$, the fact will be known that the volume of hydrogen will be, at any given pressure, twice as great as that of the oxygen.

The Missouri House committee on private corporations has agreed to report favorably the telegraph and telephone bill introduced by Mr. Barry. It provides for one important change by the insertion of the words "and deliver." The Supreme Court in a recent case held that the word "transmit" did not include the delivery of a message, and the words "and deliver" are, therefore, to be incorporated into the law if this bill passes.

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## DATES AHEAD.

Iowa Telephone Association (annual meeting), Chamberlain Hotel, Des Moines, March 14th to 16th.

Ohio Independent Telephone Association (annual meeting), Columbus, March 30th.

Iowa Electrical Association (annual meeting), Hotel Julien, Dubuque, Iowa, April 19th and 20th.

National Electric Light Association (annual convention), Denver, June 6th, 7th and 8th, and Colorado Springs, June 9th and 10th.

National-Interstate Telephone Association (first convention of consolidated telephone associations), Chicago, June 21st, 22d and 23d.

International Association of Municipal Electricians (annual convention), Erie, Pa., August 29th, 30th and 31st.

Ohio Electric Light Association (annual convention), Hotel Victory, Put-in-Bay, August 16th to 18th.

American Electrotherapeutic Association (annual meeting), Academy of Medicine, New York city, September 19th, 20th and 21st.

Now that the leading candidates are nominated and carefully considered statements of policy have been made, the readers of the Western Electrician will be interested in an impartial account of the arguments advanced in the campaign for the election of a mayor in Chicago, which, as turning on the question of the municipal ownership and operation of the street railways, is of wide significance.

Both of the candidates are well known; both are vigorous men of character and ability in the prime of life; both have devoted much attention to the "traction question." So far as can be foreseen, the election will be decided by the sentiments of the voters on the question of municipal ownership, or municipal operation, or both, of the surface street railways. John M. Harlan, the Republican candidate, is a practicing lawyer, who, in days gone by, distinguished himself by opposition to the "machine," and who ran for mayor as an independent candidate several years ago. Judge Edward F. Dunne, the Democratic nominee, is a Circuit Court judge now on the bench of Cook County.

Mr. Harlan says that there are three elements to the traction business—the streets, the market for transportation and the money needed for the investment. The people own the streets and are themselves the market. They furnish the two most important elements in the enterprise and their interests are paramount. No ordinance shall be passed until the people have had ample opportunity for a referendum under the public-opinion law. But the streets are in possession of the traction companies, which have acquired some rights. No solution will be accepted which does not provide for the complete termination of all outstanding rights and claims. "And no solution will be accepted that does not make effective and genuine provision for municipal ownership and operation when the city shall be legally and financially able successfully to adopt it." How shall the city most wisely and promptly accomplish municipal ownership? Court proceedings for condemnation are inadvisable. There would be appeals all the way to the Supreme Court of the United States. Four or five years would be thus consumed, and then, if the final decision was favorable to the city, it would have to be determined what were the property and rights to be condemned. In the course of time judgment might be entered for an unknown but very large sum. Then would come another series of appeals, taking four or five years more. But would the city have the money at that time? It is proposed to appeal to a syndicate of capitalists for advantageous arrangement by lease or license. But if we are going to do business at all with any syndicate, the sooner the better. The long-drawn-out condemnation proceedings are really a subtle blow at municipal ownership. It is not shown how the condemnation scheme can be worked out. No concrete plan has ever been submitted to the people. Mr. Harlan does not propose to try to get votes by pretending to do things that he knows he can't do. He pledges himself to diligent and firm action to bring about the right solution of the question—a solution making provision for municipal ownership and not to be adopted until referred to popular vote. But there must not be too great haste. The city of Chicago is bigger than all the traction companies combined. A complete plan will be prepared and submitted to the people by referendum if Mr. Harlan is elected.

Judge Dunne declares that it lies in the power of the city of Chicago to blaze the way among American cities for putting into actual operation the principle of municipal ownership and operation of public utilities. He cites the examples of foreign cities furnishing street-railway service. "No city that has ever tried municipal ownership and operation of street cars has ever reverted to private ownership. We know that the city of Chicago is operating one of the greatest electric-light plants, if not the greatest, in America, and that it has reduced the cost of electric light more than one-half." "We know from bitter experience in our own city that private management of public utilities has been grossly inefficient and indecent." The judge criticizes severely the existing street-railway service, saying, among other things, that passengers are compelled to "ride in cars whose temperature would chill the living and preserve the dead." "Private ownership of the street-car system has become a stench in the nostrils of the people; yet we are told that there is no present remedy for these intolerable evils." "We deny this assertion and will appeal to the people to determine the truth of the issue." "We assert that the city is legally and financially able at the present time to institute proceedings for the immediate acquisition of the present systems or to build and construct new ones." The Mueller law gives the legal right, and Judge Dunne gives several methods of meeting the financial difficulty, admitting that the city has not today the ready cash to acquire or build a street-railway plant and cannot increase its indebtedness under existing law. One is the issue of "street-railway certificates," authorized by the Mueller law. These are secured only by municipal street-railway property and are not a general liability on the city. Judge Dunne, going into the law at some length, says that these certificates are more effectual securities than stocks and bonds of private companies. "If private companies, having only the security offered by the tangible property and by the 20-year franchises, can raise $117,000,000 upon $27,000,000 worth of actual, tangible property, what is to prevent the city of Chicago now, on much better security, raising the same amount of money?" But actually less than $80,000,000 is needed to pay for existing plants and franchises and modernize the former. Street-railway certificates would be purchased, if not by capitalists, by people of moderate means having savings-bank deposits. The judge also suggests that a syndicate might furnish capital to buy the roads if given back a lease for a term of years not specified. Or a popular syndicate of such a nature might be organized by the beforementioned savings-bank depositors. Again, under the promised new charter, Chicago may raise the needed money by issuing bonds. Only two things are needed to accomplish municipal ownership—the will of the people and public officers with the disposition, courage and virility to carry out the people's will. Judge Dunne advocates a rigid civil-service law, so that the street railways would not be put into politics but rather taken out of politics. Present street-railway employes should be placed on the city roster and should not be dismissed except for cause after an impartial trial. Vacancies should be filled after practical civil-service examinations. In conclusion the judge says that the people should "register their solemn protest against further spoilation of their streets and further exploitation by the millionaires of Wall Street."

Thus is the issue joined. We have summarized the opposing arguments at some length, because, although the present election is a local one, the questions involved are of more than local importance. Perhaps it would not be difficult to criticize with effect both statements. Mr. Harlan is a little vague about the future plan of his prospective administration, while Judge Dunne is unfortunate in citing the municipal electric-light plant, which, we believe, operates street arcs at a real cost of between $90 and $100 a year rather than $55, which is about the figure given in the reports. The judge, too, has perhaps too much faith in the public spirit of the savings-bank depositors and is rather vociferous in denouncing Wall Street. But nevertheless the "municipalization" proposal constitutes a very real and pressing problem. What the citizens of Chicago think of it will be known on the evening of April 4th.

We believe that the date of the first annual convention of the National-Interstate Telephone Association—the consolidation of the two existing telephone associations—is now fixed for June 21st, 22d and 23d, the place being Chicago. This time of meeting does not conflict with that of any other electrical convention and should be satisfactory to all interested. With a combination of the two Independent bodies and a burial of all past differences the coming convention should be a great success.

CONCRETE is coming into use in increasing degree in central-station construction. A power house at Janesville, Wis., built of concrete blocks, is illustrated in this issue, and a large station at South Chicago, described by Mr. E. B. Clark in an Institute paper, exhibits the possibilities of cement to an unusual and interesting extent.

## Institute Meetings in New York and Chicago.

At the meeting of the American Institute of Electrical Engineers held in Carnegie Hall, New York city, on Friday evening, February 24th, President Lieb presided. Secretary R. W. Pope announced that at the meeting of the directors in the afternoon 50 associates were elected and that three associates were transferred to full membership. The secretary also announced the death of Eugene F. Phillips of Providence, R. I. Dr. Samuel Sheldon, in the absence of the author, read the paper by N. McD. Crawford of Hartford, Conn., on "Two-motor versus Four-motor Equipments." A. H. Armstrong, S. T. Dodd and Calvert Townley discussed the paper. An abstract of the paper and discussion are given elsewhere in this issue.

C. W. Ricker of the New York Central railroad then read his paper on "Track Bonding," which was discussed by H. A. Lardner, A. A. Knudson, William Pestell, Mr. Townley and R. D. Mershon.

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Two interesting papers were read at the meeting of the Chicago branch of the American Institute of Electrical Engineers, held on February 28th. The first was by E. B. Clark on "The Use of Cement in Central-station Construction." Mr. Clark described the new power house in South Chicago of the Illinois Steel Company, which is constructed almost entirely of concrete—foundations, walls, partitions, floor, roof and cell construction for the oil switches all being of this material. The whole result is satisfactory, although the roof is very heavy. Mr. K. B. Miller, who presided at the meeting, called on Mr. Bergquist to open the discussion. Mr. Bergquist told about the characteristics and constituents of Portland cement. Brief remarks were also made by Mr. Sessions and Mr. Warder.

The second paper was presented by Mr. John M. Humiston and was entitled "Some Notes on the Maintenance of Underground Structures," illustrated by lantern slides. The speaker gave many interesting examples of underground work, one in particular showing a conduit that was carried over an elevated steam railroad. Mr. Humiston spoke of the electrolysis problem, and this subject was uppermost in the discussion that followed. He said that electrolysis of buried cables could usually be prevented by the use of auxiliary copper wires. He dwelt on the necessity of simple construction in underground work, the need of keeping records of all details and the undesirability of temporary work. In the discussion W. G. Carlton said that it was hard to make new work fit in with the old. He spoke of several cases of electrolysis, usually due to stray current from street railways. Peter Junkersfeld said that in electrolysis the root of the trouble was usually difficulty in maintaining good bonds and good return circuits. It is hard to make a good contact between copper and iron or steel rail. Another speaker said that electrolysis was blamed for many ills for which it was not guilty. Alkaline constituents in earth seem to corrode buried pipes. Cinders in the soil will also do more damage to pipes than electrolysis will.

The next meeting of the Chicago branch will be devoted to the general subject of illumination, and it is expected that Mr. George N. Eastman of the Chicago Edison Company will lead the discussion.

## Ohio Interurban Railway Meeting.

The monthly meeting of the Ohio Interurban Railway Association was held at Lima on February 23d. It was decided to carry 150 pounds of baggage free on all interchangeable mileage coupons. This subject has been under discussion for some time and perhaps has caused more trouble than the adoption of the coupon system itself. If understood correctly, baggage will be checked through on these tickets and transferred wherever changes are necessary. Because of the fact that interurban roads do not use the same depots at junction points or have no depots at all, the matter of transferring baggage presents more difficulty than with the steam roads. But this is being remedied to some extent each year by the adoption of advanced methods in handling terminal business.

The Toledo and Indiana, the Dayton and Muncie and the Springfield, Charleston, Washington C. H. and Chillicothe railways were admitted to membership in the mileage-coupon bureau. Thirty new members were taken into the association. In the afternoon Master Mechanic G. H. Kelsey of the Western Ohio led a discussion on "The Use and Abuse of Equipment," and this was followed by a general discussion.

The next meeting will be held on March 23d at Cincinnati. The April meeting will be held at Springfield, the May meeting at Cleveland and the June meeting at Cedar Point. More than 100 persons were present at last week's meeting, showing that interest is rapidly increasing in the plans that have been adopted and the work the association is doing.

## Serious Short-circuit at Niagara Falls.

On the morning of February 23d the Niagara Falls Power Company suffered from the most serious short-circuit that has ever taken place in the big power houses at Niagara Falls. Three employes of the company named John Frommert, Frank Frommert and Roy Robinson started to change the connections between a 2,300-volt transformer and a small transformer used for lighting. They were at work in the switch chamber and cable subway under switchboard No. 1 in power house No. 1. John Frommert was in charge of the two men, Frank Frommert and Roy Robinson, and he had only just entered the space under the switchboard when the short-circuit occurred. All of the insulation of the adjacent conductors took fire, which spread to the cables beneath the switchboard. All of the handy fire appliances, such as powder and chemicals, were used without extinguishing the fire, and it was necessary to call the city fire department. The firemen used their chemicals, but finally had to throw water on to the fire to conquer it. It was an exceedingly fierce fire, it being remarkable how the insulation burned. Quite a quantity of cable was destroyed. All of the auxiliary wiring leading to the instruments and field rheostats was practically destroyed, putting the five 5,000-horsepower generators operated from this switchboard out of business temporarily. The local trolley service was interrupted an hour and a half, while the long-distance load was off for about 20 minutes. The load normally carried by the five generators interrupted was transferred to other machines within a few hours and the company's full service resumed.

All three men were severely burned and were quickly removed to the Memorial Hospital, where Frank Frommert died early Friday morning. He was 19 years old and had been employed at the power house for over two years. Roy Robinson was also severely burned, and at this writing the result in his case cannot be anticipated. Of the three, John Frommert was the least burned, but still he did not escape frightful burns. He is expected to recover.

Electrical engineers of the Niagara Falls Power Company after making a careful investigation following the accident feel that during John Frommert's absence Roy Robinson must have made two or three mistakes in making connections, and had either one been avoided the short-circuit would not have occurred.

## Shrinkage of the Earth's Magnetism.[1]

By L. A. Bauer.

A tabulation of the values of the earth's magnetic moment as derived by various analysts for the period 1843 to 1885 shows a diminution for the interval of 40 years of about 1.6 per cent. Computations of the earth's total magnetic energy for the same period prove that the shrinkage in the portion equivalent to a uniform magnetization is not compensated by a corresponding increase in the remaining portion of the earth's magnetism. As all of these results, however, are obtained on the basis of the distribution of the earth's magnetism as portrayed by the existing magnetic charts, which, owing to paucity of data, especially in the oceanic areas, are more or less inaccurate, the deductions regarding a possible shrinkage of the earth's magnetism cannot be accepted as absolutely conclusive.

In the present paper the results derived depend on actual observations between 1890 and 1900 at a series of land stations fairly uniformly distributed over the earth and lying between the parallels 60° N. and 60° S., the same number of stations having been selected in each magnetic hemisphere.

From the mathematical analysis of the secular variation of the earth's magnetism between 1890 and 1900 it is found that the observed secular variation in the uniform portion of the earth's magnetism is to be ascribed to systems of magnetic or electric forces, two of which are as follows:

1. A system situated below the earth's surface, having a potential and acting in opposition to the earth's momentary field, hence demagnetizing it. The magnetic axis of this system of forces, besides being reversed with reference to that of the earth's momentary field, is also displaced toward the west, so that its effect is to cause the north magnetic pole to move westward and southward and to diminish the earth's magnetic moment at the rate of about one twenty-two-hundredths part annually.

[illegible]

[illegible] magnetic moment will [illegible] present value in 1500 years. [illegible] yet sufficient grounds [illegible] [illegible] indications are that [illegible] have been prevailing as far back as our [illegible] data extend.

It is thus found that the secular [illegible] earth's magnetism results not only from a change in the direction of the axis of magnetization [illegible] from a change in the intensity of magnetization.

1. Abstract of a paper presented at the Philadelphia meeting of the Physical Society, December 30, 1904.

## The New Atlantic Cable.

As stated in the last issue of the Western Electrician, the Commercial Cable Company has been considering bids for a fifth Atlantic cable to be laid between Nova Scotia and Ireland by the northern route. The cable will be about 2,300 miles in length and will cost about $2,300,000. It is probable, according to the published statements, that the contract will be divided between the Silvertown company and the Telegraph Construction Company of London, England. Mr. George G. Ward, vice-president of the Commercial Cable Company, when asked by a representative of the Western Electrician to explain why only English companies were asked to bid for his work, said:

"It is not because our company is failing in patriotism, but because there is no American cable company so well equipped that it could make and lay a cable of the standard of excellence we require in the time we want it. The English companies have complete facilities for the manufacture of the cable and in addition they have steamships specially designed and manned for laying cables. The copper wire for the new cable will weigh about 600 pounds to the mile. The English companies insulate the wire with a covering of gutta percha, held in place by a covering of steel wire. The more pressure on such a cable the better the insulation. The new cable will not only have a larger copper wire to increase its speed, but it will be more heavily armored than any this company now uses. The manufacture of such a cable is a gigantic piece of work, but the English companies can turn it out at a rapid rate and have every inch tested by trained men. The increase in cable business which has made another Atlantic cable necessary for our company has been due in great part to the messages passing between members of the London and New York stock exchanges."

Mr. Ward added that the chief question about the new cable was the fact that the Commercial Cable Company insists upon gutta-percha insulation. The contract had not been definitely closed and he would not authorize any statement that it was going to any particular English manufacturer.

## International Railway Changes.

A controlling interest in the International Railway Company has been acquired by Henry J. Pierce of Buffalo, Nelson Robinson of New York and Thomas E. Mitten of Chicago at an expenditure of over $3,000,000. Hon. W. Caryl Ely will resign the presidency of the company, but will hold his stock, it is said. The International Railway Company controls all of the electric lines in the city of Buffalo, Lockport and in Niagara Falls with the exception of the Great George route. It owns the Buffalo and Niagara Falls line, the Buffalo and Lockport line, the Lockport and Olcott road, the Kenmore road, the Buffalo, Bellevue and Lancaster line and the Niagara Falls Park and River railroad, the latter on the Canadian side at Niagara. It also owns the upper steel arch bridge at Niagara Falls and the suspension bridge across the river near Lewiston. The various interests were placed under one control in 1899, with Mr. Ely at the head. Burt Van Horn was general manager, but later was succeeded by Mr. Mitten. A short time ago Mr. Mitten resigned to become vice-president and acting president of the Chicago City Railway Company. He will now become a director of the International Railway Company. It is believed that Henry J. Pierce will succeed Mr. Ely as president, the salary being $25,000 a year, it is said.

## Tesla Synchronous Motor Patents Upheld.

In pursuance of a decision handed down by him on February 20th, in the United States Circuit Court for the Eastern District of Wisconsin, sustaining the contention of the Westinghouse Electric and Manufacturing Company that synchronous motors made by the National Electric Company were an infringement of the broad rights covered in Tesla patents Nos. 381,969 and 382,281, Judge Seaman, in Milwaukee, on February 24th, enjoined the National company from the sale of such motors. The decision in the suit is the first that has been obtained in the litigation begun some time ago by the Westinghouse company to prevent the sale of synchronous motors and rotary converters by American manufacturers not enjoying a license under the Tesla polyphase-motor patents. The hearing in the suit against the National Electric Company was conducted before Judge Seaman on February 6th and 7th, Thomas B. Kerr and Parker W. Page appearing for the Westinghouse company.

The Tesla patents involved in suit have been the subject of considerable litigation in the last few years. Other manufacturers have been enjoined from manufacturing induction motors, but the decision in the suit against the National company is the first court ruling that the synchronous motor is within the generic Tesla invention. Extracts from Judge Seaman's decision are as follows:

"The defendant's contentions are, in substance, that the Tesla invention, embodied in each of the patents, is the rotating-field mode of operation, which is 'the production of the conjoint effect of out-of-phase currents of a progressive shifting by the polarity,' and thus 'identical in its effect with that of a rotating physical magnet' that it is limited to a self-starting motor so operated, and both by the terms of the patents and the state of the art, the defendant's synchronous motor with direct-current excitation is not within the invention; that the defendant's synchronous motor is simply a reversed 'two-phase alternating-current dynamo of the prior art used as a generator,' adapted to alternative use; and that the claims of patents 381,969 and 382,281, which bring in 'direct-current excitation producing synchronous operation,' must be limited to such use 'after the motor is started by the Tesla means and method and brought up to speed.' If the invention is so limited by the prior art it is plain that the defendant escapes infringement. On the other hand, if not so restricted, it is equally clear that the claims of the patents are broad enough to reach the defendant's means and method of operation."

"The Tesla discovery for which these patents were granted revolutionized the art of electrical power transmission, as well demonstrated in the record from both judicial and scientific standpoints. Judge Townsend's definition, in reference to the generic patents in the New England Granite case, repeatedly approved by other courts, is adopted for this consideration, namely, 'Tesla's invention, considered in its essence, was the production of a continually rotating or whirling field of magnetic forces for power purposes by generating two or more displaced or different phases of the alternating current, transmitting such phases, with their independence preserved, to the motor, and utilizing the displaced phases as such in the motor.' So viewed, the patent monopoly was rightly granted for its brief term to the use of the means and methods thus discovered. While it could not exclude the known uses of the prior art, it is surely entitled to be protected against like motor structure and mode of operation, not clearly disclosed in the prior art, and the patent claims to that end must be fairly construed in conformity with the rule applicable to such inventions. I am of the opinion, therefore, that the several contentions for the defendant are either without force or untenable."

"Whether the effect of the Tesla invention in its production of the 'whirling field of magnetic force' is identical with that of a rotating physical magnet, as argued by experts and counsel, does not impress me as material to this issue. Nor does it seem material that in the one form of motor 'the rotation is produced by the unaided effect of alternating out-of-phase currents,' as described by counsel, and that so applied a self-starting motor is obtained. The discovery was of means and method in the polyphase rotating-field motor to produce the whirling field of force, and employment thereof was patentable with or without direct-current excitation of the armature or secondary element. So the fact that its use produced a self-starting motor without the aid of such excitation cannot alone serve to limit the invention to that effect, and I find no such limitation in the terms of the patent. The quotations from the arguments of counsel and experts for the complainant in prior cases, urging the distinction of this self-starting effect in reference to the application of the generic patents to non-synchronous motors, are without force in the present controversy, and it is unnecessary to ascertain their consistency or inconsistency with the interpretation sought on this hearing. Unless limitation to self-starting motors arises out of the prior art none can be imposed upon the claims in suit."

"The further propositions urged by way of defense—aside from the defense founded upon prior inventions of the synchronous type to be considered—are these—(1) that the synchronous motor of the defendant is the old generator of the art, simply reversed, and (2) that the Tesla invention is not present therein, because (as asserted) 'the preponderating magnetization of the direct current displaced and obliterates the 'shifting alternating-current magnetization,' or Tesla's 'whirling field of force.' However specious both propositions appear on their face and in the argument, neither of them impresses me as controlling."

"I believe that no proposition in the able and extended arguments on the part of the defense have been overlooked in my consideration of this case, although it has not seemed needful to discuss all of them for the purposes of this opinion. My conclusions are that the defendant's synchronous-motor structure and operation are within the generic invention as patented, and expressly covered by the claims of Nos. 381,969 and 382,281; that the invention is utilized in the defendant's motor operation, notwithstanding the introduction of direct-current excitation to make it synchronous, in lieu of the full realization of the revolving-field effect for self-starting; that such supplemental aid does not escape infringement, with or without advantage in such associations; and that, in any view, the combination patents referred to are not limited to after-effect of the direct-current excitation, but apply to the defendant's combination. Decree will be entered accordingly as prayed in the bill."

The National Electric Company has given notice of appeal from the injunction. On its behalf, it is also declared that the patents expire in May of this year in any event.

## Krupp Motor Starter and Controller.

The Friedrich Krupp Manufacturing Company of Essen, Germany, world renowned as a builder of ordnance, armor plate and heavy steel construction of a similar nature, is reported to have entered the electrical field. That this is possibly the case will be evident from the fact that the company has secured a patent upon the electric motor starter and controller, illustrated herewith. This device, which contains some commendable features, is described in l'Electricien of Paris, and the following description and illustrations will explain the essential features of its construction and operation:

Figs. 1 and 2 represent the controller, which is extremely simple and so arranged that any part is readily accessible for repairs. The use of this controller makes the operation of motors reliable and

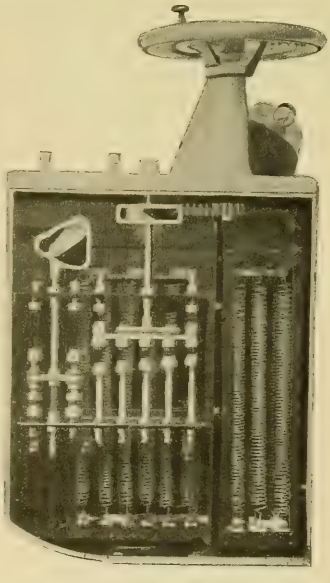


FIG. 1. KRUPP MOTOR STARTER AND CONTROLLER.

prevents all sudden rushes of current which might prove harmful. The motor can be reversed or stopped instantly, this latter being effected by short-circuiting the motor armature. This operation does not, however, short-circuit the feeder lines, as the resistance of the controller is in series with armature.

The exterior handwheel shown in Fig. 1 is geared to two crank arms (g) and (f), (Fig. 2). These cranks operate the shafts (r) and (n), respectively, cams (p) and (v) establishing the desired motion. The contacts (1) to (22) are insulated from their supporting plates ($n_1$), (t), (x) and (z), but are interconnected as shown. Contacts (1) to (8) serve as a disconnecting and reversing switch, and 9 to 22 are for cutting in or out the various resistances (u). On open circuit the follower (k) rests in the notch (m), holding the contact plates ($n_1$) and (t) midway between the stationary contacts.

The motor is started by lowering the contact plates against the lower contacts, their relative positions being so proportioned that the switch contacts are first closed, followed by gradually cutting out the various sections of the resistance.

The instantaneous stopping of the motor is effected by raising the plates up against the upper

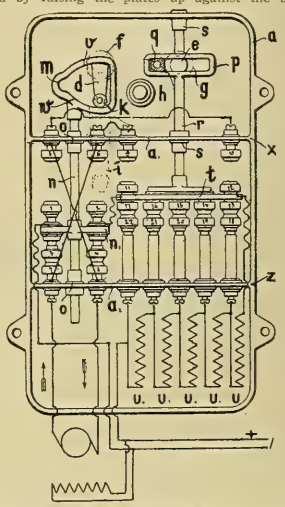



FIG. 2. DIAGRAM OF CONNECTIONS OF KRUPP MOTOR STARTER AND CONTROLLER.

set of contacts, thereby short-circuiting the motor and leaving all of the resistances ($u_1$) interposed in the feeder circuit. It will be noted that the field of the motor is not disconnected or short-circuited by this operation, so that the stop is produced without harmfully affecting the motor.

This same apparatus may also be used with series and compound motors, only slight modification being necessary.

## Chicago Traction Developments.

Contrary to the Republican party, the Chicago Democrats have declared for immediate municipal ownership of Chicago's street railways as an issue in the spring election. As was expected, Judge Edward F. Dunne was nominated. In his address he declared that municipal ownership is possible and cited the experiences of many foreign cities as proof that it is feasible.

The platform adopted at the convention says the principal issue is "Whether the expressed will of our own citizens or the interests of a Wall Street syndicate shall direct our public policy regarding the ownership and control of our streets for traction purposes." The traction litigation, franchise history and physical condition of the surface systems is reviewed and then the programme for the acquisition of the traction properties by the city is outlined under five heads, as follows:

1. The council shall at once stop all negotiations with the companies for an extension of existing franchises.
2. The city shall at once enter into negotiations with the companies for the purchase of their property.
3. In case such negotiations are found impossible it shall proceed to get the property by condemnation proceedings.
4. Pending such acquisition of the properties the companies shall be allowed to operate through revocable licenses.
5. After the city has got the properties the people shall decide by referendum vote whether they want municipal operation as well as municipal ownership.

The Chicago City Council at its meeting last week extended until May 5th the permit under which the Chicago City Railway Company is operating certain lines on which the franchise has expired. As to the Union Traction Company, the council committee on local transportation has recommended the mayor's resolution that he be empowered to invite proposals for the installation of a street-railway service on the Adams Street line, which is being operated by the Union Traction Company under a license, the franchise having expired. The local transportation committee of the council has been considering the tentative ordinance for the Chicago City Railway Company and has recommended several amendments as a preliminary to the submission of the franchise to the voters at the spring election.

## OBITUARY.

### Eugene F. Phillips.

Few electrical business men in the United States were more widely known or more cordially liked than Eugene F. Phillips, general manager of the American Electrical Works of Phillipsdale, R. I., who died from heart disease on February 22d. Mr. Phillips' illness, due to angina pectoris, complicated by pneumonia, dated from February 4th, and while his condition was extremely critical during the first three days, it was hoped thereafter that he would recover. But on Washington's Birthday, while up and about the house, apparently regaining his health, he died, almost without warning, in his home in Providence. The event threw a gloom over the officers and employes of Mr. Phillips' companies, for he had the respect and confidence of his employes,

EUGENE F. PHILLIPS.

from the highest to the lowest. It caused sincere sorrow, too, among electrical men throughout the country, for Mr. Phillips possessed a personal acquaintance with practically all the leading men in the electrical field. He was intimately associated with the experimental work of the promoters of the telephone, of the electric light and of the electric railway. The funeral services were held on February 26th and were largely attended by mourning friends engaged in electrical pursuits.

Eugene F. Phillips was born in Providence November 10, 1843, his father being David Gresham Phillips of Scituate. The early years of his life were spent in Scituate at his father's home, after which he was educated in the public schools of his native city. While in the Providence High School the Civil War began and Mr. Phillips enlisted in the Tenth Rhode Island Volunteer Regiment, before he had finished his high-school course, and went to the front with many other students, returning after his term of enlistment to finish the course of studies.

After leaving school Mr. Phillips engaged in different lines of business, among which was banking, until about 1870, when he began to manufacture insulated telegraph wire in a very small way, in a shed or barn in the rear of his home on Chestnut Street. This was the beginning of an industry which has grown to such proportions as to stand today as one of the largest wire manufacturing establishments in the world. Mr. Phillips conducted the business under his own name until 1882, when the American Electrical Works were incorporated, Mr. Phillips being president. This position he continuously occupied until 1897, when the administration of the company was reorganized in order to include Mr. Phillips' sons, who had then finished school, and had for several years been connected with the factory. Mr. Frank N. Phillips was then elected president, Mr. E. Rowland Phillips, vice-president and general superintendent, and the elder Mr. Phillips general manager. The last mentioned continued in the capacity named until his death.

Mr. Phillips, the founder of the business, advanced it in accordance with the discoveries of the possibilities of electricity, and every opportunity to push forward the enterprise was taken full advantage of, so that in a short time the first plant of any size, which was at the corner of Stewart and Conduit Streets, was too small to accommodate the growing business, and in 1890 the greater part of the whole square in the same location was utilized by a new factory which was built for the purpose of accommodating the needs of the company.

The first building was occupied in 1880, and at that time it was considered a large plant, but the business grew so rapidly that in 1892 Mr. Phillips purchased the location on the [illegible] which at the time stood the mill of the [illegible] Paper Company, and in the [illegible] alterations such as were necessary [illegible] facture of wire. The large [illegible] soon was in operation furnished the [illegible] such an amount of business that the village was named Phillipsdale in his honor.

In addition to serving as general manager of the American Electrical Works, Mr. Phillips was also the president of the Washburn Wire Company, an organization allied with the American Electrical Works, having open-hearth-steel furnaces at Phillipsdale and wire mills at both Auburn, R. I., and One-hundred-and-eighteenth Street and Harlem River, New York. The Montreal branch of the American Electrical Works is known as the Eugene F. Phillips Electrical Works, Ltd. The company maintains stores in New York and Chicago, the latter in charge of Mr. F. E. Donohoe.

Mr. Phillips liked to entertain his friends. For many years it was his custom to invite members of the electrical fraternity to the number of several hundred to a genuine Rhode Island clambake, held annually on the shores of Narragansett Bay. These jolly reunions were only abandoned when the facilities of the largest of the local clubhouses proved insufficient to care for Mr. Phillips' guests properly.

### James Bradshaw.

James Bradshaw, mechanical engineer for the Northwestern Mutual Life Insurance Company, died at his home in Milwaukee on February 1st, aged 53 years. Mr. Bradshaw had filled for 20 years the position he occupied at the time of his death. He had charge of the electrical and mechanical plants in the many buildings owned or controlled by the great insurance company throughout the country. He was English by birth and possessed a bright, eager mind. He had many friends in Chicago, including the late Philip D. Armour, who had a high estimate of his ability. Mr. Bradshaw took a keen interest in electrical development and had been a subscriber for the Western Electrician for many years, nearly from the time the paper was founded. His death at a time when he should have had a number of years of usefulness before him will be sincerely regretted.

JAMES BRADSHAW.

### Albon Man.

Albon Man, who was associated with William E. Sawyer in the invention of the Sawyer-Man incandescent lamp, died at a hotel in Brooklyn on Saturday, February 19th, in his 78th year. His death revives the story of the patent litigation concerning this lamp. Mr. Man was a Brooklyn lawyer who had studied physics. In January, 1878, he became impressed with the ability of Mr. Sawyer and went into partnership with him, the original design being that Mr. Man should furnish the money to develop Mr. Sawyer's inventions. Early in February they opened a shop at 43 Centre Street, New York, and as the work progressed Mr. Man became directly interested in the Sawyer invention. In the following June a patent for an incandescent lamp was issued to them jointly, and in July they obtained another patent for a lighting system for lamps in series which, it was claimed, would give uniform illumination. To further this plan they incorporated the Electro-Dynamic Lighting Company of New York, in which they were associated with Hugh McCullogh, Jacob Hayes and others. This was perhaps the earliest company incorporated for the purpose of carrying on a general lighting business with incandescent lamps. In May, 1879, Thomas Wallace of Ansonia, Conn., became president of the company, and in April, 1881, the Sawyer-Man patents were sold to the Eastern Electric Manufacturing Company of Middletown, Conn. The patents were next passed on to the Consolidated Electric Light Company, and finally both the Electro-Dynamic Company and the Consolidated were acquired by the Westinghouse Electric and Manufacturing Company of Pittsburg.

There were prolonged lawsuits over the Sawyer-Man inventions, and the patents were finally declared invalid. In 1883 the Sawyer-Man Illuminating Company was formed with the object of installing lamps under the Sawyer-Man patents, and a plant was actually installed in New York in October, 1883. The lamp was made with an arched-shaped fibrous carbon and was little more than a simplification of the Crookes' radiometer, but the Edison interests contested the matter from court to court, and after

### A. P. Goddard.

[illegible] old. Mr. Goddard was prominently identified with [illegible] visors. He also served in the Civil War as first lieutenant in the Illinois volunteer infantry, and [illegible] Goddard was a prominent Free Mason and a valued member of the National Electric Light Association

### Chess Playing by Telegraph.

Chess matches by telegraph are not new by any means, but it is of interest to observe the precision and ease with which they are carried out and the practical freedom from error in transmitting the "moves" over the wire. On February 22d the first telegraphic contest of this nature between the Chicago Chess and Checker Club and the Manhattan Chess Club of New York was played. There were 16 players on each side. In Chicago the wires of the Postal Telegraph-cable Company were brought into the club rooms. There were two telegraph operators, one sending and one receiving. Each board was numbered, and each player conducted his own game without the help of other players or of spectators. The time limit was 40 moves in the first two hours and 20 moves an hour thereafter. Each club had a representative at the other's rooms to make sure that the time limit was observed and that there was no consultation. Tellers looked after all details of carrying messages between players and telegraph operators and recording the progress of the games; the contestants sat at their respective tables and gave their entire attention to the mimic warfare in which they were engaged. Messages came in addressed to players by number, and were copied on regular telegraph blanks of small size. Thus, one read: "No. 3. P—Q3." Another might have been: "No. 11. Kt × B;" and so on. Very few errors in telegraphic transmission were made, and moves were made rapidly and smoothly. If, by error in transcribing or other cause, an impossible move was telegraphed, the player affected simply asked, over the wire, for a correction. Play was begun at 11 a. m., Chicago time, and lasted until 5:30 p. m. After an hour's intermission it was resumed at 6:30 and concluded at 11 p. m. At that hour several of the games were still unfinished and were referred to Lasker, the chess champion, for adjudication. Owing to the unfinished games, the exact result cannot be given, but New York won and drew enough games to score a victory, by a tally, perhaps, of 9 to 7.

### Chicago Trade Press Association.

The monthly meeting of the Chicago Trade Press Association was held at the Hamilton Club, Monday evening, February 27th. About 75 publishers and other newspaper men were present. Mr. Arthur Warren, manager of the department of publicity of the Allis-Chalmers Company, delivered "A Plain Talk on Trade Journals," which he gave before the American Trade Press Association in New York on February 17th. It is needless to say that Mr. Warren's address was received with close attention. Some points from it were given in the Western Electrician last week.

Mr. Emerson P. Harris of New York also delivered an able address on "What a Trade Paper is Worth." An animated discussion followed the presentation of the addresses. The meeting was presided over by J. Newton Nind, president of the association.

### Chicago Office-appliance Show.

Chicago's first office-appliance and business-system show will be opened on March 15th at the Coliseum and continue one week. The first show of this kind in this country was given at Madison Square Garden, New York city, last December, and was a success. The Chicago show is to be made an annual affair. There will be exhibits of modern office appliances and demonstrations of the newest business systems. Among exhibitors who have already engaged space in the Coliseum are many who will show electrical devices and appliances intended to facilitate business. Manufacturers of electrical appliances and some of the large telephone manufacturing companies will have interesting exhibits. The show is under the management of Mr. F. W. Payne, Monadnock Building, Chicago.

## Two-motor Versus Four-motor Equipments.[1]

By N. McD. Crawford.

It is manifestly impossible to consider judiciously the relative commercial efficiency of two-motor versus four-motor equipments, or to reach any absolute conclusion unless certain conditions under which the equipments are to be operated have first been determined. For the purpose of this paper a line was selected having light grades and reasonably small line losses, a line passing through the business center of a city and reaching the residential section, thus at all hours of the day calling for a fair average number of stops and therefore reasonably rapid acceleration, in order to make the time schedule.

Four types of equipment were selected for this service, as follows: Car 169, having a 20-foot body, single trucks, two 25-horsepower motors, and a gear ratio of one to 4.87; car 138, having a 26-foot body, two trucks, two 35-horsepower motors, and a gear ratio of one to 2.82; car 101, having the same length of body and number of trucks as car 138, but having four 35-horsepower motors and a gear ratio of one to 2.82; car 480, having a 29-foot body, two trucks, four 40-horsepower motors and a gear ratio of one to 3.67.

The service required of these four equipments was exactly the same, namely, 136.5 miles per day at an average schedule of 8.45 miles per hour. The runs were made on succeeding speed days and during the same relative hours. Each car was equipped with a wattmeter, an ammeter and a voltmeter; the wattmeter readings at the end of each half trip were recorded and at the end of the run checked by the ammeter and voltmeter readings. The wattmeter was also carefully calibrated with a standard meter, using a water rheostat as a load. The peaks were noted at times of acceleration and on grades. These tests have been tabulated as follows:

Fig. 1.—Average watt-hours per ton-mile.

Fig. 2.—Kilowatts at peaks during day's run.

Fig. 3.—Passengers and kilowatt-hours per half trip.

Fig. 4.—Passengers and kilowatt-hours per half trip.

Fig. 5.—Passengers and kilowatt-hours per half trip.

Fig 6.—Passengers and kilowatt-hours per half trip.

The following table has been deduced from the curve-sheets given:

| Car Number. | Capacity Seats. | Horse-power Motors. | Gear-ratio | Total Tons. | Total Cost. | Cost Per Seat. | Cost Per Ton. | Commercial Efficiency. |
|---|---|---|---|---|---|---|---|---|
| 169 | 26 | two 25 | 1:4.87 | 9.075 | $2,710 | $104.23 | $290.62 | 17% |
| 138 | 34 | two 35 | 1:2.82 | 12.425 | 3,275 | 96.38 | 263.59 | 11.11 " |
| 101 | 34 | four 35 | 1:2.82 | 14.675 | 4,360 | 128.23 | 297.10 | 12.53" |
| 480 | 42 | four 40 | 1:3.67 | 20.680 | 5,040 | 120.00 | 243.71 | 10.66 |

The commercial efficiency, E, was obtained as follows: $\frac{A + B + C + D}{H} = E$, and $\frac{H}{E}$ = commercial efficiency.

[1] A paper presented at the meeting of the American Institute of Electrical Engineers in New York, February 24, 1905. Mr. Crawford is general manager of the Hartford (Conn.) Street Railway Company.

The same formula, substituting B for H, will give greatest commercial efficiency. The letters used in the above formula represent the following: A, cost of current per watt-hour at station switchboard; B, value of seated load; C, platform labor per mile run; D, interest and depreciation per mile run, figured at eight per cent.; H, value of actual passengers carried per mile.

[When the paper was read, Mr. Crawford, who was not present in person, sent a note containing this explanation: "In looking over my paper to be read tonight I desire to explain term A in the submitted efficiency formula. The definition of term A may be misleading; its value is obtained by multiplying the average watt-hour per ton-mile by ton-weight of car, and this result by the cost of power per watt-hour at the switchboard. It has also seemed to me important to use the cost of current per ton-mile at switchboard: the value of seated load; the platform labor per mile run, and the interest and depreciation per mile run, considering these terms as input and the returns per mile as output in determining this efficiency. It is manifestly true that it would be extravagant practice to run a heavy, high-speed, expensive car of large seating capacity over a line from which—due to the density of population and other causes—a small earning would be returned, when a lighter, slower speed, less expensive car with smaller seating capacity would fully accommodate the travel and produce an efficiency more nearly the ideal—100 per cent. I have endeavored, possibly erroneously, to name the efficiency obtained 'commercial efficiency.' It has been suggested that possibly 'load factor' or 'earning efficiency' would be better. I am looking at this matter, however, from the viewpoint of a street-railway manager and not from an engineering viewpoint."]

In obtaining the commercial efficiency, line losses and repairs of equipments and track have purposely been omitted, because it is almost impossible to determine what these values should be; the value of the standing load has been omitted for the same reason.

Applying the above formula and substituting values obtained during the test the results are as follows:

CAR NO. 169.

$$\frac{0.0006787 + 1.30 + 0.0475 + 0.0043}{1.3525} = \frac{1.3525}{0.23} = 0.1698 \text{ per cent.}$$

$$\frac{0.0006787 + 1.30 + 0.0475 + 0.0043}{1.3525} = \frac{1.3525}{1.30} = 0.96 \text{ per cent.}$$

CAR NO. 138.

$$\frac{0.001050 + 1.70 + 0.0475 + 0.0056}{1.7542} = \frac{1.7542}{0.23} = 0.1310 \text{ per cent.}$$

$$\frac{0.001050 + 1.70 + 0.0475 + 0.0056}{1.7542} = \frac{1.7542}{1.70} = 0.96 \text{ per cent.}$$

CAR NO. 101.

$$\frac{0.001174 + 1.70 + 0.0475 + 0.0070}{1.7557} = \frac{1.7557}{0.22} = 0.12553 \text{ per cent.}$$

$$\frac{0.001174 + 1.70 + 0.0475 + 0.0070}{1.7557} = \frac{1.7557}{1.70} = 0.97 \text{ per cent.}$$

CAR NO. 480.

$$\frac{0.000847 + 2.10 + 0.0475 + 0.0087}{2.1570} = \frac{2.1570}{0.23} = 0.1065 \text{ per cent.}$$

$$\frac{0.000847 + 2.10 + 0.0475 + 0.0087}{2.1570} = \frac{2.1570}{2.10} = 0.97 \text{ per cent.}$$

An examination of the table readily shows that car 169 is the most efficient for the service selected. This apparent efficiency must, however, be modified when the number of passengers carried, as shown in Fig. 3, is considered, because it will be seen that many times during the day's run the number of passengers was greater than 26, the excess constituting a standing load.

Car 138, although showing a lower commercial efficiency, probably on account of its greater weight, yet accommodates the passengers much better throughout the entire day.

Car 480 was the least efficient of those tried, although there was only a short time when all the passengers could not be seated. This car was provided with 33-inch wheels and could have made the time schedule easily with a lower gear ratio.

Temperatures were taken at the end of each day's run; these were not excessive except possibly in the case of car 138, due no doubt to the weight of the equipment and the greater number of stops to the mile as shown on Fig. 4. (See appendix for record of temperatures.)

The tabulated records point to the superiority of the light two-motor, single-truck equipments for service on the line and under the conditions selected. With longer trips, heavier grades, greater speed in miles per hour, and greater density of population, requiring more rapid acceleration, there is no doubt but that a car of the 480 type would show the greatest efficiency.

The operating manager is looking not only for an equipment that will fulfil all the requirements of any particular service with the least cost for repairs and the minimum demand on the power station, but also for one that will combine these advantages at the greatest speed with safety to the public and the distance to be traveled per trip will allow. If the dis-

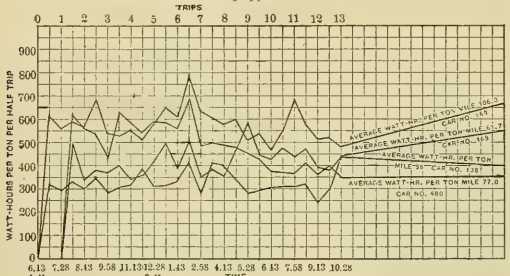



Fig. 1. Average Watt-hours Per Ton Mile.

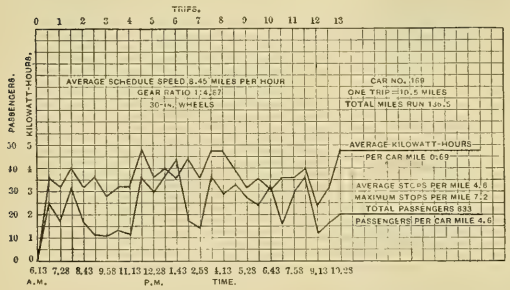



Fig. 3. Passengers and Kilowatt-hours Per Half Trip.

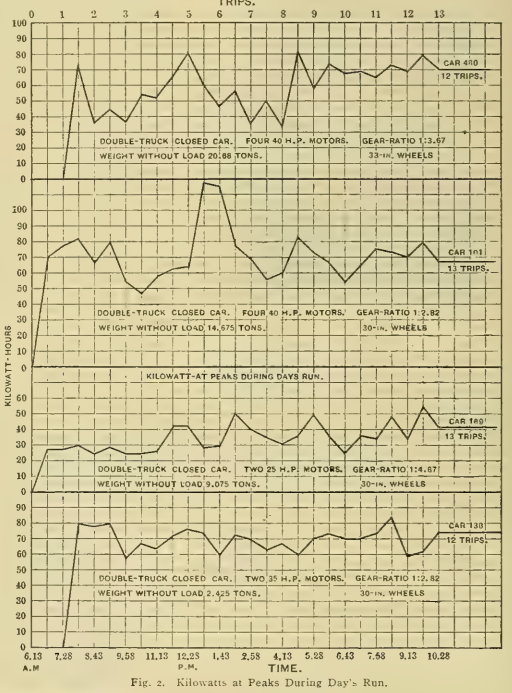



Fig. 2. Kilowatts at Peaks During Day's Run.

TWO-MOTOR VERSUS FOUR-MOTOR EQUIPMENTS.

tance is, say six miles per half trip, or 12 miles per round trip, requiring four cars for 15 minute service at 12 miles per hour, and three cars for the same headway at 16 miles per hour, the platform labor per mile in the first instance will be 0.0335 × 4 = 0.1340, and in the second instance 0.025 × 3 = 0.075, a saving in labor of 0.059 per mile, and 0.0085 per car mile. This great saving in cost of operation appeals to the operator, but not so greatly if the operating costs are increased by excessive demand on power-station equipment and by added interest charges due to increased line copper and rail bonds. In selecting motors and cars for a given run it will be found necessary to consider the following:

Density of population, as governing the size and seating capacity of the car body; the number of stops per mile, and consequently the acceleration; the frequency of service and the speed in miles per hour.

The number of trucks and motors, as determining the size and weight of cars selected; the tractive effort, and the acceleration.

The speed in miles per hour, as determining the number of cars in service; the platform labor; the demand upon power-plant equipment; the increased interest charge for line and power plant.

The gear ratio, as determining the size of motors; the acceleration; the number of stops per mile; the heating of motors and consequent repairs, and additional power-station and line requirements.

Too much care cannot be exercised in determining the gear ratio for given service; for there can be no doubt that in many cases lack of power-station equipment and excessive motor repairs can be traced to the use of wrong gear ratio. In the first place, cars should be selected of ample capacity for the service requirements, and then motors should be selected with a rating only slightly greater than the service requires and with a gear ratio so designed that the schedule may be made without resorting to rapid acceleration on starting, and, as a consequence, running the motors on low-efficiency points in order to kill time.

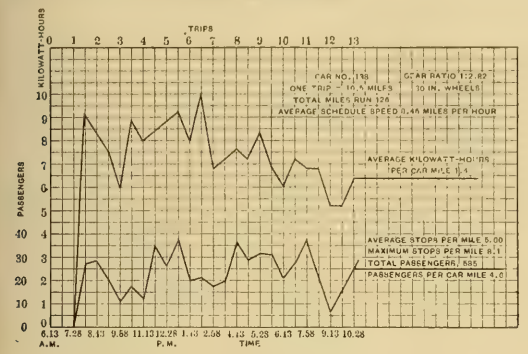



Fig. 4.

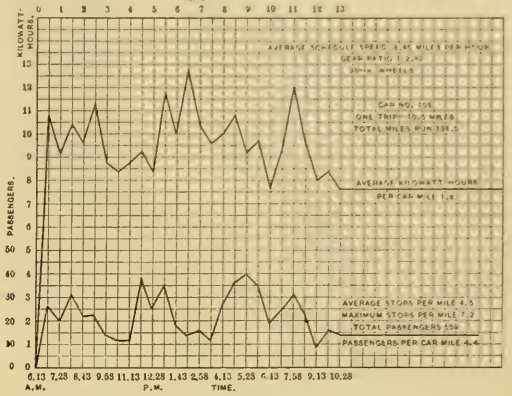



Fig. 5.

TWO-MOTOR VERSUS FOUR-MOTOR EQUIPMENTS.—CURVES SHOWING PASSENGERS AND KILOWATT-HOURS PER HALF TRIP.

## Appendix.

Car 138. January 16.

Motor 1:
Car in at 10:35 p. m.
Temperatures are in degrees C.
Temperature of air: 0.
Temperature of armature iron: 68 degrees.
Temperature of field: 63 degrees.
Note: Nearly 10 minutes were lost in getting thermometers in place on this motor.

Car 101. January 17.

Motor 1:
Car in at 10:35 p. m.
Temperatures are in degrees C.
Temperature of air: one degree.
Temperature of armature iron: 70 degrees.
Temperature of field: 46 degrees.
Temperature of air in car barn at 6 a. m.: 17 degrees.

Car 480. January 18.

Motor 4:
Car in at 10:35 p. m.
Temperatures in degrees C.
Temperature of air: 1.5 degrees.
Temperature of armature iron: 29 degrees.
Temperature of field: 25 degrees.
Temperature in barn at 6 a. m.: 23 degrees.

Car 169. January 19.

Motor 1:
Car in at 10:35 p. m.
Temperatures in degrees C.
Temperature of air: five degrees.
Temperature of armature iron: 41.5 degrees.
Temperature of field: 27.5 degrees.
Temperature in barn at 6 a. m.: 20 degrees.

In all the above temperature readings the temperature of the field coil was obtained by placing a thermometer on the top right-hand field coil at about the same point. The armature temperature was obtained by placing the thermometer on the iron core.

### Discussion (in Abstract).

A. H. Armstrong, Schenectady, N. Y.: The contest between two and four-motor equipments is of long standing, but of late years has seemed to have settled itself in the majority of cases in favor of the four-motor equipment. No general rule can be formulated for predicating in all cases the use of a two or four-motor equipment. Each case must be considered by itself and local conditions will be the governing element. Perhaps the fundamental reason for adopting the four motor equipment [illegible] of course, that the car will have a double truck in the need of increased traction. The two-motor equipment seems to be relegated more specific to the instance cited by Mr. Crawford, of light city traffic, roads enjoying a fairly level profile, having a schedule that can be accommodated with an immediate amount of acceleration, and where the climatic conditions are not perhaps so severe that they will destroy the tractive effort available with two-motor equipments.

It seems in arriving at the efficiency that the numerator is taken as the actual miles[illegible] earned per mile, while the denominator is largely made up of the possible earnings per mile—that is, the author assumes that at the end of every mile an entirely new set of passengers is taken on board the cars with their accommodating nickels. If instead of a one-mile basis a two-mile basis had been taken, the 17 per cent. in the case of car No. 169 would have been nearly doubled without in any way changing the factors entering into the case.

There is no reason why a car should demand more energy for a given service when equipped with four motors than with two, provided the total weight of the car is the same in each case. The common method of comparing two-motor and four-motor equipments is unfair and that is true in the present paper, when a two-motor 35-horsepower equipment is compared with four motors of the same size. The weight of the car is greater and the comparison is not on an equal basis. It should have been made by comparing two 70-horsepower motors against four 35-horsepower motors, as obviously in one case the motors are either overloaded or else underloaded.

S. T. Todd, Pittsfield, Mass.: In regard to the term which is called "commercial efficiency," of course the author does not mean efficiency in the ordinary engineering sense, but he means that he wants to get at a general term which will express the value as a carrying factor of different cars. The criticism which I would make in regard to his method of deriving that quantity of commercial efficiency is on his introduction of the "seating value," as he calls it. He has attempted, in other words, to combine not only the operating expenses of the car, but tried to combine in the same formula the possible carrying capacity of the car. It seems to me, with motor equipments are worked enough harder in the service under consideration for the cost of repairs to run up to double—and it would not take many burned-out armatures to do that—it would make the operating cost per mile of the four-motor equipments less than the operating cost of two-motor equipments. If Mr. Crawford had only gone one step further and divided up the seating capacity of the car and given us the cost per seat-mile instead of car-mile, it would have shown that the cost of operation per seat-mile of the four-motor equipment was less than the cost of either of the two-motor equipments. If he wished to introduce, in addition, this question of earning capacity, as compared with earnings, he could have introduced separate formulas, dividing earnings by the possible earning capacity.

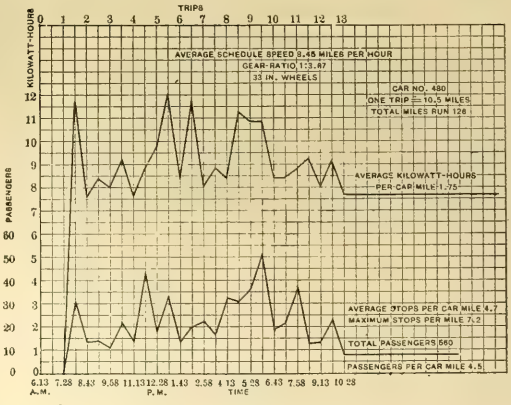



FIG. 6. TWO-MOTOR VERSUS FOUR-MOTOR EQUIPMENTS.—PASSENGERS AND KILOWATT-HOURS PER HALF TRIP.

Calvert Townley, New Haven, Conn.: In the usual comparison of these two classes of equipment a difficulty always arises when, instead of strictly comparing two motors with four motors, a lot of other factors are brought into the discussion; for example, the question whether the car seats 42 persons or 28 persons, or any other number. The question whether such a car is the most economical to use is not really a question of two or four motors, but a question of local requirements, density of traffic and other conditions. Similarly, and yet in another direction, the question of the gear ratio ought not to be brought into it, because within ordinary limits you can apply any reasonable gear ratio to either size motor.

Admitting the value of the increased traction [of the four-motor equipment], let us see to what extent it is necessary. The two-motor equipment will have from 55 to 60 per cent. of the total weight of the car on the drivers. If we assume the best conditions of rail, level track, etc., and take away 60 per cent., that gives us 1,200 pounds on the drivers for every ton of weight in the car and we can allow 20 per cent. adhesion safely. Twenty per cent. of 1,200 pounds is 240 pounds, so you will have with two-motor equipment, under favorable conditions of track, 240 pounds per ton to provide for acceleration. Take a very severe condition of grade, say eight per cent., which usually calls for 160 pounds to propel the car up an eight-per cent. grade, leaving 80 pounds for acceleration; and if you have as much as 20 pounds to overcome friction, which is rather larger than is usually allowed, you still have 60 pounds for acceleration, so that under these favorable conditions, on the most unfavorable grade, you

can accelerate at a fair rate. Of course, if you have the ordinary grades and track conditions you will have a much better acceleration. Now, when you come to winter service, with snow and slush on the rail, you are likely, of course, at any time to come to a point on the track where you get no adhesion at all from one truck; so that instead of 1,200 pounds on drivers you only have 600 pounds, and if you get instead of 20-per cent. adhesion only 10-per cent., or even lower—say 10-per cent.—you would have but 60 pounds to start your car, and with snow banked up on the track and other troubling conditions, you can readily see that you might not be able to start at all, and that is where the two-motor equipment would fall down. Bearing in mind these two extremes of possible conditions, it is important that we should not be carried away by the trend or fashion of the times, because it is my observation that engineers are not entirely free from the weakness of following fashion. If you take the ordinary conditions of summer service, where you have no snow, where the worst condition of rail is the greasy rail from a mist and where your grades are not too severe, there are very few conditions where the two-motor equipment will not give you all the traction you can possibly use; but where you come to heavy service in the winter—speaking more particularly of city service—you will occasionally get to a condition where you cannot pull your cars in with the two motors.

## Switching Stations for Small or Isolated Exchanges.

The small or isolated telephone exchange, often located at some remote point and of necessity in charge of a person of limited experience, for economical operation must be so constructed as to require very little, if any, repairs. One of the steps taken by the North Electric Company of Cleveland to keep pace with the rapid growth of rural systems has been the development of a line of switching appliances of a character to fulfill the demand for high-class apparatus fast becoming imperative in the construction of such systems. Of the accompanying illustrations, Fig. 1 is a view of one of the more elaborate types of this class of apparatus known as the No. 39 switch, with drops and connecting cords. Fig. 2 is a diagram of the circuits.

The drops used in these switches are standard tubular drops of the magneto or relay types. These drops are bored from solid rods of Norway iron, leaving the head and shell in one piece. The shells are thoroughly annealed and are then heavily electroplated with copper and nickel. While this method of constructing the drop requires the use of accurate and costly machinery, it is admitted by all manufacturers that in no other manner can so highly efficient a drop be produced. The shell when made in this manner forms a return path of least resistance to the magnetic lines, rendering the drop extremely sensitive while at the same time it constitutes a magnetic and electric shield, eliminating entirely the annoying element commonly described as cross-talk in so far as the switch is concerned.

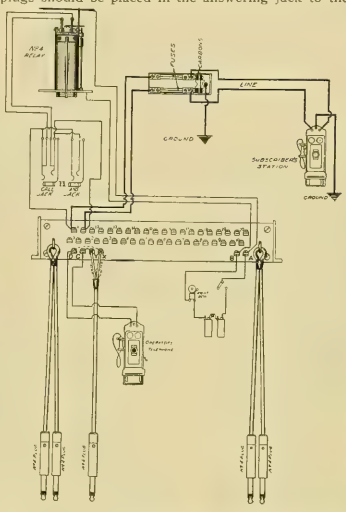



FIG. 2. DIAGRAM OF CIRCUITS OF SWITCHING STATION FOR SMALL EXCHANGE.

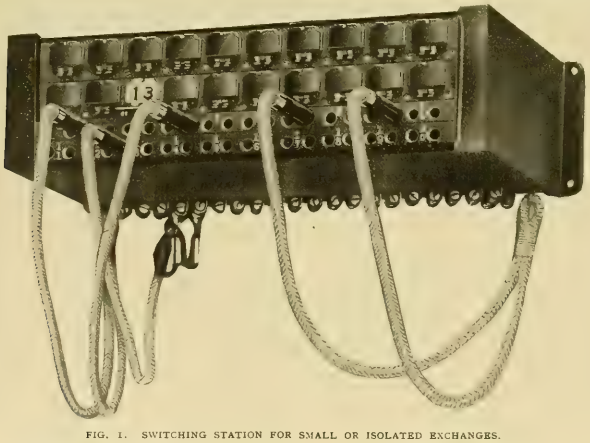


FIG. 1. SWITCHING STATION FOR SMALL OR ISOLATED EXCHANGES.

The cores of the drops are made of the best quality Norway iron and are wound with silk-covered magnet wire.

The jacks are mounted on aluminum plates in banks of five, 10 or 20. The jacksprings are of german silver, are provided with platinum contacts and are securely supported and held in place by hard-rubber mounting strips. Individual springs are insulated from each other by mica. These springs are of greater length than ordinary, thus adding to their flexibility and reducing liability to breakage or displacement from failure to resume their normal position after subjection to unusual or frequent strain. No holes are drilled or punched through the jacksprings at the point of support, as is frequently done for the purpose of fastening them.

Duplicate jacks, or two jacks for each drop, are installed with these switches, the jacks being so connected that inserting the plug in the answering jack or jack to the right of its number leaves the drop bridged across the line, while inserting the plug in the calling jack or jack to the left of its number opens the drop or cuts it off of the line. In connecting two lines together one of the connecting plugs should be placed in the answering jack to the right of its number and the other connecting plug in the calling jack to the left of its number, thus leaving but one of the drops bridged across the line while the subscribers are talking. This drop will then respond to the ring-off or clearing-out signal and will indicate when they are through talking. Another advantage of the duplicate jack is that the speaker's plug can be inserted in one of the jacks of the connected lines without disturbing the connection, for the purpose of ascertaining whether the speakers have completed their conversation and have failed to ring off, as is sometimes the case.

All switches are carefully wired with the best grade of tinned copper switchboard wire. All interior connections are thoroughly tinned and soldered, the flux used being resin, which is entirely free from acid, and all terminals are soldered to the inner end of outside binding posts, which are plainly numbered.

The plugs are made from drawn brass of a quality which resists wear. Speaker's and connecting cords have tinsel conductors, insulated with reverse layers of silk and cotton, and are protected by a spiral wire winding, the whole being covered by a strong and durable linen braid.

The method of operation of the switch is as follows: A ring from the line is indicated by the falling of the drop and the ringing of the night or relay bell, if connected. The attendant inserts the speaker's plug in one jack of the calling line and ascertains the name or number of the subscriber wanted. The attendant then removes his plug from the calling line, inserts it in one of the jacks of the line wanted and rings the subscriber desired by means of his telephone generator. The attendant then connects the calling line and the line called by means of one of the pairs of connecting cords, inserting one of the plugs in the jack of the calling line to the left of its number and the other plug in the jack of the line called to the right of its number. When the subscribers ring off the disconnecting signal is indicated by the falling of the drop shutter of the line having the plug in the jack to the right of its number. The lines are then disconnected.

## Telephone News from the Northwest.

The Northwestern Telephone Exchange Company has leased quarters in a new building to be erected at Faribault, Minn., this spring and will equip a central-energy exchange for that city and make improvements to the local system.

The Groton-Ferney Mutual Telephone Company has effected a preliminary organization at Ferney, S. D.

The Farmers' Springbrook Telephone Company has been formed at Mora, Minn., by farmers of Arthur Township.

Farmers of McPherson and Edmunds counties, South Dakota, have formed the Edmunds County Mutual Telephone Company and will build rural lines.

The People's Telephone Company of Superior, Wis., has plans for a new exchange and office building to be erected in the spring.

A new company has been formed at Hector, Minn., and has bought the W. B. Strom line and exchange. It will be extended and improved. H. L. Torbenson is secretary of the new company.

The Lakota (N. D.) Telephone Company will build 35 miles of new lines this summer.

The Farmers' Mutual Telephone Company of Reading, Minn., has been incorporated with $25,000 capital by Fred Baker, J. Hurr and R. J. Jones.

Materials are being collected at Pierre, S. D., for the construction of a line from that city to Rapid City, S. D.

The Hector (Minn.) Telephone Company has been incorporated with $25,000 capital stock by Emil Larson and others.

Browns Valley, Minn., is considering the installation of a municipal telephone exchange.

The Mississippi Valley Telephone Company contemplates the expenditure of $200,000 in rebuilding its lines and for new equipment for the exchanges at Burlington, Keokuk, Muscatine, Wapello and Fort Madison, Iowa.

A number of the rural lines centering at Corydon, Iowa, will unite and apply to that city for a franchise.

The proposition to grant a telephone franchise to Dr. Greaves at Sibley, Iowa, was voted down.

The Hastings (Neb.) Independent Telephone Company will erect a new exchange building.

J. E. Adamson is having plans prepared for a new telephone exchange building, which he will erect this spring at Broken Bow, Neb.

A new telephone company has been organized at Bronson, Iowa. M. G. Smith was elected president and F. H. Oertel, secretary.

The Mutual Telephone Company has purchased the Harkens interests in the telephone exchange at Russell, Iowa. R.

## Indiana Telephone Items.

The Citizens' Telephone Company of Decatur has purchased the Nichols Block and the building will at once be remodeled and enlarged. The exchange will occupy the entire second floor of the block. F. M. Schirmeyer, manager and secretary, announces that the company has arranged for further improvements this spring.

The Cumberland Telephone and Telegraph Company is preparing to erect an office and exchange building in Princeton, work to begin next month. Leland Hume of Nashville, Tenn., assistant general manager, spent the last week in Princeton and secured a site for the new building.

The Home Telephone Company of Crawfordsville has announced that it has made arrangements through the New Long-distance Telephone Company of Indianapolis for service connections with Cleveland, Dayton, Columbus, Hamilton, Lima, Toledo and all points in Ohio reached by lines of the Independent telephone companies. The primary period of conversation is fixed at three minutes.

Indiana patrons of the Cumberland Telephone Company have received a statement from the home office of the business for December, 1904. The report shows that the company had 119,499 subscribers December 1, 1904. During December 3,998 were added and the number discontinued was 2,184, leaving a net increase of 1,814 for the month.

The Delaware and Madison Counties Telephone Company has 4,243 telephones operating in Muncie, Anderson, Elwood and Alexandria. S.

## Ohio Telephone Notes.

Col. Frederick S. Dickson, president of the Cuyahoga Telephone Company, has been appointed agent of the trustees who have had the Everett-Moore matters in hand, with authority to settle the few remaining claims.

At the annual meeting of the Harpersfield Tele-

phone Company last week the following named officers were chosen: President, Franz Leslie; vice president, Charles Bishop; secretary, Ed Lister; treasurer, A. H. Gray.

The Farm and City Telephone Company has accepted the franchise granted by the council of Van Wert. The company now has 100 subscribers in the town and 200 in the country and has done little soliciting.

Twenty-eight companies were represented at the district meeting of the Ohio Independent Telephone Association held in Dayton last week. W. D. Rush of Greenville, Gilbert Thompson of Hamilton, Frank L. Beam of Columbus and Judge Elam Fisher of Eaton made addresses. J. H. Thadick of Sidney was chosen vice-president of the sixth district. H. P. Miller of Dayton will represent the district at the national meeting in Chicago.

Extensions at the Doan and East exchanges have been completed by the Cleveland Telephone Company, Cleveland, which, it is claimed, will make an increase in capacity of 1,000 lines.

It is said that the stockholders of the Toledo Home Telephone Company has decided upon the course to be pursued at the annual meeting in March. But one change is scheduled. An out-of-town director will be retired and a Toledo man will take his place. It is also intimated that the rates will be advanced.

A telephone was the only means the family of Henry Kohl, near Waterville, had of communicating with the outside world for 60 days. Smallpox broke out in the family and the house was quarantined. The manager of the Citizens' Telephone Company put up an instrument on a tree in the yard and members of the family who were able would stand there and talk with friends. Mr. Kohl also dictated letters over the telephone to those living at a distance.

The Windham Telephone Company of Windham has been incorporated with a capital stock of $10,000 by C. A. Landall, E. W. Mallett, J. W. Shank; H. T. Sheldon, D. B. Wagner, E. A. Lehman and P. B. Higby. C.

## Michigan Telephone Matters.

It is understood that the telephone war which has been going on in the village of Litchfield between the Litchfield Farmers' Mutual Telephone Company and the manager of an Independent exchange is about at an end, George E. Knowles, who has been operating the exchange, having been given a 30-day written notice to vacate the premises, with an opportunity to sell his apparatus and switchboard to whom he pleases.

The Washtenaw Home Telephone Company of Ann Arbor has increased its capital from $250,000 to $300,000. This company is also building an exchange at Ypsilanti and proposes to have an exchange in every village in Washtenaw County.

The Saranac Improvement Company has increased its capital stock from $5,000 to $10,000 and changed its name to the Saranac Telephone Company. W.

## Growth of Telephone Interests in Canada.

At the annual meeting of the Bell Telephone Company held at Montreal, Mr. C. F. Sise, the president, stated that the company could spend as much as $2,000,000 a year in extensions and improvements so rapidly was the system growing, but it was within $2,000,000 of the total capital it was allowed to issue by its charter. To secure the right to issue additional capital, application would have to be made to the Dominion Parliament, and he feared that such an application would meet with very strong opposition. Twenty-five years ago the company began business with a capital of $397,000. Today the capital is $8,000,000 in stock and a bond issue of $2,000,000. In 1885 the long-distance mileage amounted to 2,000 miles; today it is 32,000 miles; 10 years ago there were 69,000,000 exchange connections during the 12 months; now there are 328,000,000 during the same period. In 1895 there were 29,000 subscribers throughout Canada; now there are 66,160 instruments earning rentals, 375 exchanges and 789 agencies. The company now has 32,211 miles of wire strung on 7,866 poles. The total receipts for the year amounted to $2,833,000, the net revenue being $701,000. At present some 30 municipalities in Canada have given the Bell company exclusive rights.

## NEW COMPANIES.

The Lewistown and Billings Mutual Telephone Company has been incorporated at Helena, Mont., with a capital stock of $20,000. The directors are P. B. Moss of Billings, G. M. Stone of Lewistown and others. The principal place of business is Lewistown.

The following-named telephone companies have been incorporated recently in Oklahoma: German-American Telephone Company, Orlando, H. C. Arnold and others; Foss Mutual Telephone Company, Foss, W. J. Lawson and others; Byron Mutual Telephone Company, Byron, H. B. Holderby and associates.

## Bell Telephone Traffic Conference.

Representatives of the Bell telephone companies throughout the country were in Indianapolis last week to attend an important "traffic conference" at the Claypool Hotel from February 20th to 25th. The conference brought together about 80 traffic and engineering officers, representing essentially every Bell company in the United States. Quite a number of executive officers were also present.

The programme contained the following papers: "Duties and Records of a Traffic Department," Mr. Driver; discussion by Messrs. Sherwood, Allen, Foster, Rorty, Sise and Valentine. "Selection and Training of Operators," Mr. McBride; discussion by Messrs. Thompson, Corrigan, Driver, Kerwin and Penfield. "Local Service Tests and the Merit System of Grading Operators," Mr. Rogers; discussion by Messrs. Baldwin, Alexander, Carpenter, Foster and Sherwood. "Local Operating Methods and the Handling of Irregular Calls," Mr. Valentine; discussion by Messrs. Foster, Cowdery, Hayward and Ranney. "The Handling of Suburban Toll Traffic," Mr. Sherwood; discussion by Messrs. Driver, Peavey, Spring and Watson. "The Center Checking System," Mr. Kennedy; discussion by Messrs. Van Meter, Cotter, Fosdick and Rogers. "Tariff and Routing Systems," Mr. Allen; discussion by Messrs. Rorty, Boggs, Gates and Smith. "The Handling of Long Haul Toll Traffic," Mr. Van Meter; discussion by Messrs. Rogers, Allen, Cozad and Gates. "Toll Service Tests and the Checking of Toll Revenue," Mr. Rorty; discussion by Messrs. Doolittle, Fisher, Kennedy and Valentine.

The standardization of Bell apparatus, which has been so largely accomplished throughout the country, has brought about a general uniformity of method, without which it would now be almost impossible to carry on the immense daily traffic in the way of local and toll messages handled by the corporations represented. The reading of the several papers by superintendents of traffic and traffic engineers and the interchange of ideas which followed brought out much that was interesting and which will no doubt be of help in providing further adequate facilities to handle the business.

One of the enjoyable features of the meeting was the banquet tendered the visitors at the Columbia Club by the Central Union Telephone Company. The decorations and menu were unique. The viands served in each course were indicative of telephone service terms.

Mr. F. P. Fish, president of the American Telephone and Telegraph Company, and Mr. E. J. Hall, vice-president, were unavoidably absent. Mr. C. J. French, vice-president of the company, was in attendance throughout the meeting, as well as a number of others representing the parent company. Among those who were present were the following:

American Telephone and Telegraph Company, Boston and New York—C. Jay French, vice-president; H. V. Hayes, chief engineer; C. H. Wilson, general superintendent; T. B. Doolittle, J. C. T. Baldwin, K. W. Waterson, T. Cotter; F. L. R. Van Meter, special agent; J. P. Downs, F. B. Driscoll.

Bell Telephone Company of Buffalo—J. M. Knapp, superintendent of territorial exchanges; A. B. Watson, manager.

Bell Telephone Company of Canada, Montreal—C. F. Sise, Jr., assistant general superintendent; J. A. Baylis, electrical engineer.

Bell Telephone Company of Missouri, St. Louis—George F. Durant, general manager; J. W. Thompson, superintendent of exchanges; J. K. Wass, auditor.

Bell Telephone Company of Philadelphia and the Delaware and Atlantic Telegraph and Telephone Company—T. Spencer, general manager; William R. Driver, Jr., superintendent of traffic; Nathan Hayward, traffic engineer.

Central District and Printing Telegraph Company, Pittsburg—M. H. Buehler, general manager; M. C. Rorty, superintendent of traffic; F. O. Hale, traffic engineer; C. Bradley, toll traffic agent; R. F. Esterbrook, chief service inspector.

Central New York Telephone and Telegraph Company, Utica; Empire State Telephone and Telegraph Company, Syracuse; New York and Pennsylvania Telephone and Telegraph Company, Elmira—W. W. Nicholson, assistant general manager; E. B. Rogers, general superintendent; H. H. Kennedy, assistant engineer in charge of traffic.

Central Union Telephone Company, Indianapolis—L. G. Richdson, president; H. P. Hall, general manager; W. S. Chapman, secretary and treasurer; J. Uprichard, auditor; E. H. Bangs, engineer; A. P. Allen, traffic engineer; F. A. de Peyster, assistant traffic engineer; C. M. Fosdick, service inspector; G. C. Brooks, general contract agent; F. Redmund, special agent; W. J. Maider, special agent; W. R. Hirst, Indianapolis manager; E. A. Reed, division superintendent Ohio; L. N. Whitney, division superintendent Indiana; C. H. Rottger, division superintendent Illinois.

Chesapeake and Potomac Telephone Company, Washington—P. O. Coffin, traffic inspector.

Chicago Telephone Company, Chicago—Arthur D. Wheeler, president; A. S. Hibbard, general manager; S. J. Larned, general superintendent; W. G. Worp, engineer; H. N. Foster, superintendent of traffic; D. J. Matlock, superintendent of toll department; G. P. Jones, operator inspector.

Cincinnati and Suburban Bell Telephone Company, Cincinnati—J. E. Peavey, superintendent of traffic.

Cleveland Telephone Company, Cleveland—P. Yensen, general manager; E. E. Ranney, traffic manager; H. W. Marsh, chief operator.

Colorado Telephone Company, Denver—W. F. Brown, assistant general superintendent; W. F. Cozad, superintendent of traffic.

Cumberland Telephone and Telegraph Company, Nashville—A. M. Fisher, Jr., manager long-distance service.

Freeport Telephone Company, Freeport, Ill.—L. E. Farwell, president.

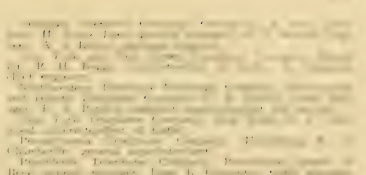
Hudson River Telephone Company, Albany, N. Y.—L. S. Greenleaf, general superintendent; F. D. Cowdery, superintendent of traffic; W. S. Nicholson, engineer and acting superintendent of construction.

Iowa Telephone Company, Des Moines—E. B. Smith, general manager; C. E. Hall, superintendent.

Missouri and Kansas Telephone Company, Kansas City—Sherman R. Hall, assistant general manager; F. C. Penfield, traffic manager; F. J. McDonough, operating manager.

Michigan State Telephone Company, Detroit—J. F. Land, general manager; G. E. Kerwin, traffic manager.

New England Telephone and Telegraph Company, Boston—T. C. Wales, chief engineer; F. P. Valentine, engineer of traffic; H. D. McBride, superintendent of traffic



## GENERAL TELEPHONE NEWS.

The Scranton (Iowa) Independent Mutual Telephone Company has been incorporated with a capital stock of $5,000.

The Cawker City (Kan.) Telephone Company has increased its capital stock to $10,000, and will soon begin the construction of an exchange.

The Orange-Newton Telephone and Telegraph Company has been incorporated with a capital of $2,500 to build toll lines out of Orange, Texas.

W. B. Moore intends to organize a telephone company to install a system at Yorkville, S. C., if the franchise for which he has applied is granted by the city.

The Independent Telephone Company has submitted to the City Council of Spokane, Wash., a second application to establish a terminal point for its system in that city.

The Sunset Telephone Company will establish two branch offices at Seattle, Wash., within the next few months, and between $250,000 and $300,000 will be expended on extensions in the vicinity of Seattle.

The Bell Telephone Company, which has succeeded to the plant of the Mutual Telephone Company in Fort Scott, Kan., will consolidate the two systems and will, it is said, erect a new $75,000 exchange.

J. A. Cook of Monitor, W. Va., heads the incorporators of the Farmers' Union Telephone Company, capitalized at $10,000. The company will build a telephone system in Monroe, Greenbrier, Pocahontas, Summers and Fayette counties, W. Va.

Plans are being perfected by the Rocky Mountain Bell Telephone Company to extend its system from Salt Lake to Los Angeles, following the route of the San Pedro, Los Angeles and Salt Lake railroad, which is now completed, and will shortly be in operation.

A committee appointed at a recent meeting of the official board of the First Methodist Church of Melrose, Mass., to consider the feasibility of installing a system of interior telephones connecting the pulpit and pews for the benefit of parishioners who are hard of hearing, is making preparations for a practical demonstration of such a system.

It is reported that the Consolidated Telephone Company of Arizona, an organization headed by Epes Randolph of Los Angeles, Cal., has perfected negotiations looking toward the acquisition of all Independent telephone lines in Arizona. The Arizona system is to be connected within a few months at Imperial, Cal., with the California system, and with eastern lines at El Paso, Texas.

The Home Telephone Company of Grand Meadow, Minn., recently incorporated with a capital of $50,000, is the outgrowth of the Home Telephone Exchange organized six years ago and owned by C. F. Greening, secretary and treasurer of the new company. Mr. Greening built 200 miles of line and installed many telephones, but in order to extend further the Home Telephone Company was incorporated. The company has exchanges at Grand Meadow and Dexter, toll lines connecting Racine, Spring Valley, Le Roy and Elkton, and connection with the Northwestern Telephone Exchange Company. W. H. Goodsell is president, W. A. Nolan, vice-president, and Martin Axness, manager.

The International Telephone Manufacturing Company of Chicago says that from a very hard coal secured from the southern part of the state of Sao Paulo, Brazil, granulated on crystallized under the proper process and given a special treatment to make it as hard as possible, a carbon is produced which enables the use, if so desired, on a transmitter for long-distance toll-line work or central-energy systems, of from 100 to 400 percent. more battery, without causing the transmitter to "fry" or "pack;" while with the ordinary amount of battery this carbon gives the transmitter a louder and more distinct tone.

## New British Patent Law.[1]

By James Boyle.

The new British patent law, passed in response to a long-standing and urgent demand for reform, came into full operation on January 1, 1905. It is a matter of considerable importance to American inventors, as for many years past about one-fifth of the patents issued by the British office have been to Americans. In 1903 the total number of patents granted by Great Britain was 15,718, of which 3,466 were to Americans.

It has always been complained that a British patent was not only expensive, but that it afforded no guarantee that it had not been wholly or in part described or claimed in some prior specification. In this country the American patent law generally has been pointed to as the best model. The German law has also been commended, it being to a great extent copied after the American law, but British experts criticize the laws of both countries, particularly as to the power of the commissioner in America to refuse a patent on his dictum that the invention had been anticipated. An attempt has been made in the new British law to meet some of the objections raised against both the American and the German laws. There is also provision in the new law to remedy what was considered to be in some cases a great injustice to the British people through the holding of British patents by foreigners, particularly by Germans. In these cases the British market was flooded with German-made goods under British patents, when the holders of these patents had refused to manufacture the articles or permit them to be manufactured in this country.

There is some difference of opinion among experts as to whether the new British patent law is really a reform. Although Liverpool is not a manufacturing center, it probably has more connection with patents, legally and through agencies, than any other city in the United Kingdom outside of London. Locally there is some difference of opinion as to the value of the new law. The general opinion is favorable, but one of the leading patent experts in Liverpool sums up his criticisms as follows:

"On the whole, the new law simply shortens the length of provisional protection, makes the granting of patents more uncertain, increases the cost very greatly, and makes it more expensive than it was before to obtain a compulsory license, while at the same time there is absolutely no guarantee that the patent when granted is new or patentable."

The following is a summary of the principal features of the new act:

(1) Novelty.—The patent office is required to examine every application which reaches the complete stage to ascertain whether it has been wholly or in part described or claimed in any prior specification other than a provisional specification (not followed by a complete specification) published in the United Kingdom during the 50 preceding years. This is really the most important feature of the new law, and its administration has required an extensive reorganization of the British patent office. It was the inevitable delay consequent on this reorganization which made it necessary to postpone the going into full effect of the new law until January 1, 1905, although the law was passed in 1902. To facilitate search the whole of the specifications and abridgements, from 1855 to date, have had to be arranged and attached to reference cards, of which there have been about 600,000 arranged. It is intended also to include all the specifications from 1617 to date.

Under this law "any new art, manufacture, or composition of matter, new combination of two or more known parts producing a new advantageous result, or any new chemical or other process or improvement on existing processes, may be validly patented." When an application for a patent reaches the patent office it is referred to examiners, of whom under the new law there are 92. A special fee of $5 is charged for this examination. The patent office has no power to reject a patent as being old (except in the case of a third party intervening and successfully opposing the application), but if in the opinion of the examiners a single patent covers the invention in its entirety it is referred to the controller, who hears the applicant if necessary. If satisfied that the patent is entirely covered by a prior patent he can "indorse" the patent as so covered and issue it, such form of issuance, however, being subject to appeal to the attorney-general. If, on the other hand, the examiners find the patent claim only partially covered by prior applications the applicant is notified, and he can amend or can contest the examiners' objections before the controller. Here, again, an appeal can be made to the attorney-general. If this contest and appeal be decided against the applicant, the patent is issued with a note appended on the specification making reference to such prior patents as the controller considers anticipate the new patent to a greater or less extent. If there be no objection by the examiners, or if the objections have been overcome, the patent is issued without any memorandum indorsed thereon. It should be particularly observed, however, that the patent, even under the new law, does not necessarily insure validity, that still being a question open for contest before the courts; and it is still the case, as put by an American expert critic of the old law, that "an English patent which has not been successfully litigated is naturally an object of suspicion." Still, if the patent is issued without a note appended thereto, referring to a prior patent, it is prima facie evidence that it is genuine and valid.

(2) Provisional Protection.—The right of provisional protection has been reduced from nine months to six months for the United Kingdom, while at the same time if the patent is filed in a foreign country the period of provisional protection is extended to one year.

(3) Compulsory Licenses.—Formerly a foreigner or other inventor could take out a patent in England and hold it without working it or allowing other people to work it in this country. The only recourse a manufacturer or other interested party had to force the foreigner or other holder to grant him a license to manufacture under the patent was to petition the Board of Trade, which heard the petitioner and the patentee, and then decided whether it would compel the patentee to grant the license or not. The new law requires that the applicant for a compulsory license must not merely obtain the consent of the Board of Trade, but that he must also secure the consent of the Privy Council. Not only can the Privy Council compel the patentee to grant licenses in this country, but if he fails to satisfy the court that he has fulfilled the reasonable requirements of the public his patent can be revoked, but not before the end of three years from the date of the patent.

Probably the strongest criticism of the new law is in regard to the great expense attached to compulsory licenses and revocation, as above explained. It is claimed that, under the old law, when petitions for compulsory licenses were made only to the Board of Trade, there were very few such petitions made because of the great expense; but under the new law application must also be made to the Privy Council, which is the most expensive court in the country. It is believed that the new law will very much curtail the business of patent agencies, although it will very likely increase the legal expenses incidental to securing a compulsory license.

1. A report dated January 6, 1905, from the United States consul at Liverpool.

## BOOK TABLE.

Wireless Telegraphy. By William Maver, Jr. New York: Maver Publishing Company. 1904. Pp. (six by nine inches), 216, with 123 illustrations. Price, $2.

Those desiring to become familiar with the art of space telegraphy, including the history of its development and the practical systems in use today, will discover that this work contains much besides descriptions of the present working systems. The book is presented with the wish that it may contain the essentials of a complete handbook on space telegraphy. It was begun several years ago as an appendix to the author's well-known "American Telegraphy and Encyclopedia of the Telegraph," but so rapid have been the strides in the art of late that it was soon recognized that a separate book would have to be given to the subject. Clear theoretical diagrams are interspersed freely throughout the reading matter, as the author believes, and justly, that they are of greater utility to the student than pictures showing the external appearance of the apparatus.

Die Formelzeichen (Formula Symbols). By Olof Linders, Leipsic: Jäh & Schunke, 1905. Pp. (6⅝ by 10½ inches), 96. Price (in Germany), five marks ($1.20).

The question of determining symbols for technical and scientific formulas is one of importance, and any work which will offer suggestions for the adoption of a standard or universal code of symbols is worthy of careful consideration in view of the confusing diversity which now exists in scientific literature in the use of letters to denote various quantities in such formulas. Suggestions have been offered from time to time for more uniformity in the usage of designating letters, but still it is found that nearly every author on scientific subjects has his pet system of designating the various quantities in the formulas he uses. The book which Mr. Linders has written is a step in the right direction and could the system which he proposes, though perhaps not perfect, be followed consistently, it would lead to much less confusion than the "every man for himself" method. The author has prepared 10 tables. In the first six tables are given an outline of the basis upon which the system is founded. Table 7 is divided up into a number of sections under such headings as geometrical, mechanical, thermal, optical, etc. The table has a number of divisions, beginning with the name of the quantity, followed by its dimension symbol according to the c. g. s. system. Then come the letters and symbols proposed by different writers heretofore and finally the symbols proposed by the present author. Each quantity in Table 7 is given a number. In succeeding tables, which are a sort of index to Table 7, are given the letters and symbols themselves with the number under which they may be found in Table 7. Thus if it is desired to ascertain what particular quantity a letter represents it may be found readily. The book is valuable on account of the completeness with which the system is carried out, there being represented in the tables most of the quantities ordinarily dealt with. But the author recognizes that a work of this kind should receive the attention of more than one contributor and is desirous that other schemes be worked out by those interested in the subject.

The Recent Development of Physical Science. By William Cecil Dampier Whetham, M. A., F. R. S. Philadelphia: P. Blakiston's Son & Co. 1904. Pp. (5¾ by 7¾ inches), xii., 344, with 39 illustrations and several portraits. Price, $2.

This thoughtful and scholarly work is written with the expressed object of enabling the non-scientific mind to follow the deeper generalizations of natural science with understanding and profit. How well the author has succeeded may be judged from the fact that the chapter on such a naturally dry subject as "The Philosophical Basis of Physical Science" is one of the most interesting in the book.

The treatise opens with the study of physical equilibrium, which contains a complete and satisfying account of the efforts made to liquefy the so-called permanent gases, of which hydrogen was the last to yield. A brief description of the more newly discovered gases, such as argon, neon, krypton and xenon, is then given; and the section closes with a recital of the as-yet-unsuccessful attempts to liquefy helium. The subject is a popular one, and the methods and apparatus employed in the liquefaction of gases are well described.

The chapters on "The Problems of Solution" and "Fusion and Solidification" contain matter of much value to the chemist and the metallurgist, and of considerable interest to the general reader. Many beautiful illustrations are here shown, exhibiting clearly the structural changes accompanying solidification. Figs. 19 to 24 are of especial interest, for they demonstrate the fact that the process of polishing is not, as is generally thought, a mechanical grinding away of the surface irregularities, but that the pressure of the polisher upon the metal sets up a surface flow, the metal behaving like a viscous liquid. In this way a surface film is formed, which presents a non-crystalline appearance and acts as an excellent reflector of light.

The concluding chapters are devoted to such subjects as radioactivity, atoms and the ether and astrophysics, which are handled in the author's clear and entertaining manner. In fact, the entire work is characterized by an unusually pleasing and expressive literary style, which renders the perusal of the book by the non-scientific reader an agreeable diversion instead of a task. The work may be termed a popular exposition of the more recent discoveries in the realm of physical science, but accuracy and high ideals have not been sacrificed to popularity. It will therefore be as welcome in the scientist's library as in the hands of the general reader.

A Treatise on the Theory of Alternating Currents. By Alexander Russell. Volume I. Cambridge: The Cambridge University Press (London: C. J. Clay & Sons). 1904. Pp. (5¼ by 8½ inches), 407, with 132 illustrations. Price (in England), 12 shillings ($2.88).

In the first volume of this work are gathered together the more general theorems of alternating-current work which are applied to every-day practice, the proofs of the more important ones being given. In the second and last volume will be given the theory of alternators, transformers, converters and the apparatus in general. The reader is supposed to be acquainted with the theory of electricity and magnetism and to have a working knowledge of trigonometry and the elements of calculus, and it would seem that there are not many elements of either branch of mathematics that are left out, for the book is replete with mathematical demonstrations. References are given at the end of every chapter to the books and papers consulted by the author, which will be found of value in case further information is desired on the subject. The early chapters of the book deal mainly with inductance and capacity, and illustrations are given of methods by which the capacity of polyphase cables and overhead wires are determined, which are of practical value. One chapter is devoted to problems in two-phase theory, discussed graphically. Each important paragraph has an appropriate indented heading in smaller type which aids the reader greatly in seeing at a glance the gist of what the paragraph contains and is a time-saver when running through a chapter in quest of information on some particular point of a subject.

Elementary Course in Mechanical Drawing for Manual Training and Technical Schools (Part I.) By Arthur W. Chase. Chicago: Howland Speakman. 1904. Pp. (8½ by 5¼ inches), 189, with 95 illustrations. Price, $1.50.

The book is intended for beginners, and as such is free from technical language. It starts with a description of the instruments and materials necessary to do good and thorough work, what they should cost and how to know the good from the poor. Following this comes a course of lessons designed to give the student skill in the manipulation of the various instruments and also to give him at the same time the method of solution of various problems in plane geometry and descriptive geometry, thus beginning with the concrete instead of the abstract conception. Specifications are given with the problems, supplying the student with drill similar to that in practical work and excluding all

mere time-consuming exercises designed solely to give skill in the use of the instruments. Copying of drawings is prevented by the omission of all plates required in the course. The course as outlined is the result of several years' experience in placing the subject before manual high-school students, and the book is intended as a textbook for individual use. The method of representation used conforms to the best modern practice, that is, the third angle of projection is used and the object is shown in each instance as viewed from a position adjacent to the side shown. Hence if the student adopts drafting as a vocation, he will not have to unlearn what he has acquired in the course.

## Electrical Device Provides Artificial Deer Hunting.

In his Harbor Hill estate near Rosslyn, L. I., Clarence H. Mackay is said to have installed a novel and costly electric railway which furnishes artificial means for Mr. Mackay and his sporting friends to get a shot at imitation big game in a manner true to nature.

According to the Cincinnati Enquirer—upon the veracity of which the present relation depends—the railway is a mile long and runs in an irregular ellipse, winding in and out among the woods and broken ground. A small bogie truck constitutes the rolling stock, and on this is mounted a life-sized metal deer. At a speed which can be regulated up to 10 or 12 miles an hour the deer is carried through the woods, and as it appears at the different openings that have been cut among the trees along the route of the railway, it offers a chance for a quick shot. At the end of the run the truck passes over an automatic swich which shuts off the current, and the deer comes to a standstill in a sheltered pit, where a marker is posted. He notes the places where the deer has been hit, telephones, by means of a special wire, the results of his aim to the man with the gun, and then is ready to start the deer off again to run the gauntlet of the marksmen.

## Aurora-Elgin-Chicago Electric Cars to Run Downtown.

Authority has been given by the Chicago City Council permitting the Aurora, Elgin and Chicago Railway Company and the Metropolitan West Side Elevated Railway Company to carry out an agreement whereby the large interurban cars of the former company will be run over the tracks of the latter company to the Fifth Avenue elevated terminal of the Metropolitan road. The Metropolitan cars in turn are permitted to run over the right-of-way of the interurban company as far as the Desplaines River. This arrangement does away with the annoying change of cars at Fifty-second Avenue, allowing passengers from Aurora, Elgin and intermediate towns to get downtown in Chicago without change of cars. The Aurora, Elgin and Chicago company has comprehensive plans for improving and extending its fine system, including also lighting and power schemes, which will develop into one of the most complete electric properties in the country.

## Colorado Waterpowers.

In a recent lecture in Denver General Irving Hale said: "It has often been asserted that Colorado has unlimited water resources by which to furnish electric power. This is an exaggeration, since our mountain streams are low much of the year, the winter flow being from one-tenth to one-twentieth of that in the spring. Reservoirs could be built, and many will be erected in the future, but sites are not so plentiful as might be supposed. The work of the United States reclamation service may greatly assist in this direction. It is a common expression that waterpower costs nothing, but reservoirs, pipes, machinery and transmission are expensive, and interest, depreciation and repairs must be figured on this heavy investment in comparison with steam power. Nevertheless a good waterpower can generally compete profitably with steam, even with the cheapest coal, and especially in the mining districts, where fuel is expensive."

## Theft of Electric Current Not Punishable in Indiana.

A correspondent of the Western Electrician writes: "A singular omission in the Indiana statute was discovered at Wabash last week in an attempt to prosecute a man for stealing electricity. It was shown that the man had wired his house for electric lights, successfully tapped a circuit and run feed wires into his house, and had enjoyed the free use of all the lights he wanted for some time. When the culprit was discovered it was found there was no law in Indiana against the theft of electricity. The grand jury failed to indict because of the lack of a law to punish a person indicted for such an offense. The only thing found possible was to cut the connections and stop the use of electricity by the one charged with the offense."

The city of Lake Charles, La., is considering plans for the construction of a municipal electric-light plant.

# CORRESPONDENCE.

## Great Britain.

London, February 15.—That it is the Englishman's privilege to grumble is a hackneyed phrase, but the recent increase in electrically operated trains seems to have enabled a perfection of this propensity to a somewhat remarkable extent. At first blush it may appear unreasonable, although on further consideration there is no doubt some justification. The first complaint which is being seriously made in connection with the electric trains on the hitherto steam railways is that there is only one class of passenger coach. Probably in few countries is class distinction so severe as in England, and especially in London, and really it appears to be inevitable when the conditions are taken into consideration. Many a city clerk is willing to pay a little extra for a second-class seat in order to steer clear of the genus British workingman, whose main delight is to spoil the other man's better suit of clothes by rubbing up against him and leaving a good deposit of lime or grease, as the case may be. Then, again, on those lines where trains do not run solely in tunnel, such as the Northeastern and the Metropolitan, the usual comfortable run down to the city in the morning is being spoiled by the new condition of things, for out in the open country the new type of corridor carriage is not a model of comfort, and the constant opening of the iron trelliswork doors with as much clanging as possible, and the consequent incessant drafts of cold air, is having a tendency to frighten those whom we regard here as of the "older school" from traveling by the new trains. The prospect is certainly not cheering from the point of view of those who live some distance out of town, but no doubt the powers that be will meet the difficulties raised in the right spirit.

While on the question of electric traction, mention may be made of a new monorail system which is just now receiving lengthy notices in the newspapers. At present the system has only reached the model stage, but it is intended to make application to Parliament next session for building a railway line from London to Brighton upon this system. There are two overhead rails, one above the other, the car running between them, with wheels both top and bottom. Current is to be collected from the top rail, and the bottom one is to be used as the return, the supports being placed 50 feet apart. As a matter of fact, many of the engineering details either have not yet been worked out, or else the promoters of the scheme have not seen fit to divulge them. It is stated, however, that all the necessary money for the promotion and completion of the scheme above mentioned has been guaranteed by a group of American financiers. The idea is to run the 50 miles between London and Brighton in half in hour, and to maintain a five-minute service. In view of what has happened to the monorail line which was sanctioned some years ago between Liverpool and Manchester, it is to be doubted whether anyone here will take the scheme too seriously for the present. Two proposals for a similar line from London to Brighton have already failed.

An interesting statement has recently been issued by the National Telephone Company, which purports to show the increase in the number of instruments on its systems in certain of the towns which have a municipal telephone service, as compared with the number of instruments connected to the municipal exchanges in each case. Thus in Glasgow it appears that during the year ended December 31, 1904, the National company's instruments have increased by 5,209, as against 1,504 for the corporations; at Swansea the figures are 702, against 488 and at Portsmouth 981 against 553, in favor of the company.

The troubles of the Dublin corporation in connection with the new generating station at Pigeon House Fort are not yet over. Having satisfactorily settled their differences with the consulting engineer for the time being, an application was made to the Local Government Board for sanction to borrow certain sums of money for necessary extensions of the plant to meet the increase of load. After holding an inquiry, the Local Government Board has communicated with the corporation to the effect that it is not satisfied that the corporation is in possession of clear information as to what is necessary at the generating station to convert the scheme into a successful undertaking. It is further stated that unless very careful management is maintained it will be impossible to prevent an annual loss in the working of the undertaking or to reduce the present average sale price of 4½d. per unit to the more moderate figures that are charged for electric supply in other places.

Mr. J. Allan Baker, the chairman of the highways committee of the London County Council, has just published an interesting comparative statement concerning the conduit tramways in London and New York, as a result of his recent visit to the States. First pointing out the great difference in the mileage open, viz., over 200 miles in New York and under 50 in London, he gives figures to show that the cost of construction was 50 per cent. higher in New York, owing to the excavation work in rock that had to be carried out; the average earnings in New York are 30 per cent. higher; the operating costs per mile are about the same; the cost of power station and sub-stations per mile about the same; average cost [illegible]

## New York.

New York, [illegible] lighting plant. No definite location has been selected, but a [illegible] purchase the land privately.

It is estimated that 9,000 incandescent lamps are in use for advertising purposes [illegible] the theater district. In the district between Eighth and Fifty-ninth streets and from river to river there are probably 30,000 lamps burnt nightly for advertising purposes, mainly used on about 200 large signs. The expense for current for these signs is not inconsiderable.

Citizens of Wave Crest, Far Rockaway, L. I., which is included within the limits of Greater New York, have grown impatient at the delays in establishing public lighting in their section. They have accordingly organized themselves for the purpose of putting in an electrical plant at their own expense. The Wave Crest summer colony includes many very prominent New Yorkers.

The New York Club, Fifth Avenue and Thirty-fifth Street, has abandoned its private lighting plant and now takes current from the Edison mains.

A large contract, which includes 1,200 incandescent lamps, elevators and an electric pump, has been given out in connection with a new 12-story apartment hotel at 17-19 East Twenty-seventh Street.

The Simplex Electric Heating Company has received an order for 133 electric curling-iron heaters for use in the dressing rooms of the new Thompson & Dundy Hippodrome. A number of these heaters have been in use in the New Lyceum Theater in this city for some time and have apparently given satisfaction to the ladies.

The electrical plant of the Brooklyn Daily Eagle was visited on Thursday by the members of the American Newspaper Publishers' Association, who came from all parts of the United States, and were hospitably lunched. The Eagle's electrical equipment —recently fully described in the Western Electrician —is under the charge of a Chicago man, Charles F. Hart, formerly of the Record-Herald. The visitors included G. A. E. Kohler of Kohler Bros., contracting electrical engineers of Chicago.

A commencement has been made with the work of laying the power rail on certain parts of the Long Island railroad and several miles of track have been fitted up with circuit connections at the track rail joints. The first electric trains to run over the system will be on the Atlantic Avenue division. Electric traffic over a portion of the line is promised in June.

William J. Hammer, consulting electrical engineer, is now transacting most of his business at his laboratory, 153 West Forty-sixth Street, but he still maintains his old office at 26 Cortlandt Street.

The rapid-transit committee considered today the pros and cons for as many as 25 different subway schemes affecting Greater New York. The result of its deliberations had not been made public when this communication left New York.

Plans are being considered for the enlargement of all the platforms of the subway stations in order to allow of longer trains being used during the rush hours. The platforms at the local stations are now 200 feet long and accommodate five or six cars, but it is proposed to lengthen them for eight or 10-car trains.

The extension of the subway along Lower Broadway to South Ferry is promised to be in working order by June 1st. Trains will probably run through the Hudson River Tunnel to Brooklyn a few weeks later, some experimental trains having been already run through the submarine tubes. The southerly terminus of the subway is at present at Fulton Street, which, although in use, is only partially completed. There is to be seen here a remarkable ramification of every kind and size of cable—power, telephone and telegraph. The cables are hanging down beneath the roadway like grotesque spider webs, and here and there they are caught up with old bits of rope.

L. K. Comstock & Co. have been assigned the contract for wiring and fitting a large new studio building adjoining the Sixty-seventh Street studio, near Eighth Avenue. The A. B. C. Electric Elevator Company has also a contract for the same building, which, with its neighbor, is owned by an association of New York artists. D. W. W.

## Dominion of Canada.

Ottawa, Ont., February 25.—The lighting committee will recommend to the City Council of Kingston, Ont., that the electric-light rates be reduced from 14 cents to 12 cents per kilowatt on and after the 1st of July next. Kingston's rates are probably the highest in Canada, and in view of the fact that the city now owns the plant the people are clamoring for lower rates. The question whether the city will continue to furnish power to the street-railway company has to be considered before March 6th, when the agreement with the company

expires. At present the city is supplying power to the company below cost.

The citizens of Morrisburg will soon have to decide upon what concessions are to be made to the Canada Steel and Tin Plate Company. The Dominion government has passed an order granting the corporation the right to develop 1,100 horsepower in the Williamsburg Canal, and a by-law is to be voted on. If this by-law carries it will authorize the Town Council to borrow $76,100 to be used for electric-development purposes as follows: Thirty thousand dollars to the government for developing the waterpower, $38,750 for electrical machinery, $5,100 for transformers, and $2,250 for land. The concessions demanded by the company are 700 electric horsepower, free water and exemption from taxation. The company will buy from the town the surplus electric power, estimated at from 400 to 500 horsepower, at $12.50 per horsepower.

A big project to develop the waterpower of Grand Falls, New Brunswick, has been laid before the government of that province. The capitalists interested in the proposed enterprise are those comprising the Electric Manganese Company and include B. E. Kingman of New York and Fred Sayles of Providence, R. I. The project includes the manufacture of ferro manganese at the falls and the operation of big pulp, paper and sawmills, the operation of an international railway by electricity and the transmission of electric power to St. John River Valley to be sold for use in lighting and manufacturing along the line as far as the city of St. John. It is estimated that the project will involve an expenditure of from $3,000,000 to $4,000,000.

W.

## Southeastern States.

Charlotte, N. C., February 25.—It is given out that the United Railways and Electric Company of Baltimore, Md., has under consideration the expenditure of $1,500,000 for improvements in the next five to 10 years.

The House committee on interstate and foreign commerce at Washington, D. C., has authorized a favorable report on an amended bill granting to Captain Fels the authority to construct a lighthouse on Diamond Shoals, Cape Hatteras, N. C. The amount which the government is to pay for the light after it has stood for five years is increased from $590,000 to $750,000.

The Norfolk (Va.) Railway and Light Company is endeavoring to secure a franchise to build an electric railway to Elizabeth City, N. C., from Norfolk. It is first proposed to build the Elizabeth City line and then make the extension to Norfolk.

The town of Dallas, N. C., has requested the state Legislature to give the right to issue $5,000 in bonds for the construction of an electric-light plant in that town.

Representatives of the Lockwood-Greene Company of Boston and of the Westinghouse company have visited Parr Shoals, near Newberry, S. C., where a 25,000-horsepower development will be carried out. The work will represent an outlay of $1,500,000. Work is expected to begin in the spring.

The receivers of the Hampton Roads (Va.) railway have asked for additional certificates to meet pressing claims and for improving the road. The amount asked, it is said, is from $60,000 to $75,000.

L.

## Ohio.

Cleveland, February 25.—A Cleveland syndicate, closely allied with the Lake Shore Electric Railway Company, has apparently purchased the Lorain street railway, Lorain, which, it is said, will be operated in connection with the former. Besides the lines in the town the road extends to South Lorain and Elyria over a private right-of-way. It is the intention of the syndicate to build a line five miles in length from South Lorain to Avon Beach.

Trouble overtook the Springfield, Charleston, Washington C. H. and Chillicothe Traction Company of Springfield a few days ago when liens aggregating nearly $50,000 were filed against it. The Springfield-Xenia Traction Company shut off the power when the liens were filed, but finally the current was turned on again. It is reported that the Springfield-Xenia company may acquire the property and complete it.

The capital stock of the Brilliant Electric Company of Cleveland has been increased from $75,000 to $125,000.

An increase in capital stock from $100,000 to $150,000 has been made by the Washington Gas and Electric Company of Washington C. H.

Postoffice inspectors have been going over the ground between Lima and Dayton within the last week with a view to introducing a trolley mail service. The Dayton and Troy, Western Ohio and the Van Wert and Lima division of the Fort Wayne, Van Wert and Lima were all examined. It is said that the trolley companies made a favorable proposition, including the delivery of mail to the postoffices at points touched. A special schedule would be provided for mail cars so that the service would be of the best at first.

The arrangements for the reorganization of the Columbus, Delaware and Marion Electric Railway Company have been completed, the preferred stock being retired and exchanged for the new 40-year bonds of the Columbus, Delaware and Marion Railroad Company, which was organized to take over this road, the Marion Railway, Light and Power Company and the Columbus Northern Railway, Power and Equipment Company.

The Yost Electric Manufacturing Company of Toledo has been incorporated with a capital stock of $200,000 by J. S. Lauer, J. M. Bour, W. E. Jacoby, E. Thirwech and F. H. Chapman.

It is said that the organization of the Miami Transit, Light and Power Company will insure an air line between Cincinnati and Springfield. The incorporators are residents of towns along the proposed line and it is rumored that the owners of the Interurban Railway and Terminal Company of Cincinnati, operating the rapid-transit line to Lebanon, are also interested. This would form a link between Cincinnati and Xenia, with the remainder of the line between Lebanon and Xenia completed. From there to Springfield the Springfield and Xenia line is already in operation.

Arrangements have been completed between the Lake Shore Electric and the Northern Ohio Traction and Light Company and the Detroit United Railway Company by which tickets will be sold to any point on these lines or the connecting lines at Detroit. The connection between the Lake Shore and the Detroit United will be over the Detroit and Toledo Short Line. It is said that arrangements will in all probability be completed with other roads in the near future for interline business. The Lake Shore has had a satisfactory experience with this business so far and expects it to be of mutual advantage.

O. M. C.

## Indiana.

Indianapolis, February 25.—There is considerable evidence of activity in Northeastern Indiana among electric-railway companies, indicating a busy summer. The Toledo and Chicago Interurban Railway Company, which is backed by the Seagraves syndicate, is making an effort to further its electric-railway interests to the south, entering Fort Wayne as an extension of the line as it reaches Waterloo. During the week this syndicate secured a franchise for 40 years to operate in the streets of Auburn and agrees to have cars running by August 1, 1906. This syndicate is constructing an interurban line to form connection from Toledo to Chicago, touching Butler, Waterloo, Albion, Garrett, Kendalville and other towns. The Toledo and Western and the Toledo and Chicago Interurban Railway Company are two distinct companies and have no connection with each other except that it is the purpose to connect at Alvordton with a view of interchange of business.

The Indianapolis and Northwestern Traction Company has procured a site in Crawfordsville upon which to build a modern passenger and freight station. By means of a spur the freight cars will be run to the rear of the building and directly into the freight department.

Word comes from Southern Indiana that an electric line from Cincinnati to Louisville through Southern Indiana and Jeffersonville, over the Big Four Bridge, is now said to be a certainty. A year ago the Cincinnati and Louisville Traction Company was organized to construct the road, but little was done up to last week, when a meeting was held in Jeffersonville and steps taken to put the road through without delay. The route selected will parallel the Ohio River almost the entire distance, running between the big hills near Madison and the river. The length of the line will be 100 miles.

At a meeting of the officials of the Consolidated Traction Company it was decided to use the third-rail system on its line now building between Indianapolis and Crawfordsville. The grading is about all done and track-laying will begin with the advent of suitable weather. This link is only a part of the system, as it is the intention to extend the line from Crawfordsville to Danville, Ill. The power house will be constructed in Crawfordsville.

It has been disclosed that a Philadelphia syndicate, presumably the Elkins-Widener combination, which is largely interested in traction and electric systems in Indianapolis and Fort Wayne, is negotiating for the purchase and merging of the Chicago and South Shore Railway Company, which owns and operates an interurban line between Laporte and Michigan City, now in a receiver's hands; the Lake Cities Electric Company at Michigan City, the Michigan Traction Company and the Laporte Electric Company, which owns the electric plant and hot-water system. James and Charles Murdock of Lafayette are interested in the amalgamation.

A movement is on foot at Columbus to build a union station at that point to be used jointly by steam and electric railways.

The Legislature has passed bills relating to electric railways as follows: To prohibit county commissioners from granting franchises on county roads to railroads and interurban companies; to enable street-railway companies to increase their maximum number of directors from seven to 15; to give hydraulic companies power to purchase electric-light companies; removing obstacles in the way of street and electrical railroad companies owning and operating electric-light, gas, steam-heating and power plants in towns and cities with less than 30,000 inhabitants; providing for a general system of track elevation in Indianapolis and Fort Wayne.

The Wabash steam railroad has announced its intention to fight traction lines that parallel its route for the passenger business to the county seats. The road has seven trains a day each way through Logansport, Peru, Wabash, Huntington and Fort Wayne, and has cut under the rates of the traction lines on round-trip and two-trip tickets.

The Toledo, Fort Wayne and Chicago Electric Railway Company has filed articles of incorporation. The company proposes to construct an electric railway through Allen and DeKalb counties, connecting Fort Wayne, Garrett, Auburn, Butler, Huntertown and Waterloo. F. H. Frochlech, John White, G. E. Cummings, W. H. Edwards, J. S. Clark and D. A. Prosser are the incorporators.

S. S.

## Michigan.

Detroit, February 25.—The employes of the Detroit United Railways instead of resorting to a strike for a raise in wages to 25 cents an hour have left the matter in the hands of their business agent, J. B. Cunningham, and the secretary of their association, Charles H. Johnson.

The proposed ordinance ordering all Detroit telephone, telegraph and electric-light wires placed underground within the mile circle has been amended somewhat as relates to certain streets. It has also received a setback by estimates from the police, public-lighting and fire commissions showing that the cost to the city to conform with this regulation will be considerable.

The Bay City council has granted a franchise to the city of West Bay City to do commercial lighting in Bay City. The West Side commercial plant will thus obtain the commercial-lighting franchise for both cities, which are soon to be consolidated.

It is understood that the St. Joseph Traction Company, which was originally organized to connect Benton Harbor with Niles and Dowagiac, will extend north from Benton Harbor to Kalamazoo, with a spur to Sister Lakes. The length of the line from Benton Harbor to Kalamazoo will be about 50 miles and will run through a rich farming country heretofore untouched by any railroad. This will make the St. Joseph Traction Company one of the largest street-car systems in the western portion of the state.

Hopkins Station is making plans to have installed an electric-light plant. W. F. Nicoli has been consulting experts at Grand Rapids and has plans perfected for establishing a gasoline engine to furnish energy for 300 lamps to start with.

The property owners and business men generally of Detroit are asking to have the tower lights discontinued and mast-arm lights put up in their stead.

It is understood that the Edison Sault Electric Company will build a plant at Sault Ste. Marie which will rival the Michigan Lake Superior Power Company's plant and will have more than 3,000 horsepower to start with. Alex Dow of Detroit is at the head of this new company and plans are being drawn for the construction of it as soon as snow leaves the ground and buildings can be started. The plant will be located on the St. Mary's Rapids, and it is intended to develop all the power possible from the rapids, and probably over $100,000 will be invested in the undertaking.

The Greusel bill providing for the municipal ownership of street railways will be given a hearing in the Michigan Legislature on March 20th.

The general manager of the Detroit, Ypsilanti, Ann Arbor and Jackson suburban line has advised the Ypsilanti Business Men's Association that the Saline division of the road will be extended to Adrian and the power station at Ypsilanti enlarged.

The Detroit United railway is to put on an automatic speed controller which will prevent the motorman from shoving the handle around six points at once on starting the car and thereby burning out the fuse. It is expected that 50 cars will be equipped with this improved apparatus at once.

C. G. W.

## Northwestern States.

Minneapolis, February 25.—The Twin City Rapid Transit Company has secured the withdrawal of Messrs. Phelps and Kenaston of Minneapolis, who were granted a franchise for a trolley line at Excelsior, Minn., and the former company has now been granted a franchise. Work will be started on the new line from Minneapolis to Excelsior soon, and it is expected that the line will be completed by July. Most of the right-of-way has already been secured and the company has given a bond to have the work completed by August.

The Telephone and Electric Light Company of Granville, N. D., has decided to incorporate with $10,000 capital.

An electric-light company is being organized at Creston, Iowa, and a franchise will be asked for at the spring election. If granted, an electric-light plant will be erected without delay.

The electric-light plant at South Stillwater, Minn., has been damaged by fire to the extent of about $6,000. It was fully insured and will be reconstructed at once.

W. D. Rowe and others have incorporated as the Watertown Transportation Company, which will build a trolley line from Watertown, S. D., to Lake Kampeska. The company is capitalized at $100,000.

W. J. Annon has resigned as superintendent of the Anoka (Minn.) Waterworks, Electric Light and

Power Company to accept an appointment as postmaster of that city.

The Milwaukee Heat, Light and Traction Company has increased its capital from $500,000 to $1,000,000. Most of the increase will be used for improvements.

The Wisconsin Light and Power Company has accepted the franchise recently granted it at La Crosse, Wis.

Steps are being taken looking to the construction of a big electric power plant at Taylors Falls, Wis. The scheme is to build a large dam across the St. Croix River at that point and to transmit power to the Twin Cities.

The Citizens' Railway Company of Lincoln, Neb., will be incorporated and if a franchise can be secured a street-car line will be built at once. It is proposed to buy the old Home street railway franchise. R.

## Rocky Mountain States.

Salt Lake City, February 23.—The Utah Light and Railway Company has recently made application to the City Council of Salt Lake City for a 50-year extension of its franchise, although it will be 42 years before the present franchise expires. Samuel Newhouse, a large mine owner, submitted a counter proposition in which he stated that if given a franchise he would guarantee to furnish better light at from 25 to 30 per cent. lower than the rate now charged by the lighting company. Mr. Newhouse has deposited a certified check for $10,000 as evidence of good faith, and announced that he will expend from $500,000 to $1,000,000 on his proposed steam-power plant.

Electrical equipment for its plant has been ordered by the Shoshone Falls (Idaho) Power Company.

A special election has been called by the City Council of Missoula, Mont., at which the citizens will vote on the proposed granting of an electric-railway franchise, petitioned for by J. R. Wharton of Butte.

W. E. Pierce has applied to the City Council at Boise, Idaho, for a franchise to construct and maintain an electric railway in Boise. Mr. Pierce states that his company proposes to build a line down the valley, and the line in Boise will be part of the main project.

It is reported that the Southern Pacific Railroad Company is soon to erect an electric power plant at Carlin, Nev. It is understood that the plant is to be one of several that will be installed along the railroad between Ogden, Utah, and San Francisco.

W. E. Pierce, promoter of the proposed interurban electric railway between Boise, Idaho, and neighboring cities, recently announced that active work would be commenced in the near future, and that within 12 months the entire system would be in operation. G.

## Pacific Slope.

San Francisco, February 24.—Bids will be received by the Culiacan Electric Company, 303 California Street, San Francisco, for a three-phase generator and other equipment for an electric-lighting plant at Culiacan, Mexico. This company has secured concessions from the Mexican government for telephone lines and for electric railways. Practically all of the equipment and supplies for the improvements will be purchased in the United States.

The National Electric Company of Milwaukee has been awarded contracts by the Nevada Power, Mining and Milling Company of San Francisco for furnishing two three-phase generators for the new electric power plant to be erected by the latter company at Bishop, Cal., for transmission of electrical current to Goldfield and Tonopah, Nev.

The new machinery for the Monterey County Gas and Electric Company's plant at Salinas, Cal., is expected to arrive in the near future. The equipment will consist of two 250-horsepower boilers and two 200-horsepower Corliss engines; also two 150-kilowatt National alternators of the revolving-field type.

The Alert Fire Company of Cloverdale, Cal., has taken up the matter of installing an electric fire-alarm system in that town, and a committee has been appointed, consisting of Walter Crigler and E. E. Gibbons, to ascertain the cost of the system.

The Mitchell Mining Company of Los Angeles, Cal., operating copper properties at La Dicha, state of Guerrero, Mexico, is developing power from the Papagallo River for an electric plant to furnish light for the town and mines at La Dicha. George Mitchell of Los Angeles is president and treasurer of the company.

The Walker River Electric Company has been incorporated at Bodie, Cal., with a capital stock of $20,000. The incorporators are Arthur Cohn, Charles Day, Will Reading and others.

The foundation is being laid for the 150-foot tower which the Bay Counties Power Company proposes to build at the corner of William and Third Streets, Sacramento, Cal. The tower is planned to support one end of the electric cable that will be suspended across the Sacramento River. The second tower will be constructed soon.

The Battle Creek Power Company is preparing to construct a power line at Gridley, Cal.

Dalton & Everleigh are preparing plans for the new sub-station to be erected at Eburne, B. C., at a cost of $30,000. [illegible] a capacity of 1,000 horsepower. [illegible] of copper wire has been ordered [illegible]

The Petaluma and Santa Rosa Railway Company has awarded a contract to [illegible] for the construction of the electric road from [illegible] to Forestville, Cal. Work will be commenced at once.

A meeting of citizens of [illegible] and Menlo Park, Cal., was held at the latter place recently for the purpose of devising means to establish an electric lighting system. John McBain and [illegible] O'Keefe were appointed a committee to [illegible] the feasibility of the plan.

The promoters of the Spokane and Inland electric railway have closed a contract with M. D. Wright for 250,000 ties, to be used in the construction of the line between Spokane, Wash., and Moscow, Idaho. A.

## PERSONAL.

W. Stanley Bruen has been appointed manager of the electric-lighting plant at Hoosick Falls, N. Y.

H. C. Hutchison, for some years connected with the Cincinnati Gas and Electric Company, has accepted the position of eastern representative of the Philip Carey Manufacturing Company, with headquarters at Buffalo.

Comfort Avery Adams of Cambridge, Mass., Fred Atwood Jones of Houston, Texas, and Alfred Lewis Kenyon of Lima, Peru, were transferred from associate to full membership at last week's meeting of the American Institute of Electrical Engineers.

A private message from West Orange, N. J., states that Thomas A. Edison is better. Until last week he had been confined to his house, but he is now able to visit his laboratory, and is expected to be entirely recovered from the effects of his recent operation in a few weeks.

Charles W. Cross, M. E., E. E., formerly of the Roberts & Abbott Company, consulting engineer of Cleveland, and later electrical engineer for the Eastern Ohio Traction Company, has entered the employment of the Crocker-Wheeler Company of Ampere, N. J., and is attached to the Cleveland office of the company.

President William R. Harper of the University of Chicago submitted himself to a surgical operation last week, which revealed the existence of cancer of the colon, too far advanced to be removed. X-ray treatment has been suggested and may be tried. Dr. Harper bears himself with manly fortitude in his great affliction and is the recipient of widespread sympathy.

Norton P. Otis, chairman of the board of directors of the Otis Elevator Company, died at his home in Hudson Terrace, Yonkers, N. Y., on February 20th. He was born 65 years ago in Halifax, Vt. His father, Elisha G. Otis, was the inventor of the Otis elevator. After the death of the elder Otis, Norton and Charles took the elevator factory established by their father, and, by the aid of several safety devices which they conceived, developed the present large business. At the time of his death Mr. Otis was a member of Congress from the 19th New York District. He was a member of the Engineers' Club of New York city and many other clubs and societies.

Friends of Mr. J. B. Cowen, who for eight years has been prominently identified with the General Incandescent Arc Light Company of New York, will be interested to know that Mr. Cowen will sever his connection with that company on April 1st. Mr. Cowen's experience has been a most extensive one not only in electrical manufacturing but in central-station practice as well. In 1897-1899 he was superintendent of the West Madison Street station of the Chicago Edison Company and since that time has been New York district sales manager of the G. I. company and also export manager, assistant general sales manager and manager of the publication department of the same company. Mr. Cowen is an accomplished linguist, speaking and reading French, German and Spanish as well as English. He is also familiar with newspaper and magazine work. While his plans for the future are somewhat undecided, he will probably accept an eastern connection that will permit him to retain his residence in New York.

William Birch Rankine, second vice-president of the Niagara Falls Power Company, and Miss Annette Kittredge Norton were married in St. Peter's Church, Niagara Falls, N. Y., on February 23d by Rev. Philip W. Mosher, assisted by Right Rev. William D. Walker, bishop of Western New York. The bride is a daughter of Mrs. Edward Kingsley Norton of Niagara Falls, formerly of Detroit. Her bridesmaids were Miss Ernestine Tappey of Detroit and Miss May Newport of St. Paul. The ushers were Richard F. Rankine, DeLancey Rankine, Richard P. Meek, Reginald F. Meek, Augustus G. Porter, Henry B. Bodine, Hugh A. Irvine and Max Mauran. The page of honor was Master W. Pertle Herod of New York city. Mr. and Mrs. Rankine will reside on Buffalo Avenue, Niagara Falls. Mr. Rankine is an officer or director of a large number of electrical companies, including the Niagara Development Company, Niagara Junction Railway, Niagara [illegible]

George R. Metcalfe, electrical editor of the Street Railway Review, has resigned to become editor of [illegible]

Edwin H. Smythe, [illegible] Western Electric Company, [illegible] associated with the firm of Rector & Hibben, patent lawyers, in Chicago. Mr. Smythe has been engaged in the electrical business for the last 14 years, having served in the engineering departments of the Chicago Telephone Company, the Central Union Telephone Company and the Western Electric Company. His active participation in patent work dates back five years, during which time he has had experience in all branches of the business, including invention, the soliciting of patents, litigation and the giving of expert testimony. In connection with his new employment Mr. Smythe expects to take up the study of law. He is a young man of unusual capability, yet modest withal and greatly liked by all who know him.

EDWIN H. SMYTHE

## ELECTRIC LIGHTING.

A new electric-light plant is being established in the City Hall at Kansas City, Mo.

A recent fire in Carlisle, Ky., did $10,000 damage to the plant of the Citizens' Electric Light and Power Company.

The Stillwater Gas and Electric Light Company contemplates installing a new system of street lighting in Stillwater, Minn.

Correspondence is invited by the city of Shelbyville, Tenn., looking to the installation of an electric-light plant by the city.

The Algiers (La.) Waterworks and Electric Light Company will extend its system, it is said, so as to furnish electric light to Gretna, La.

The Nebraska Lighting Company has decided to expend $25,000 for improvements in its gas and electric-light plant at Plattsmouth, Neb.

Improvements amounting to $50,000 are contemplated by the Texarkana Gas and Electric Light Company to the system in Texarkana, Ark.

It is reported that the establishment of an electric-light plant at Fort Worth, Texas, is contemplated by E. G. Bruckman of G. H. Walbridge & Co., New York city.

The Watkins (N. Y.) Consolidated Gas and Electric Light Company has been placed in the hands of a receiver. The receiver is Senator Cassidy of Montour Falls.

The C. C. Henderson Electric Light and Power Company will establish a plant in Greenville, Ala., having secured a franchise from the city. A $15,000 power house will be built.

A company is being formed at Aguilar, Colo., to construct an electric-light plant in that city. A. R. Lindsey, Morris Pitti, H. Pinamonti and A. B. Harbison are said to be interested.

The Consumers' Gas and Electric Company of Decatur, Ill., has been incorporated with a capital of $50,000 to manufacture light, heat and power. The incorporators are W. M. Bering, Charles S. Needham and James M. Gray.

With the opening of spring the Rockford Edison Company contemplates a large number of extensions. Besides the purchase of additional machinery, two boilers of 500 horsepower each will soon be placed in position. It is estimated the cost of improvements will amount to about $15,000.

Organization of the Lawrenceburg (Ky.) Electric Light Company has been completed by the election of officers as follows: President, J. M. Johnson; vice-president, E. W. Ripy; secretary, C. A. Leathers; treasurer, R. S. Collins. An electric-light plant will be installed by the company at once.

The Lee Electric Light Company of Clarinda, Iowa, has been organized to take over the copartnership of the Lee Electric Light Company, formed by Lee Brothers. The company will need a 100-horsepower high-pressure return-tubular boiler, a

simple or compound Corliss engine for direct connection to a two-phase alternator and a 100 or 150-kilowatt two-phase 60-cycle 2,000-volt alternator.

The Taylorville (Ill.) Gas Company has bought the stock of the Taylorville Electric Company, and the corporate name of the new company will be the Taylorville Gas and Electric Company, with a capital stock of $127,500. For the present, at least, J. N. C. Shumway, who has been the manager of the Taylorville Electric Company, will be manager for the new corporation.

The Yoe, Windsor and Dallastown Electric Light Companies has been incorporated in Pennsylvania. The incorporators and directors are Eli S. Nissly, Florin, Pa.; George R. Heisey, Lancaster, Pa.; E. R. Heisey, Dallastown, Pa. The object is to furnish Dallastown, Yoe, Red Lion and the surrounding territories with light, heat and power by electricity generated at Red Lion, Pa.

The Missouri-Edison Electric Company and the Union Electric Light and Power Company of St. Louis had a legal right to consolidate, according to the decision of Judge Pollock of the United States Circuit Court. The opinion was given on a demurrer presented by the companies in the suit of Morgan Jones against the Missouri-Edison Company in which he sought to prevent the company from consolidating with the Union company. Mr. Jones was a stockholder, but despite his efforts to prevent it a merger was effected September 9, 1903.

## ELECTRIC RAILWAYS.

Rails for the DeKalb and Rockford electric railway have arrived at Elgin, Ill. As soon as the weather permits, the contractors expect to rush the work as far as Maple Park.

The franchise of the Vandergrift Construction Company of Philadelphia to build a $3,000,000 electric road from San Juan to Ponce is said to have been revoked by the executive council of Porto Rico.

It is said that contracts have been awarded for the construction of the Lima, Findlay and Fort Wayne road, connecting Lima, Ohio, and Fort Wayne, Ind. This line will complete the line of the Western Ohio from Lima to Findlay.

The City Council of Watseka, Ill., has granted a 20-year franchise for the use of its streets to the Watseka and Kankakee Electric Traction Company, which company is projecting an electric railway to extend from Watseka to Kankakee, Ill.

The Winnipeg (Man.) Electric Street Railway Company has been making important additions to its buildings and equipment. A 50-ton crane has been provided for handling the machinery. New boilers, engines and generators have been installed.

The Michigan Traction Company has let the contract for the construction of two buildings, on property recently bought in Kalamazoo, one a three-story office building and clubrooms for the company and the other a brick freight house, 25 by 65 feet.

The Brooklyn Rapid Transit Company is about to order 200 new surface cars. The cars will be larger than any surface cars hitherto used in Brooklyn, being 42 feet in length, and seating 48 passengers. They will be of the convertible type, with four-motor equipment.

The management of the Washington Water Power Company of Spokane announces that its electric railway to Medical Lake will be in operation early in July, and that 10 miles of the proposed route to Palouse will probably be completed about a month later. Terminal yards and passenger station for the two lines will be located on an island near Spokane.

## AUTOMOBILES.

A destructive fire last week at Long Acre, the center of the motor-car and carriage industry of London, England, resulted in damage estimated at $1,250,000. Hundreds of automobiles which had just been returned from the exhibition which had just closed were destroyed.

The Cycle Dealers' Association and the Motor Trade Union of Copenhagen, co-operating with the manufacturers, wholesale dealers and others engaged in the trade, have arranged for an international exhibition of automobiles, bicycles, motor cycles and motor boats to be held in the spacious "Tivoli Gardens," Copenhagen, the coming spring. The automobile has been adopted by the Danish government for delivering mail throughout the country wherever stage coaches are now in use.

## PUBLICATIONS.

A street-lighting system making use of Nernst lamps is in operation at Sewickley, Pa., and the Nernst Lamp Company has issued a little illustrated pamphlet describing this system.

Two advertising cards of handsome design are being distributed by the National Electric Company of Milwaukee, one showing a motor and trail car of the most up-to-date design for high-speed operation on the lines of the Birmingham (Ala.) railway system and fitted with Christensen air brakes and the other illustrating two 300-kilowatt National direct-current generators installed for the St. Joseph Lead Company at Bonne Terre, Mo.

A neat little pamphlet containing the constitution and by-laws of the American Railway Mechanical and Electrical Association has been issued which contains also a list of the active and junior members of the organization.

"Doing Things Easily and Quickly in the Office" is the title of what appears to be the first of a series of pamphlets on this subject written by Jonathan A. Rawson, Jr. The first number is devoted to the telephone, showing how to use it with the greatest convenience, describing various makes of brackets, desk attachments, telephone pads, indexes, etc. The pamphlet is interesting reading and gives many hints which will be found of benefit to the office man.

Kaisling Protectors for use on telephone switchboards are described in a well-designed catalogue from the American Electric Fuse Company of Chicago. The protector pairs for use on the main distributing frames are grouped together in banks of 20 or 25 lines, each bank forming a separate unit. These units are illustrated in the catalogue, which shows the method of mounting on the frame. Kaisling self-soldering heat coils are given their fair share of attention and the Kaisling test plug and individual protector are also mentioned. "The Same Old Things, also Some New Ones," is the title of another publication distributed by the same company devoted to its general products, including mica fuses, combined fuse blocks and cut-outs, line fuses, cable heads and a great variety of other apparatus of this sort.

Catalogues from the Allis-Chalmers Company are high-grade, like the products described. The recent one entitled "Reynolds Corliss Engines," is no exception. It is finely printed on a high grade of paper and the cuts are remarkably clear. The engines described were designed and constructed under the direction of Mr. Edwin Reynolds, well known from his connection for many years with the manufacture of automatic cut-off engines. The catalogue is divided under four heads, viz., "Standard Engines," "Reynolds Horizontal-vertical Engines," "Direct-connected Engines" and "Rolling-mill Engines." Under the second class are described the well-known monster engines, of which the "Big Reliable" at the St. Louis Exposition was a type. Fine illustrations of this engine and the Manhattan type are shown. Not much is said in the catalogue about the various engines, but a look at the illustrations showing their symmetry and massive proportions speaks more than printed words. In general three distinct types of engines are made by the company—the heavy-duty type, Reliance type and girder-frame engines. The valve gear used is of a type introduced in substantially its present form 29 years ago, though improvements have been made to the details of its construction by the inventor, Mr. Reynolds.

## SOCIETIES AND SCHOOLS.

The Young Men's Christian Association of Evanston, Ill., has instituted a course in experimental electricity. Members of the junior department are also eligible to membership.

The Jury of Awards of the St. Louis Exposition awarded the National Electric Light Association a gold medal for its publications and its work in advancement of the electric-lighting industry.

The executive committee of the International Association of Municipal Electricians has named Erie, Pa., and August 29th, 30th and 31st as the place and date of the next convention of the association.

The Armour Institute of Technology has recently received a full line of samples of conduits from the Fiber Conduit Company of Orangeburg, N. Y. These samples, representing the various kinds of conduits used in telephone work, have been placed in the telephone laboratory of the Institute.

The data asked for by the National Electric Light Association, to be used for the annual revision of its municipal lighting statistics, are being returned this year with unusual promptness. This is one of the most useful publications of the association, and every year shows a growing disposition on the part of electric-light companies to do their share toward keeping it accurate and up to date.

Mr. Homer E. Niesz, the editor of the question box of the forthcoming National Electric Light convention, is now sending out in printed form the first list of questions, which is being sent to managers of plants, electrical manufacturers, dealers, technical colleges, etc. This list now contains 444 questions, covering 26 headings. Answers are desired from all interested and should be sent in within 30 days.

## MISCELLANEOUS.

By a decision of the Illinois Supreme Court the Chicago Union Traction Company must either proceed at once to lower the Van Buren Street tunnel under the Chicago River or appeal to the Supreme Court of the United States. The decision is rendered on an appeal by the traction companies from the Appellate Court, which held that the position of the city in its mandamus petition to compel the lowering of the tunnel was correct. The suit was brought originally by the city in July, 1900.

Mayor Wells of St. Louis in a letter addressed to petitioners who request him to be a candidate for renomination, among other things says: "If I shall be nominated and re-elected, I pledge myself to continue our policy of municipal ownership so far as is consistent with economy."

President A. G. Wheeler of the Illinois Tunnel Company estimates that the underground electric cars in Chicago will carry 3,000,000 tons of dirt and building material in the remainder of the current calendar year. The charge for hauling is 62½ cents a cubic yard. By the use of the tunnels the Northern Trust Company will be able to save four months' time at least on its proposed new structure. Without disturbing the tenants whose leases do not expire until May 1st, the foundations for the building are being put in. The foundations for the new addition to Marshall Field's store are also being laid with little disturbance to the present building.

At a meeting last June in Atlantic City of the American Society for Testing Materials a report was read upon "Protective Coatings for the Preservation of Iron and Steel" and it embodied the views of committee E of that body. Since that time the committee has been working along the lines stated in the report and the conclusions reached only emphasize the earlier statements of the committee. The further investigations were further crystallized at a recent meeting of the committee, when it was resolved that: "The sense of this committee is that standard methods of making service tests should be formulated and adopted in order that laboratory tests may become of real value in determining the efficiency of protective coatings." Sub-committees were also appointed to report on the various branches of the subject.

## TRADE NEWS.

Recent newspaper reports that the General Electric Company is to establish a branch at Albany, N. Y., to facilitate shipping by canal is declared by officials of the company to be without foundation.

The stockholders of the Menominee Electric Manufacturing Company of Menominee, Mich., whose plant was destroyed by fire recently, have decided, it is said, to accept an offer from the citizens of Marinette, Wis., and will locate their plant there.

The board of directors of the Barriett Electric Company of Cincinnati, Ohio, through Secretary L. K. Behrens, announces that the death of S. L. Barriett, president of the company, will in no way interfere with the carrying on of the business of the company. The factory is in active operation, orders being filled promptly, it is said.

H. S. Bush and H. M. Frazier have formed a partnership and will conduct an electrical supply and contracting business at 163 East Main Street, Lexington, Ky. Mr. Bush has for some years been an architect in Lexington. Mr. Frazier has conducted an electrical supply house for some years, and with the addition of Mr. Bush the business will extend its scope.

At the annual meeting of the Holt Electric Company of Carthage, Mo., the name of the corporation was changed to the Empire Electric Power and Supply Company. R. M. Holt has been succeeded as electrician by Robert Brown, for 12 years with the Southwest Missouri Electric Light Company. The officers are: President J. E. Lang; vice-president, Samuel McReynolds; secretary and treasurer, R. J. Claflin.

## BUSINESS.

The F. Bissell Company of Toledo, Ohio, says that the Security pole seat which it manufactures is being received with much favor. It is made of metal and is tested at 1,000 pounds.

Partrick, Carter & Wilkins, the well-known manufacturers of annunciators, bells and house goods, announce that in their new factory at Twenty-second and Wood Streets, Philadelphia, they have nearly doubled their space and facilities, and are well equipped to fill the increasing demand for their products. The firm was established in 1867.

"Klein" tools, manufactured by M. Klein & Sons, Chicago, are said to be all hand forged, made from selected tool steel by modern machinery and appliances, wherever such appliances can be utilized for economical production and where superiority in quality and finish is thereby attainable. The company will be pleased to mail its catalogue to those interested in its products.

The Cutler-Hammer Manufacturing Company of Milwaukee has received an order from the Northern Electrical Manufacturing Company of Madison, Wis., for 135 of its new type of machine-tool controllers, equipped with fuses and switch in conformity to the U. S. navy specifications. All of these controllers will be installed in the plant of the Winchester Repeating Arms Company. Although

this controller has been on the market but a few months, its sales have far exceeded the most sanguine expectations of the Cutler-Hammer Manufacturing Company.

The H. W. Johns-Manville Company of New York city is mailing a small pamphlet on Kearsarge flange-joint gaskets. The commendable features of these gaskets, according to the maker, are their ability to withstand the highest temperature and pressure; elasticity sufficient to compensate for expansion and contraction; in themselves they are not subject to expansion and contraction, due to temperature changes; they will maintain a tight joint against vibration of the line and will prevent leakage of steam or condensation. Another important product of the company is [illegible] tape cover-ing, which is described in a separate circular.

Two types of motors which the Westinghouse Electric and Manufacturing Company wishes to bring to the notice of the trade are type B bipolar motors for direct-current circuits and type K direct-current series-wound motors for crane work, etc., and two new bulletins have been issued devoted to these machines. The bulletins describe the motors accurately and show by numerous illustrations the various parts and the methods of mounting to which the motors are adapted. The type K machines represent the latest developments in machines of this [illegible] The [illegible] parts.

The Central [illegible] organization of its large supply business. The company [illegible] supplies is already on hand, and the company says that it is making prompt shipments. President George A. [illegible] amount of business is being received daily.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued (United States Patent Office) February 21, 1905.*

782,816. Electric Fan. Adolph F. Becker, Elizabeth, N. J., assignor to the Diehl Manufacturing Company. Application filed April 12, 1904.

The mechanical features of the frame of the fan are described.

782,826. Alternating-current Rectifier. William B. Churcher, Cincinnati, Ohio, assignor to Kennon Dunham, Cincinnati, Ohio. Application filed September 3, 1904.

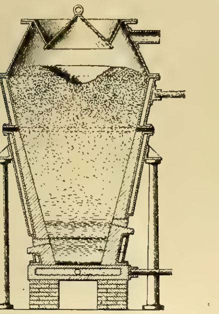
In an alternating-current rectifier employing electrolytic cells with aluminum electrodes are means for cooling the electrolyte consisting of a fluid-cooling medium. Aluminum conductors are immersed in the electrolyte.

782,828. Measured-service Telephone-exchange System. Henry M. Crane, New York, N. Y., assignor to the Western Electric Company, Chicago, Ill. Application filed August 31, 1903.

A service meter is connected with a contact of the line spring-jack. A cut-off relay in a local branch circuit is closed in making connection with the line and a shunt of the service meter is closed by the relay when excited. A source of current, a switch associated with the plug circuit and connections for the switch adapted to render the cut-off relay inert and apply current to the service meter when the switch is actuated are further provided.

782,849. Electric Time Alarm. Frank Hermance, Union Hill, N. J. Application filed July 30, 1904.

A dial similar to a clock dial is provided with numerous holes over its face for the insertion of a metallic pin. Hands driven over the dial close a circuit through the pin at any point, corresponding to any hour or minute, where the pin may be inserted.



NO. 782,922.—METHOD OF SMELTING ORE.

782,857. Portable Cut-out Box. Anton T. Kliegl and John H. Kliegl, New York, N. Y. Application filed August 4, 1904.

A portable cut-off box comprises a casing, oppositely disposed sockets in the ends of the casing carrying contacts in their inner walls, a fuse plate supported between the sets of sockets, conducting bars on opposite sides of the fuse plate, and fuse wires connecting the socket contacts to the bars on their respective sides of the plate. (See cut.)

782,863. Alternating-current Motor. Robert Lundell, New York, N. Y. Application filed January 11, 1904.

An alternating-current motor has a stationary field magnet and an armature of the ring or drum type the coils of which are connected to a commutator. Means cause local or short-circuited currents to flow through certain armature coils and additional means cause other currents from an outside source of alternating-current supply to flow through the other armature coils. (See cut on next page.)

782,873. Electric Igniting Plug. George H. Oakes, Arlington Heights, Mass. Application filed December 8, 1903.

An electric igniting plug comprises in its construction an insulating sleeve formed of sheet material wound in cylindrical form in layers extending longitudinally, one portion of the sleeve being greater in diameter than the other.

782,884. Electric Signaling Apparatus for Railways. Thomas H. Traylor, Denver, Colo. Application filed November 9, 1904.

Electrical connections are placed along the track which is arranged in blocks and a train-signaling equipment co-operates with the track connections through the axle and wheels. One pole of a source of electricity is connected with the track through a wheel and axle of the train. A brush mounted on the train and insulated from the wheel and axle is electrically connected with the other pole of the electrical source. This with electromagnetic devices for operating the signals make up the system.

782,887. Rheostat. Hermon L. Van Valkenburg, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed June 6, 1904.

A sheet metal base of the rheostat has an integral supporting flange at one end, a non-conducting, heat-resisting sheath and a coil of wire wound upon the sheath and connected to the base at the end having the supporting flange.

782,892. Telegraphic Repeating Apparatus. William E. Athearn, New York, N. Y., assignor to the American Telephone and Telegraph Company. Application filed May 13, 1904.

Combined with an open telegraphic line circuit are a closed line circuit, alternative terminal branches for the former, including respectively a receiving relay and a battery and a second relay having its magnet in the closed circuit line. The armature-lever of the magnet is in the open-circuit line, the armature lever constituting a switch for transferring the open-circuit line between the alternative relay and battery terminal branches.

782,893. Method of Treating Alkali-metal Amalgam. Charles E. Baker and Arthur W. Burwell, Cleveland, Ohio. Application filed April 15, 1904.

Treatment of the amalgam consists in electrolyzing an alkali-metal compound with a cathode of mercury, thereby forming an amalgam of the alkali metal; distilling the amalgam in presence of hydride, thereby separating mercury and producing the hydride of the alkali metal; condensing the mercury and returning it to the cathode; decomposing the hydride, and recovering the alkali metal.

782,894. Electrolytic Process of Reducing Metallic Sulphides. Charles E. Baker and Arthur W. Burwell, Cleveland, Ohio. Application filed July 1, 1904.

Treating metallic sulphide is done by placing the sulphide to an electrolyte of a molten chlorid and in proximity to an anode, passing an electric current from the anode through the electrolyte and causing the electrolytic chlorine to react on the sulphide and displace the sulphur.

782,917. Electric Furnace. John M. Morehead, Chicago, Ill., assignor to the Union Carbide Company, Chicago, Ill. Application filed October 19, 1903.

An electric furnace comprises a working chamber, a hood depending into the chamber, means for cooling the top of the hood, an electrode or electrodes passing through openings in the top, and means for introducing the charge into the hood and withdrawing the waste gases from the hood.

782,922. Process of Smelting Refractory Ores. Edgar F. Price, Niagara Falls, N. Y., assignor to the Union Carbide Company, Niagara Falls, N. Y. Application filed October 19, 1904.

Production of calcium carbide is brought about by interposing a charge of a calcium compound and carbon as a resistance conductor between metal electrodes, electrically heating the charge to the temperature requisite for reducing by an electric current, the density of which increases through the charge, and cooling the electrodes to maintain them at a relatively low temperature. (See cut.)

782,936. Insulated Step Joint. George A. Weber, New York, N. Y., assignor to the Weber Railway Joint Manufacturing Company, New York, N. Y. Application filed March 13, 1903.

An insulated rail joint comprises a rail chair having a bridge plate and a bolt plate, the bridge plate being provided with additional metal at one end. Insulating material is placed between one of the rail ends and the bridge plate.

782,937. Telephone-exchange System. Harry G. Webster, Chicago, Ill., assignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed December 3, 1903.

A relay connects a connection terminal with the line, and a charging source of continuous current energizes the relay. A calling generator and a ringing key adapted to connect the calling generator with the line and to open the circuit of the charging source through the relay are also provided. Means temporarily send a continuous current for the relay through a substitute circuit during the time the calling generator is connected in circuit.

782,944. Multi-party-line Locking-out System. Garrison Babcock, Chicago, Ill., assignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed November 19, 1903.

A shunt circuit is provided for the receiving apparatus at each sub-station, also means operable from the central exchange over one circuit for closing the shunt circuit at one point. Additional means at each sub-station operable from the central exchange over another circuit subsequently open the shunt circuit at another point.

782,989. Electrolytic Production of [illegible] in Alkaline Solution. [illegible] Philadelphia, Pa., assignor to the [illegible] Storage Battery Company, Philadelphia, Pa. Application filed May 17, 1902.

Electrolytically [illegible] metals is done by [illegible] an attenuated alkaline [illegible].

783,001. Reciprocating Electric Engine. Bruno O. Wagner, El Paso, Texas. Application filed September 22, 1904.

A metallically inclosed magazine of [illegible] and interposed iron rings that are to form magnetic poles co-operate with an axially reciprocating [illegible] armature inside of the solenoids and rings, the armature carrying groups of insulated copper rings.

783,007. Valve-operating Mechanism. William E. Allen and Arthur M. Houser, Chicago, Ill., assignors to the Crane Company, Chicago, Ill. Application filed May 19, 1904.

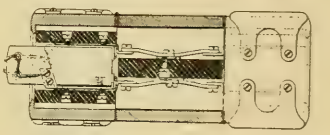
An electric motor suitably geared to the valve causes its actuation.

783,014. Burglar Alarm. Glen R. Booth, Batavia, Ill. Application filed September 20, 1904.

An electric circuit, which is closed by the attempted opening of a window or door, rings a bell to sound an alarm.

783,027. Electric Railway. Joseph Dela Mar, New York, N. Y., assignor of one-half to Mathias A. Lazareff, New York, N. Y. Application filed March 8, 1904.

Combined with the hollow third rail and its contained conductor are switches operated from the sides of the rail and plows arranged to successively engage the switches. One plow strikes the switches on one side of the rail to cut the current into the rail and the following plow strikes the switch on the opposite side of the rail to cut the current out.



NO. 782,857.—PORTABLE CUT-OUT BOX.

783,028. Electric Railway. Joseph Dela Mar, New York, N. Y., assignor of one-half to Mathias A. Lazareff, New York, N. Y. Application filed June 9, 1904.

A shoe or collector comprises a block or hanger supported in a way to permit a lateral adjustment with relation to the rail. Depending oppositely bent rods are secured to the hanger and adapted to straddle the rail, the rods carrying rollers at their lower ends, which are arranged to run on opposite sides of a contact rail.

783,057. Electric Air-diffusing Device. Timothy Mahoney, San Francisco, Cal. Application filed November 26, 1904.

An air-diffusing and heating device consists of a disk having perforations. A heating resistance coil is disposed in line with the openings in the disk, with means for passing an electric current through the coil, the air being diffused by a fan.

783,061. Electric Terminal Clip. David B. Mills, East Orange, N. J. Application filed May 3, 1904.

The clip is made of a single flat piece of spring metal, with means to hold the terminal in place.

783,080. Electric Coupling. Edward F. Ruth, Baltimore, Md., assignor of one-third to Clement H. Warner, Baltimore, Md. Application filed June 2, 1903.

Suitably supported connecting boxes are located at the adjacent ends of each car. Each box has a socket passing therethrough, a conducting sleeve located in the socket, and plugs adapted to be inserted into one end of each sleeve. Wires connect the plugs to the motors of each respective car on which they are located. A coupling comprises two shafts, with flexible conducting means connecting the shafts. Insulated heads on the shafts are placed intermediate to their ends, the outer ends of the coupler receivable in the adjacent open ends of the sleeves.

783,082. Station Indicator. Lee H. Simmons, Wilmington, N. C. Application filed May 6, 1904.

An electric motor actuates the signal, bringing a name sheet into view and closing the circuit of a buzzer at the same time.

783,102. Reciprocating Electric Motor. Louis Casper, Chicago, Ill. Application filed March 23, 1903.

Combined with a coil is a core having a bore. A shell surrounds the coil and an armature has a rod pass-

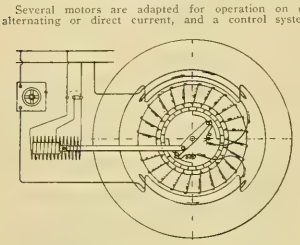
ing through the core, and provided with a circuit-breaker consisting of a pivoted tongue, engaged by stops on the rod. The tongue has a spring engagement at its outer end.

783,107. Apparatus for Separating Oily or Similar Impurities from Water. Henry T. Davis and Ernest Perrett, London, England. Application filed March 29, 1904.

Combined with a valve for supplying the oily water is a valve for supplying the conducting fluid. Electric means open the valves when the current is turned on and automatic means close them when the current ceases or is interrupted.

783,124. Motor-control System. Maurice Milch, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 10, 1904.

Several motors are adapted for operation on either alternating or direct current, and a control system is



NO. 782,863.—ALTERNATING-CURRENT MOTOR.

aranged to connect the motors to a source of alternating current with the field connections of the motors arranged to give a comparatively small number of ampere turns, and to a direct-current source, two in series, with the field connections modified to give a comparatively large number of ampere turns.

783,141. Thermoelectric Signal. Martin J. Schick, Bellaire, Ohio. Application filed April 21, 1904.

A thermometer is arranged with wires of electric circuits terminating in the inside of the tube at various heights. As the mercury rises in the tubes the circuits are closed successively, indicating the temperatures at some distant point. (See cut.)

783,174. System of Electrical Control. Eugene R. Carichoff, East Orange, N. J., assignor to the Sprague Electric Company. Application filed August 9, 1898.

A reverser for the motor is operated by controlling circuits to close the motor circuit for operation in one direction or the other. The circuits have actuating and maintaining branches and bridging contacts are placed upon the reverser and included in the maintaining branches. Normally closed contacts are included in the actuating branches and are opened upon closures of a controlling circuit.

783,207. Vibrator for Induction or Spark Coils. Arthur A. Kent, Philadelphia, Pa. Application filed November 8, 1904.

A plate to which the armature is attached is arranged so as to vibrate therewith. A fulcrum is placed intermediate the ends of the plate and projections adjacent each end of the plate produce a flection and hold it upon the fulcrum.

783,228. Trolley. Charles J. Sosenheimer, Allegheny, Pa., assignor of one-fourth to William S. X. Taylor, Allegheny, Pa. Application filed August 11, 1904.

A pin on the harp extends through an opening in the end of the pole to form a swiveled joint.

783,229. Locking Insulator. Louis Steinberger, New York, N. Y. Application filed March 19, 1903.

A locking insulator comprises a body portion provided with a surface for engaging a wire, a cap of insulating material detachably connected with the body portion and an annular facing of metal rigidly connected with the cap of insulating material for engaging the wire.

783,230. Insulator Support. Louis Steinberger, New York, N. Y. Application filed May 11, 1903.

A stem provided with a thread and carrying a metallic sleeve is provided with a thread engaging the thread of the sleeve. The sleeve is further provided with a skirt and a member connected exteriorly with the sleeve and provided at its lower end with a gutter for directing the flow of moisture.

783,231. Hygienic Telephone Receiver. Louis Steinberger, New York, N. Y. Application filed August 15, 1904.

A hygienic telephone receiver consists of a receiving member and a member of resilient material encircling the receiving member and provided with facets to prevent it from rolling.

783,268. Electricity Meter. Haydn T. Harrison, Westminster, England, assignor to the Woodstock Syndicate, London, England. Application filed August 1, 1904.

An electrolytic meter is supplied with a container and a measuring device mounted to rock about a horizontal axis below its center of gravity and formed of two compartments adapted to receive and deliver alternately electrolyte supplied to the device. A register is adapted to be operated by the measuring device and a casing provides against the supply of electrolyte to the container otherwise than by means of the measuring device.

783,275. Attachment Plug. Harvey Hubbell, Bridgeport, Conn. Application filed July 1, 1904.

A cap and an insulating block, a screw shell which receives the insulating block and is provided with a bottom upon which the insulating block bears and which bears upon the cap, are the essential parts. The cap block and shell are formed with interengaging portions to prevent relative movements when the parts are assembled.

783,279. Switch for Selective Electric Signaling Apparatus. Charles M. Jacobs, Maidenhead, and Arthur H. Nicholson, Wendover, England. Application filed April 18, 1904.

A switch for use in connection with selective signaling apparatus contains a set of contacts insulated from each other, three contacts insulated from each other, means for electrically connecting the three contacts with any three of the contacts of the set, respectively.

783,283. Telephone Receiver. William Kaisling, Chicago, Ill., assignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed February 19, 1903.

A metal diaphragm-supporting member has an adjusting member screw threaded to the lower end of the supporting member, whereby the members may be relatively adjusted. A locking member is connected with the lower end of the adjusting member and engages the supporting member, whereby the members are locked in adjustment.

783,295. Incandescent-lamp Socket. Norman Marshall, Newton, Mass. Application filed November 26, 1904.

An incandescent-lamp socket is provided with a central screw terminal, and an adapter provided with a cooperating screw terminal. Means prevent the removal of the adapter.

783,302. Automatic Telephone Exchange. Nils E. Norstrom, Junction City, Kan., assignor to John Anderson, Salina, and M. E. Richardson, Sterling, Kan. Application filed April 10, 1900.

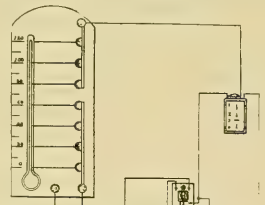
Associated with a series of telephones and an electrical connection from each one of them is a switching mechanism provided with a series of contact points divided into groups, each one of which is a terminal of a connection from a different telephone. An independently movable contact-making device is provided for each group of contact points, also a propelling mechanism. A separate rack is secured to each contact-making device and a separate guide for each rack and its connected contact-making device. Means move the racks independently to engagement with their respective gears.

783,315. Electrical Protector. Charles A. Rolfe, Chicago, Ill., assignor to the Rolfe Electric Company, Rochester, N. Y. Application filed April 21, 1900.

A pair of terminals, a number of shunts, all connected with the terminals, whereby all of the shunts form a part of a single circuit, and means controlled by one of the shunts for controlling the circuit go to make up the device.

783,321. Magnetizing Apparatus. John B. Sherwin, Butler, Pa. Application filed May 28, 1904.

A casing with two openings contains a conduit situated beneath one of the openings. Conductors extend along the conduit and a solenoid is in circuit with the conductors and has its opening located opposite the second casing opening. A battery is located within the casing and included in the circuit.



NO. 783,141.—THERMO-ELECTRIC SIGNAL.

783,333. Wire Terminal or Lug. George A. Tower, Henrico County, Va., assignor to the Tower-Binford Electric and Manufacturing Company, Richmond, Va. Application filed July 9, 1904.

A terminal for conductors comprises a tail plate and a barrel formed integral therewith and lying in a plane above the lower face of the tail plate. The rear end of the barrel is closed by a rounded wall formed integral with the barrel and the plate. A pair of inward-bent wings meet along the under side of the barrel, the wings having rearwardly-extending ears meeting the curved shoulder formed at the junction of the plate and the rounded closure wall.

783,340. Telephone-exchange System. Harry G. Webster, Chicago, Ill., assignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed December 5, 1903.

A signal bell at each sub-station is connected between one of the line limbs and ground. Means associated with the operator's cord circuit connect the source of current with one of the limbs of the telephone line and ground and other means connect the other limb of the line to ground.

783,348. Insulator. Evans C. Wright, Portland, Ore., assignor of one-half to Francis J. McHenry, Portland, Ore. Application filed March 18, 1904.

An insulator having a longitudinal bore and a transverse bore at one side of the longitudinal bore is described. The insulator has a groove commencing at one side of the transverse bore and extending downwardly and around to the front, then upwardly toward the top, then transversely toward the other side, then downwardly and rearwardly and intersecting the transverse bore at the commencement of the groove. (See cut.)

783,354. Telephone Switch. Jesse M. Beever, Effingham, Ill. Application filed April 20, 1903.

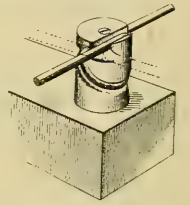
A suitably mounted non-conducting plate bears main-line-wire terminals and a movable conducting member. Receiver and transmitter terminals are likewise located on the non-conducting plate, together with means for normally retaining the movable conducting member in engagement with the main-line-wire terminals and out of engagement with the receiver and transmitter terminals to complete the main-line-wire circuit.

783,376. Electric-thermo Alarm. Percy C. Howe, Cambridge, Mass. Application filed April 23, 1904.

A base of non-conducting material recessed on the wall side and adapted to receive the conductor plates contains a recess on the face side adapted to receive thermostat posts and a thermostat.

783,388. Electrical Circuit Protector. Charles A. Rolfe, Chicago, Ill., assignor to the Rolfe Electric Company, Rochester, N. Y. Application filed January 2, 1902.

A pair of spring clips are arranged face to face and adapted to spring toward one another, each of the clips being bent so that the two bent portions form a recess between the clips. A hollow body made of softenable insulating material is confined in the recess.



NO. 783,348.—INSULATOR.

783,389. Telegraph Receiver and Recorder. Willis J. Roussel, New Orleans, La., assignor of one-eighth to Alphonse King, Chicago, Ill. Original application filed February 11, 1903. Divided and this application filed April 9, 1904.

A stylographic pen is secured to and extends through the armature of the receiver for making the code symbols on a paper strip.

783,397. Winding for Dynamo-electric Machines. Bernard A. Behrend, Norwood, Ohio, and Edwin C. Wright, Newport, Ky., assignors to the Bullock Electric Company. Application filed November 6, 1903.

A winding for dynamo-electric machines having toothed cores comprises a single conductor per slot. Half of the end connections are the same distance from the axis of the machine as the main portion of the conductors, and the other half are nearer the axis by a distance approximately equal to the depth of the conductors. The end connection of each conductor at one side of the core passes over and at the other side of the core passes under other end connections.

783,398. Dynamo-electric Machine. Bernard A. Behrend, Norwood, Ohio, assignor to the Bullock Electric Company. Application filed November 24, 1903.

Embodied in the design of the machine are a revolving field frame and a stationary frame, the field frame having a series of poles arranged in a circumferential direction on its periphery. Ventilating spaces pass through the rim of the field frame and communicate with open spaces between the circumferentially arranged poles, the poles acting as fans to force the air drawn through the rim toward the stationary frame.

783,399. Burglar Alarm. Henry Blank, Richmond Hill, N. Y. Application filed December 21, 1903.

In the device is an opening having a closing member, and a shell or casing is secured to the frame of the opening. An insulating plug is fixed in one end of the shell and a pair of spring contacts are secured to the plug. A contact plug is adapted to break the circuit, the contact plug being so located and arranged that the opening of the closing member will sound an alarm.

## EXPIRING PATENTS.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on February 28, 1905:

378,426. Automatic Electric Photographing Apparatus. Edward M. Bliss and James F. Middleton, Newark, N. J.

378,432. System of Electrical Distribution. Thomas P. Conant, Brooklyn, N. Y., and Z. Latshaw, McKeesport, Pa.

378,436. Printing Telegraphy. P. B. Delany, New York, N. Y.

378,437. Printing Telegraph. P. B. Delany, New York, N. Y.

378,440. Electric-railway Station Indicator. G. Guntz, Wilkesbarre, Pa.

378,456. Self-exciting Alternate-current Electric Generator. O. A. Moses, New York, N. Y.

378,464. Telegraph Repeater. L. Russell, Cherokee, Kan.

378,484. Battery Vessel. J. Wiest, York, Pa.

378,517. Rail Connection for Electric Railway. E. L. Orcett, Somerville, Mass.

378,547. Regulator for Electric Generators. W. S. Hill, Boston, Mass.

378,552. Relay Magnet. F. L. Orcett, Somerville, Mass.

378,560. Test Box for Underground Electric Wires or Cables. R. S. Waring, Pittsburg, Pa.

378,561. Conduit for Electric Wires or Cables. R. S. Waring, Pittsburg, Pa.

378,616. Arc Light. L. M. Poland, Cincinnati, Ohio.

378,629. Secondary Battery. M. Stecher, Philadelphia, Pa.

378,657. Automatic Electric Air Brake. J. F. Carpenter, Berlin, Germany.

378,658. Valve for Electropneumatic Railroad Brakes. J. F. Carpenter, Berlin, Germany.

378,677. Electric Gas-lighting Apparatus. C. W. Holtzer, Brookline, Mass.

378,679. Lockout Box and Shunt Circuit for Telephone Exchange. C. H. Haskins, Milwaukee, Wis.

378,681. Apparatus for Bleaching by Electrolysis. E. Hermite and C. F. Cooper, Pownall Road, Dalston, Eng.

378,737. System of Electric Distribution. T. Spencer, West Brooke, Conn.

378,738. System of Electric Distribution. T. Spencer, West Brooke, Conn.

378,780. Telephone. L. Ehrlich, B. Dubinski and G. Rein, St. Louis, Mo.

378,801. Underground Conduit for Electrical Conductors. M. R. Muckle, Jr., Philadelphia, Pa.

378,818. Double Arc Lamp. M. J. Wightman and E. Rassmussen, Hartford, Conn.

# WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXVI. CHICAGO, MARCH 11, 1905

## Power Generation and Distribution for Foligno, Italy.

By Franz Koester.

The river Menotre, rich in waterfalls, has been utilized to furnish light and power for the industrial city of Foligno, Italy, and surrounding localities. In the fifteenth century this river had been utilized for driving mills, and there had been two canals built. Within the last 10 years there arose a necessity for greater use of waterpower on account of the scarcity of coal and the growing industries. Electricity was, of course, the most available agent for distributing this power through the territory. The first installation was made in 1894, and this was the first important use of alternating current in Italy. After this was finished it was found insufficient to meet the demand, and hence the plant has been recently enlarged. The contracts for electric equipment were left to the Oerlikon Manufacturing Company.

The river Menotre rises in the Orsano Valley, and between Pale and Altolina has a fall of 590.4 feet in a run of 2,296 feet. At the lowest stage the discharge is 237.6 gallons a second, while the average discharge is 316.8 gallons. The whole water installation is divided into two parts—one on the right bank of the river, and one on the left.

On the left side a fall of 479.19 feet is utilized, and at the place where the previously mentioned old canals branched off from the river, there is built a dam 65.6 feet long, 26.2 feet high, 22.9 feet thick at the base and 8.85 feet at the top. This dam is embedded in solid rock, and is provided with a gravel gate and a head gate, which admits the water to one of the old canals. The water is conducted through a tunnel 357.3 feet long, with a section of 5 by 3.9 feet, which delivers into a reservoir of a capacity of 28,240 cubic feet. This reservoir has an outlet through a canal 236.1 feet long, with considerable fall, to a second reservoir. This canal is provided with an overflow branch, leading to the river.

A penstock 1,338.2 feet long leads from the lower reservoir to the power house. The penstock, of 17.9 inches diameter, is built in sections of 32.8 feet long, and is of riveted plates five to seven millimeters thick. All sections of the penstock have caulked lead joints. On the right bank of the river there is also a tunnel leading from the dam to a reservoir, from which another penstock carries the water, about 30 feet high, across the river to the power house on the left bank. The total length of this second penstock is 1,656.4 feet, and it has a diameter of 29.3 inches. The plates are five to nine millimeters thick, the thickest plates, of course, being toward the power house, where the pressure is greatest. It is built in sections 26.2 feet long. The first 295.2 feet is run above ground, the next 754.4 feet through a tunnel and the remainder is carried on piers above ground to the power house.

Fig. 2 (page 186) shows location of power house with reference to the river and canal. The letters on the diagram represent the following: (G) power house; (D) penstock, right bank; (S) penstock, left bank; (C) supply canal for turbine (T); (B) discharge canal; (N) tailrace; (H) tailrace reservoir; (P) headrace for turbine (T); (T') (T") tailrace; (H') (H") old canal, and (A) bridge to Altolina.

The power house is in Altolina, and has an area of 6,773.1 square feet, and besides the generator room (Fig. 1) has a penstock chamber and a three-story dwelling for the superintendent and for offices. A small hand crane, running on brackets, serves the heavy machines. The foundation of the building is concrete, the main part being of brick, and roof of wood, covered with tiles.

The larger penstock has three branch pipes running at 45 degrees to three 250-horsepower horizontal turbines on one side of the power house. These turbines are direct connected to alternating generators by means of flexible insulating couplings. Each generator is equipped with its own exciter, built on an extension of the main shaft. The smaller penstock serves four 100-horsepower horizontal turbines on the other side of power house. These make 500 revolutions a minute, and use 17.5 to 20 gallons of water a second, under a head of 492 feet. They are direct-connected to 2,200-volt alternating generators of the Oerlikon type by flexible insulating couplings. These generators are also equipped with individual exciters overhanging on the main shaft. All of these horizontal turbines discharge into two canals immediately under the floor, which carry the water to a special reservoir near the power house, from which it ordinarily runs off into the river. This reservoir is provided for furnishing supplementary power when needed, by means of an interesting installation of a vertical turbine at the side of the power house, about 30 feet below the main floor. This turbine is connected through bevel gearing to one of the 100-horsepower horizontal turbines. When this turbine is to be run, a gate is opened from the special reservoir, so that the water flows to the turbine instead of to the river. The tail water from the vertical turbine runs off in a deep tailrace to a point lower down the river. This turbine is built large enough to utilize the large volume of water discharged by the other turbines, and works under a head of about 25 feet.

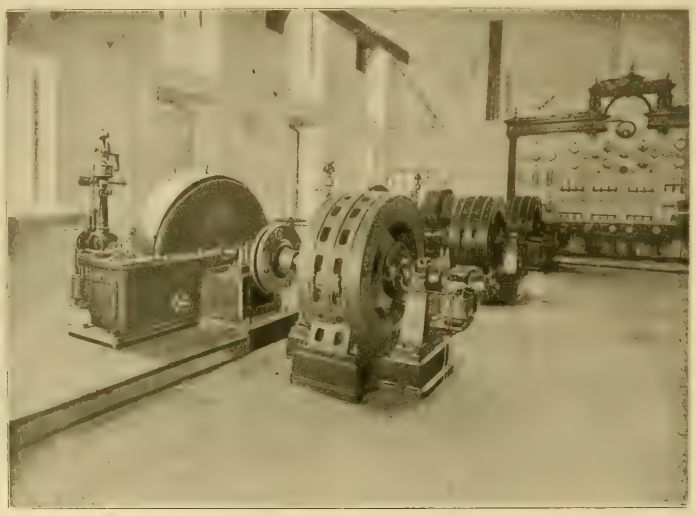


FIG. 1. INTERIOR OF POWER HOUSE AT ALTOLINA, ITALY, SUPPLYING CURRENT FOR FOLIGNO.

On the south-end wall of the power house is a switchboard for the three large units, and on the other end wall is one for the four smaller generators. Wires from all generators are run through a channel under the center of the floor on porcelain insulators to the switchboards, which are made with iron frames and white marble slabs, trimmed with ornamental wooden moldings. The switchboards are equipped with the usual instruments and also double-throw switches for connecting any generator on either the power circuit or the light circuit. There are also instruments for the proper connecting of generators in parallel, namely, voltmeters, double-throw switches and phase lamps. Two bus-bar [illegible] are the light [illegible] cuit, respectively. [illegible] ranged that they may be reported [illegible] out cutting off the main current.

A one-kilowatt transformer [illegible] house for lighting the premises. There is also in the power house a [illegible] furnish current for 732 candlepower of lighting in the village of Pale, about one-third of a mile distant, and also for running a small [illegible] in the vicinity. The secondary wiring on this circuit consists of four wires four millimeters in diameter.

There are separate wire systems for light and power, the light system consisting of four wires (one of which is neutral), the power system of three wires, all designed for 10 per cent. drop. Wires are carried on double-petticoat porcelain insulators on chestnut poles, which have been chemically treated. Where these high-tension wires cross the railroad, they are carried on iron poles for additional strength, and they are protected by means of a netting run underneath. The wires enter the city of Foligno between Porta Ancona and Porta Firenze, and lead to a main distribution station near the center of the city, from which run three four-wire light circuits and two three-wire power circuits from a common switchboard. A small special switchboard is provided for one circuit to operate three motors in the Mercurelli mill. For each circuit there are provided switches, fuses, a voltmeter and an ammeter. On the lighting circuits there are three ammeters, so arranged that an even distribution of the current may be maintained between the three phases, while one ammeter is sufficient for each power circuit.

In the main distribution station there are also three step-down transformers and an 18-kilowatt rotary transformer, which latter is to furnish direct current for 15 arc lamps. Six transformer stations serve the light circuits, and five the power circuits, besides which a number of transformers are installed in the buildings where the motors are operated.

The secondary lighting system consists of seven wires, making two circuits of three wires each, and one common neutral wire for both. One system is for municipal and one for private service.

There are a number of low-tension and high-tension motors from four to 45 horsepower each, the low-tension being 190 volts and the high-tension 3,600 volts. During daylight the lighting circuits may be made to assist the power circuits.

It may be of interest to describe a special coupling which is used in the Mercurelli mill to reduce the revolutions of the motors, and at the same time have them direct connected to the millstones.

Referring to Fig. 3, the disk (D), keyed to the motor shaft, carries three pins (A) and rollers (B), surrounded by steel rings (F), whose inside diameter is slightly larger than the rollers, and whose outside diameter is slightly more than the distance between the center shaft (C) and housing (G). These rings are thus pressed to an oval shape to the extent of one-half millimeter. When the disk revolves in the direction (H) the rings revolve in the direction (H'), and drive the center shaft, which is connected to the mill, in the direction (H"). This novel device (known as the Centrator coupling) does away with the necessity of all shafting, gearing, belting, etc., generally used for slow-moving machinery.

The charge for power is as follows: For one-six-

teenth horsepower (the smallest size), 10 hours a day, at times when lights are not burning, $1.90 a year; 24 hours a day, $8.50 a year. For one horsepower, 10 hours a day, when lights are not burning, $11.50; 24 hours a day, $50 a year. For power from two to 50 horsepower, ten-hour service, $9.50 a year a horsepower; 24-hour service, $42 a year a horsepower. Powers greater than 50 horsepower are by special arrangement.

Circuits for incandescent lights are run with 115 volts, and for arc lamps 60 volts, the latter being nine amperes for direct current and 12 amperes for

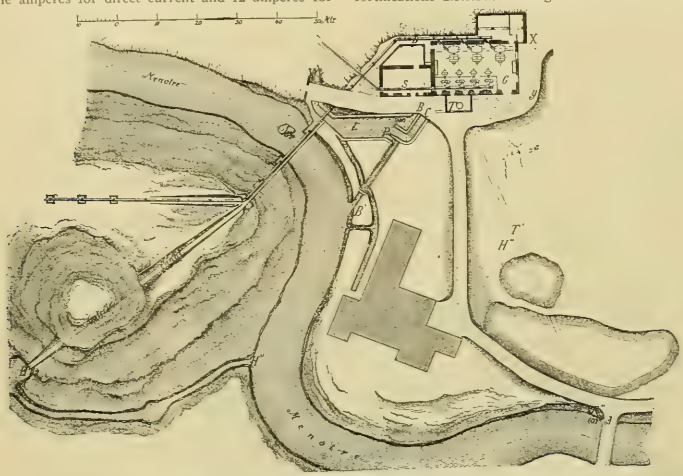


FIG. 2. HYDRO-ELECTRIC PLANT ON MENOTRE RIVER AT ALTOLINA, ITALY.

those on alternating currents. The city uses, besides a number of arc lamps, 140 incandescent lamps of 12 candlepower and 280 of 16 candlepower. For private service there are a few direct-current arc lamps, and incandescent lamps aggregating 20,000 candlepower.

The charge for 16-candlepower incandescent lamps is 48 cents a month, burning till 10 o'clock at night, or 85 cents a month burning all night. When charges are made by meter, there is a fixed charge for the installation, equal to $9.50 for each 100 candlepower, and a charge for the current equal to 12½ cents a kilowatt-hour, including the government tax of 1½ cents.

It will be noted that the charge for power for

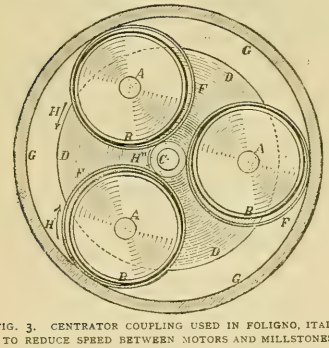


FIG. 3. CENTRATOR COUPLING USED IN FOLIGNO, ITALY, TO REDUCE SPEED BETWEEN MOTORS AND MILLSTONES.

10 hours during the period when the current is not needed for lighting is much cheaper than in this country, while for 24-hour service it is comparatively high. The charge for lighting in some instances is somewhat cheaper than in this country, and in others about the same.

## 60,000-volt Direct-current Transmission Proposed.

It is said that a direct-current transmission line is to be built between Montiers and Lyons in France, a distance of 113 miles. The power to be transmitted is 4,700 horsepower, which, with the great distance, will be the record in Continental practice. The pressure at the generating station is calculated to be 56,960 volts, to be developed by a number of direct-current machines in series, which method is largely used in the district mentioned. Inasmuch as the highest pressure direct-current line previously attempted, that between St. Maurice and Lausanne, only uses 22,000 volts, the installation contemplated will be a decided departure, and will necessitate great care to secure good insulation in the machines.

## Electric Training for Coast Defense Work.

Rapid extension of the use of electricity in the United States coast defenses is exhibited by the fortifications distributed along the coast line on both oceans. The electrical equipment has been extended until it is now perhaps the most important part of the entire outfit at many of the forts. In view of these advances it will be seen that in order successfully to operate a fort, skilled electricians are a necessary part of the force. The skill of these men in their own particular branch must excel that required for similar work in civil pursuits, for although the engineering conditions under which electricity is applied in the seacoast defense service are practically the same as in ordinary life, the requirements are of necessity more exacting and difficult.

Army officers within the last two years have made arrangements to offer instruction and training to the more apt of the men in the handling of the electrical equipment. This applies also to the militia. During the mobilization of the militia at Fort Terry, N. Y., in 1903, for instruction under the officers of the regular army, the Thirteenth Regiment of the New York National Guard formed a detachment of 40 men for the purpose of drilling in the installation, operation and maintenance of sea-coast artillery electrical apparatus. Colonel Austen, commanding the Thirteenth, detailed M. C. Sullivan, an electrical engineer from Manhattan, then a member of the regiment, to organize the detachment.

A fine opportunity for instruction presented itself to the personnel of the detachment, as well as an object lesson to the militia body and all interested in coast defense, of the importance of electricity in its relation to heavy artillery operation. The electrical outfit of the fort, consisting of several separate generating plants, with both steam and oil engines, and having storage batteries as auxiliaries, furnishes currents for motors used in ammunition hoisting, searchlights, lighting gun batteries, lights for fire and battery commanders' stations, garrison lighting, lights for night range finding, telephone, telautographs, electric clocks and the submarine mine service.

The detachment consisted of men picked from the entire regiment with reference to their aptitude for electricity. The examination consisted of questions aimed at determining knowledge, experience and how acquired, of steam boilers, steam engines, oil engines, dynamos, motors, storage batteries, searchlights, wiring, telephones, switchboards, telephone instruments, telephone lines, electric bells and signals or any special experience a man may have had that would not come under these heads.

For service in the seacoast artillery as a preliminary organization Mr. Sullivan's plan is to divide the civilian electricians into three sections:

Section A—Men who have made a study of electricity and electrical engineering.

Section B—Practical electricians, who can do anything from setting up and connecting telephone switchboards down through all kinds of construction relating to communications and signaling. Light-current section.

Section C—Electricians who have made a specialty of heavy current machinery, dynamos, motors, storage batteries and devices relating to the generation and control of what may be termed dynamic electricity. Heavy-current section.

From the experience gained at the encampment, the first experiment of the kind ever made in America with militia troops, it will be comparatively easy to organize them so as to be of valuable service to the regular establishment in any emergency calling into action the seacoast defenses. As the electrical part of fortifications consists mainly of devices which have become standard in the industrial world, very little training would be required to make the men efficient.

Unfortunately for efficiency the electrical corps of the army is entirely too small for the amount of work it has to do. Army officers are making efforts to improve this condition and will probably succeed, but as it is not likely that any force such as would be required in time of war will ever be available from the regular army, it follows that the bulk of the electrical work will have to be done by the electrician volunteers. Any arrangement resulting in the organization of skilled electricians who at a moment's notice may be called on for duty as an auxiliary to the regular army in case of need is an addition to the defensive strength of the country.

## Electrical Exports for January.

Electrical exports from the United States for the month of January, 1905, reached a total value of $942,609, an increase of $112,474 over January, 1904. Electrical appliances, including telegraph and telephone instruments, increased $12,566 for the month compared with the previous January. Electrical machinery shows an increase of $99,908 over January, 1904. Following are the figures: Electrical appliances—January, 1905, $387,610; January, 1904, $375,044. Electrical machinery—January, 1905, $554,999; January, 1904, $455,091.

The principal importers of electrical machinery from the United States in January were, in order of volume of business: British North America, $167,202; Japan, $100,814; United Kingdom, $70,919; Mexico, $49,753; British Australasia, $45,565; Argentina, 28,044; Philippine Islands, $14,444; France, $14,003; British East Indies, $13,439; Cuba, $8,250; British Africa, $5,017; Germany, $4,717; Brazil, $2,812; Hongkong, $1,275.

The most noticeable feature of these figures is that Japan, as for the last few months, continues to hold its place among the leaders, having again surpassed the United Kingdom, which has until recently always been the largest importer of American electrical machinery. For the seven months ended with January, 1905, Japan imported electrical machinery from the United States to the amount of $603,900, while in a similar period a year ago the amount was only $271,698.

## Death of F. A. La Roche.

Frederick A. La Roche of New York city, a well-known electrical inventor and business man, died in that city on March 4th of cancer of the stomach. He was born October 4, 1859, and early exhibited an aptness for mechanics. At 17 years of age he finished a course of civil and electrical engineering. In 1880 he began, in a small way, the manufacture

FREDERICK A. LA ROCHE.

of laboratory instruments and dynamo machinery, and in 1887 he entered into partnership with several others and launched out on a larger scale. This partnership was short-lived, however, and he soon formed, upon his own responsibility, the La Roche Electric Works of Philadelphia. This business started in a very small way, but rapidly grew into a flourishing condition. About 10 years ago Mr. La Roche became interested in the automobile industry and went into the business of manufacturing cars, and incidentally running them himself, for he was a racer of national fame. At the time of his death he was interested in the F. A. La Roche Company of New York, manufacturer of circuit breakers and other specialties, and in the American Darracq Company, being its president. Mr. La

Roche was a member of the American Institute of Electrical Engineers, and he was also a charter member of the Automobile Club of America. His wife survives him.

## Gigantic Frequency-changer for Shawinigan Falls.

What is undoubtedly the largest electric motor ever built is now being installed at the plant of the Shawinigan Water and Power Company, Shawinigan Falls, Quebec. This machine was recently constructed by the Allis-Chalmers Company at its electrical works in Cincinnati and embodies in its design the characteristics of the Bullock alternators, which have proved singularly successful in their application. It is a synchronous motor of 8,000 horsepower. The rating of the generator operated by this motor on standard specifications is 5,750 kilowatts at 300 revolutions a minute. The combined machines in addition to their enormous capacity, are remarkable for concentrating in an exceedingly small floor space a volume of 12,000 kilowatts. The photograph of the machines, which is reproduced herewith, was taken while they were being tested at the shops by the Behrand system, under full-load conditions, corresponding to 7,200 kilowatts on the generator, with the expenditure of no more than 300 kilowatts in order to produce the same losses in the machine which exist under full-load conditions.

GIGANTIC FREQUENCY-CHANGER FOR SHAWINIGAN FALLS.

The working of the generator and motor forming the frequency-changer at Shawinigan Falls will be carefully noted by electrical engineers in all parts of the world, and if it is as successful as the builders confidently anticipate the result will be a valuable addition to existing data on the subject of alternating-current machinery.

## Tentative Ordinances for Chicago Surface Lines.

Tentative ordinances have now been completed by the local transportation committee of the Chicago City Council. On election day the voters, therefore, will have an opportunity to vote on a definite measure intended to secure for the public first-class street-railway service without needless delay.

The tentative ordinance for the Chicago City railway requires the present waiver and surrender by the company of the rights under the 99-year law. It binds the company to reconstruct its lines at once at a cost of about $16,000,000 to give the public improved service. It reserves to the city the right of municipal ownership upon payment for tangible values at the end of a term of 13 years, during which the city will receive compensation aggregating $5,700,000. It demands universal transfers. The ordinance drafted for the Union Traction Company agrees substantially with the one for the City railway, whose most important provisions have been printed in the Western Electrician.

The committee on local transportation says that its tentative ordinance embodies "a well-considered and thoughtfully matured public programme" which "recognizes and protects both public and private interests."

## Recent Work of the Electric-railway Test Commission.

By H[illegible] H. [illegible]

Superintendent [illegible]

The field work of the Electric-railway Test Commission approaches completion, the test [illegible] being at work upon the lines of the Indiana Union Traction Company investigating the problem of air resistance in the motion of car bodies. As will be remembered, the commission, consisting of Messrs. J. G. White, H. H. Vreeland, J. H. McGraw, W. J. Wilgus and G. F. McCulloch, was appointed over a year ago by President Francis of the Louisiana Purchase Exposition in consultation with Prof. W. E. Goldsborough, chief of the department of electricity. The commission immediately began preparation for tests at St. Louis and elsewhere, and early in the summer actual testing was begun. A test corps of ample size, selected from various technical schools, has been at work making such tests as were recommended by a number of engineering committees appointed by the commission to act in an advisory capacity. The tests have comprised studies of the alternating-current losses in rails; of the efficiency of various methods of braking and accelerating both city and interurban cars; of the energy consumption in cars with different kinds of service, and of the resistance offered by the air to the motion of cars at high speeds.

While the earlier part of the work has been described in some detail in the technical press, but little has been said regarding the special dynamometer car designed and constructed for the purpose of measuring directly the head and rear pressures and the side and roof resistances of car bodies. This car was recently completed at the shops of the Indiana Union Traction Company at Anderson, Ind., this company having co-operated heartily in the rather tedious work incident to an experiment of this sort. The equipment for the car was secured partly by loan and partly by purchase of supplies through funds donated to the work by various electric and steam-railway companies and by engineers interested in the investigation of important railway problems. The Indiana Union Traction Company, in addition to the facilities offered in its shops and offices, placed at the disposal of the commission a pair of high-speed Baldwin trucks and a set of four Westinghouse No. 85 motors, rated at 75 horsepower each. The Baldwin Locomotive Works made the changes in the center plates and side bearings of the trucks necessary to enable them to turn freely under the frame of a steel flat car loaned by the Pressed Steel Car Company. A motor-compressor of ample size, with governor and brake cylinder, was furnished by the National Electric Company, and the test corps designed and constructed the special brake rigging necessary to adapt these to the steel car frame. A powerful hand-brake rigging was also constructed, with the Peacock brake drums supplied by the National Brake Company. Special "bumpers" were constructed to prevent damage to other cars in coupling, and heavy chains were used to prevent excessive motion of the car frame with respect to the trucks. As the frame was raised considerably above its usual height by the changes mentioned this was considered desirable.

The dynamometer equipment, consisting of an interurban car body 32 feet long, without vestibules, rolls freely upon rails screwed to the flat-car floor. This body, with a special steel vestibule and a standard vestibule, were supplied by the J. G. Brill Com[illegible] plied with dashpots, and the weighing mechanism consists of the regular beam with weights and poise, and in addition a spring balance with dial is employed to render easier the manipulation of the machine.

A [illegible] for the [illegible] resistances from the total. The vestibule is independent of the body, but is carried therefrom by means of a link suspension. In order to guide the vestibule and to transmit the pressure to the weighing device a [illegible] the vestibule, projects into the car a distance of eight feet and it is guided on all sides by small Chapman bearings. This method of suspension has proved very satisfactory. In order to secure stability of the vestibule and body each of these is held against the scales by counterweights, the forces of which are transmitted through bell-cranks and levers, all equipped with knife-edge contacts.

In order to eliminate from the measurements all forces but those due to the air the controllers are mounted upon iron stands carried upon the flat-car floor and projecting into the car body, thus removing the effect of stiffness in the controller cables, a serious matter in a car of this size. Similarly the trolley base is inside the car, carried upon the top of an oak post which projects upward from the flat car. No error is possible, therefore, from the resistance between trolley wheel and wire. While the forces mentioned are small in amount, the sensitiveness of the apparatus is such that the precautions taken are necessary.

The construction of the air-resistance car was carried out by the test corps, which put in about three months in the actual detail work. This included the assembling of the equipment, the construction of the special brake rigging and other equipment, with the exception of the heavy steel and woodwork, which was done by outsiders from the funds of the commission. The corps also wired the car for a double-end controller arrangement, one controller of the Westinghouse "L4" type being loaned by the Indiana Union Traction Company, the other by the Westinghouse Company, the latter also supplying a pair of circuit breakers and a large number of resistance grids for controlling the running speed of the car.

The commission has realized the necessity of making exact measurements of all of the quantities involved in these tests, especially in regard to the matter of speed. For this purpose two independent plans are employed. The test track, somewhat over 25,000 feet in length, is divided in sections of 1,000 feet each. The sections are marked by large signs plainly numbered. The instant of passing each sign is indicated on the graphical record of a General Electric recording ammeter, which is also used for the current record. This ammeter records upon a strip of paper regular intervals of five seconds each. Upon this record is superimposed the time of passing each of the section signs, this being accomplished by closing a switch for an instant as each of these signs are passed. Thus the time of passing through a section of 1,000 feet is accurately recorded.

The second speed device consists of a small dynamo carried upon the truck frame and geared to the car axle by sprocket wheels and chain. This dynamo is an "Apple" igniter of the Dayton Electrical Manufacturing Company. It has permanently magnetized field poles; but these also carry exciting coils, through which the field current of the recording ammeter is also passed. As this current must be maintained accurately at a value of one ampere for current measuring purposes, it is admirably adapted for the purpose mentioned. The electromotive force generated by the dynamo is read upon a Weston voltmeter specially arranged for this purpose. The electromotive force at 60 miles an hour is about seven volts. The readings are directly proportional to the speed. This apparatus has now been in operation for some weeks and has demonstrated its accuracy and convenience.

In addition to the speed measurements, accurate readings at five-second intervals of motor electromotive force are recorded, and the current record is continuously checked by means of a direct-reading ammeter in the same circuit. The direction and velocity of the wind are also taken at frequent intervals, accurate anemometers having been supplied by Queen & Co. for the purpose.

The tests on the Louisiana, as the air-resistance car has been named, will continue until sufficient data are at hand to determine the resistance to the motion of different shapes of car front at all speeds reached by modern interurban cars up to 70 miles an hour, this limit being set by the line and motor

capacities. A speed of 72 miles an hour has been reached for a short period.

During the last few days another important investigation has been completed by the use of a car exhibited by the Cincinnati Car Company at the St. Louis Exposition. This car is supplied with the same motor equipment as the Louisiana, but it has in addition the latest type of Westinghouse electropneumatic control. The tests made upon this car were designed to supplement those previously made and to supply important data, not only in regard to the control system but having reference in general to problems of heavy interurban-car operation. An interesting feature of these tests was that all records were taken autographically, a special recording table having been constructed along the line of the experience gained at St. Louis. A wide strip of paper is carried by motor power across a glass table on opposite sides of which the observers are stationed with their instruments. Opposite each is a guide and pencil carriage, the latter of which is operated by a cord carried over a drum attached to a pointer over the instrument needle. The observer simply follows the motion of the needle with his pointer, and the result is recorded. The base line for each record is traced by a separate pencil carried by an electromagnet through which passes the current from a time-marker recording five-second intervals, thus synchronizing all of the records. While somewhat similar to other recording apparatus in use, this equipment was designed independently and has some features of its own.

The results of all the work of the commission will be published in full in a report to be issued as soon as practicable after the completion of the work.

## Power Transmission in Formosa.

Some interesting facts are transmitted by United States Consul F. D. Fisher at Tamsui, Formosa, concerning a new power-transmission plant, work upon which was begun by the engineering department of the Formosan government early in 1904. The site selected is about ten miles to the southeast of Taihoku, immediately below the junction of the Hokusei and Nansei rivers, which form the Shinten River. Waterpower will be used, and will be supplied by a canal cut from the upper source of the Nansei River (south branch), which flows down the mountains in a series of cascades. Just above the junction the course of this stream describes a reversed S, which may be used to illustrate the construction of the canal from the upper point of the figure to its center, where the water is brought to the opposite side of the river by means of siphon pipes, thence to the lower point of the figure to the site of the plant, where it will have a fall of about 50 feet. The length of the canal is 7,200 feet, which includes a tunnel of 220 feet, and 280 feet of two-row siphon pipes each five feet in diameter. The width of the canal at bottom is from 11 to 12 feet, and the discharge will be 250 cubic feet per second. This is intended to give 1,000 horsepower, but 650 horsepower will be sufficient for the present requirements.

The plant will be equipped with two McCormick turbines, each of 384 horsepower and 450 revolutions per minute, two three-phase Westinghouse alternating generators of 250 kilowatts, 11,000 volts and 450 revolutions per minute, a McCormick exciter turbine of 49 horsepower and 950 revolutions per minute, and a Lombard governor, type D.

Considerable delay has occurred in the arrival of some of the equipment from the United States, and the plant will not be completed before June or July of this year. It will supply the electric power for lighting the cities of Taihoku and Daitotei (Tamsui), also for an ice plant, sawmill and other works in the city first mentioned. The cost, including the construction of the canal, will be approximately $175,000.

## Electric Pumps for the Comstock Lode Mines.

For years numerous efforts have been made to unwater and explore the entire Comstock lode in Nevada. The latest move in this direction has just been made by the Ward Shaft Association, consisting of a group of the middle mines, composed of Gould & Curry, Savage, Chollar, Potosi, Bullion, Alpha Consolidated, Exchequer and the Julia Consolidated Mining Company, which own and operate nearly a mile of the middle lode.

The International Steam Pump Company, which installed the apparatus at the Ward shaft, was represented by Charles C. Moore & Co., engineers, its Pacific Coast agents, and by Carl George P. de Laval, who came to Virginia City especially to investigate the situation at the Comstock lode. Leon M. Hall, chief engineer and superintendent for the Ward Shaft Association, conducted negotiations for the last-named association. The contract calls for two first-motion electrically driven pumps, each of the units to have capacity for lifting 1,600 gallons of water per minute against a pressure equivalent to a height of 1,500 feet, or from the 3,000-foot level up to the level of the south lateral branch of the Sutro tunnel.

Each pump is to be driven by an 800-horsepower slow-speed induction motor. The contract includes a column pipe, traveling crane for the pumping station, automatic oil system, a small air compressor for filling the air chambers, a small vacuum pump operated by compressed air for discharging air from the suction chamber, all the piping, valves of every description for completing the installation and a complete set of duplicate parts of the pump.

It is intended to install a temporary drainage plant at the shaft, first using an air lift to lower the water to the 1,800-foot level and thence down to the 2,500-foot level without other pumps. The present bottom of the shaft is at the 2,500-foot level, and when that point is reached the shaft will be sunk through the solid rock to the 3,000-foot level, where the permanent pumps just contracted for will be installed.

## A Method of Measuring Magnetomotive Forces.[1]

By Rudolf Goldschmidt.

Modern electrical machines are, as a rule, highly saturated in the iron of the magnets as well as in the teeth of the armature. The higher this saturation the more the ampere-turns of the fields are dependent on the magnetic properties of the iron and on accidental faults in the magnets, such as blow holes in the cast steel or bad joints. In any case it is very important, from the designing and manufacturing point of view, to find out from the actual machine how many ampere-turns are required for driving the flux through the magnet yokes and poles, the air-gap and the teeth of the armature.

The method of measuring the "magnetic potential drop" described in the following article was the outcome of special tests, which it was found necessary to make on actual steel field magnets which were suspected of being faulty in quality and

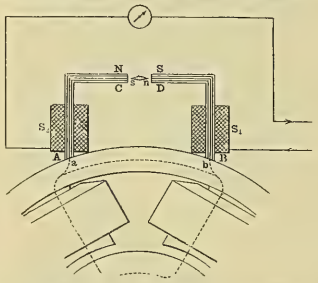



FIG. 1. DIAGRAM OF INSTRUMENT TO MEASURE MAGNETIC POTENTIAL DROP.

casting, and the results proved that it was extremely suitable for the purpose, being easy to manipulate in the shops and requiring a minimum of special apparatus or fine adjustment, which would obviously lead to complications. To measure the "magnetic potential drop" between the points (a) and (b) in the yoke of a continuous-current machine, two laminated iron cores (AC) and (BD), as shown in Fig. 1, are placed on (a) and (b), respectively, in the manner shown, the gap (CD) being from three-quarters inch to seven-eighths inch. By this arrangement we have formed a small "magnetic shunt" or "by-pass" to the yoke. This shunt will take up a small amount of the magnetic flux. Point (C), for instance, will show north polarity, point (D) south polarity, and a small compass needle placed between (C) and (D) will assume the position indicated in Fig. 2, pointing with its south poles to (C). The limbs (AC) and (BD) carry two coils ($S_1$) and ($S_2$), which we excite with a current so that they counteract the magnetic potential between (a) and (b). If we increase the ampere-turns of ($S_2$) and ($S_2$) sufficiently to overpower the magnetic force of (a, b), then the flux in the "magnetic shunt" would reverse, the polarity of (C) would become north and the polarity of (D) south, and our compass needle would point as shown in Fig. 3. If we adjust the current in ($S_1$) and ($S_2$) so that the compass just begins to move from one position to the other, the magnetomotive force

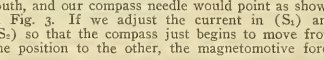



Fig. 2. Fig. 3.

A METHOD OF MEASURING MAGNETOMOTIVE FORCES.

of the coil is equal to the potential difference between (a) and (b), and thus represents directly without any further calculation the amount of ampere-turns required to drive the flux through the yoke of the machine. From the above it will readily be seen that it is not necessary to have a very good fitting joint between the field magnet and the test cores, this being a zero method.

The method as here applied to the yoke of a continuous-current machine can naturally be used in any case where magnetomotive forces are to be measured. As to the exactness of the method, I may say that this was tested by measuring known values of known magnetomotive forces and by summing up the different potential drops in simple as well as in more complicated magnetic circuits, and it was found that the measurements agreed sufficiently well for all practical purposes. For instance, the measurement of a known value of ampere-turns was carried out with satisfactory results on a choking coil in which the drop of magnetic potential in the iron was insignificant, and practically the full amount of the ampere-turns in the choking coil could be measured by the apparatus.

Among many other measurements the most interesting perhaps is that of the magnetic potential drop in the different parts of the magnetic circuit of a continuous-current machine. Fig. 4, drawn from a photograph, shows the apparatus applied to a continuous-current machine by Messrs. Crompton & Co. An actual measurement showed that the drop in the yoke was 300 ampere-turns; over the air-gap and teeth, 6,400 ampere-turns; over the teeth alone, 600 ampere-turns. The actual ampere-turns on the field of the machine were 7,300. The difference between this amount and the sum of the single measurements—that is, 7,300 — (6,400 + 300) = 600—represents the drop in the two poles, or 300 ampere-turns for each pole. To shield the compass needle from the influence of undesirable stray lines the

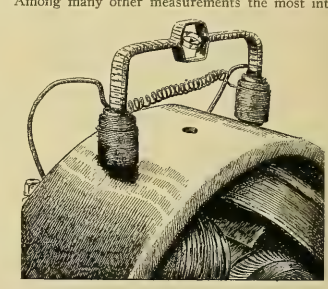


FIG. 4. PERSPECTIVE VIEW OF APPARATUS FOR MEASURING MAGNETIC POTENTIAL.

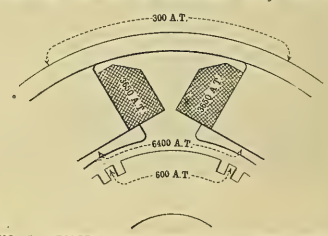



FIG. 5. DIAGRAMMATIC SKETCH OF MAGNETIC CIRCUIT.

compass can be surrounded by a small iron box, as shown in Fig. 4.

Fig. 5 shows a diagrammatic sketch of the magnetic circuit, with the figures inserted as they were actually determined by the apparatus.

## Safety In Electrical Installation.

Fred G. Dustin, city electrical inspector for Minneapolis, gave an interesting lecture on February 24th before the Society of Engineers of the University of Minnesota on "Safety in Electrical Installation." After describing the development of the present insurance rules, through the co-operation of the electrical and insurance organization, he took up the city ordinance governing electrical installation and operation. To illustrate the necessity for certain rules, he showed interesting samples of defective fittings and construction which he had condemned. Samples of new devices showed how new rules are being met. Among other instances of improper operation, he noted an instance where the only fuse in the circuit had been replaced by a tenpenny nail. In closing, he admonished the young engineers to supplement their theoretical work with practical experience, emphasizing that their ultimate success or failure would depend upon their ability to put into practical use the technical training and knowledge they were acquiring.

## No Useless Information.

A discriminating subscriber in Los Angeles writes a pleasant letter to the Western Electrician, in the course of which he says: "The more I see of the Western Electrician the more I like it. I have therefore ordered my subscription extended another year. Your paper does not contain a lot of what I call 'useless information,' but is strictly up to date in every particular."

1. Part of an article in the Electrician (London).

## Electrical Effects in the Inaugural Ballroom.

On the night of March 4th the Pension Office in Washington was the scene of a brilliant ball, or promenade, perhaps, for there was not a great deal of dancing in the crush, which wound up the festivities in honor of President Roosevelt's inauguration. The court in the Pension Office is 310 feet long and 110 feet wide, with a roof rising by different stages to a total height of 130 feet from the floor. As shown in the general view, it is surrounded by a series of balconies supported on small columns. These balconies are 10 feet wide, and the rooms surrounding the court open into them.

While in general the building is well adapted for such large social gatherings as the inaugural ball, it is considered a difficult one to decorate in such a way that the bunting and flags, flowers and plants and electrical effects shall blend in one harmonious design. The result of last week was, however, highly satisfactory.

About 14,000 incandescent lamps were used for the illumination and lighting effects of the brilliant interior. They were wired on direct-current, three-wire circuits, the current being brought into the building by means of three sets of 500,000-circular-mil cables. Each set of cables was independent, and supplied with fused main switches and wattmeters. One main provided current for the lights on the first floor and the double row of lamps on the face of the first balcony. Another supplied the lamps on the second balcony, while the third served the 4,000 lamps in the nimbus back of the music stand.

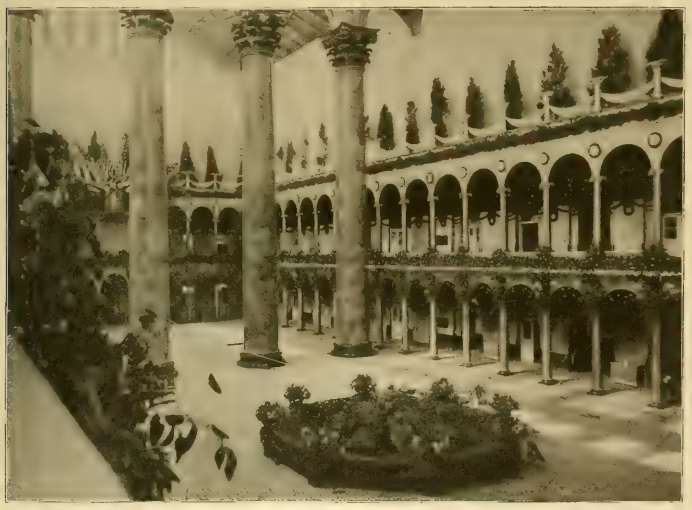
The architectural lines of the building were well preserved, while the decorative treatment gave the building its appropriate festive appearance. The first-floor decoration consisted of a ceiling of green foliage hung in festoons, with a basket of growing flowers and ferns hung opposite arch centers. The foliage was well sprinkled with miniature lamps, making an excellent effect.

In circles of evergreen above each column supporting the first balcony were four large azaleas. [illegible] cable and sign-base lamps. [illegible] the face of the second balcony, [illegible] of four candlepower frosted lamps without reflectors.

The most attractive feature of the lighting was the very elaborate nimbus back of the band stand and directly facing the president's stand at the other end of the great court. The framework consisted of two arches, the forward arch being 50 feet [illegible] the base and 50 feet high; the rear arch was 10 feet smaller in width and height, and set back two feet. These arches were strongly secured together by strap iron, bent to produce the shell effect. Between the two arches was stretched wire netting, to which the Elblight cables were secured. On the face of the large arch were two rows of four-candle-power, white frosted lamps, spaced three inches between centers. The inner arch was set with white opal lamps spaced three inches apart. The 13 medallions, each consisting of five blue lamps in pagoda reflectors, arranged star-like about a central lamp of similar type, were bordered by two rows of yellow lamps. The lamps surrounding the lower medallions were light yellow and they graduated in shade till a very deep golden yellow was reached in the lamps bordering the top and central medallion. In the space between the medallions was woven yellow Elblight cable to make a netting of about eight-inch mesh. The curved ribs of the shell were covered with green cable, lighted by white opal lamps with graduated spacing. The streamers on each side of the shell were closely studded with white opal lamps, with spacing so graduated as to bring the lamps very closely together at the point where the streamers were caught together at the junction with the outer arch.

When all the 14,000 lamps were aglow the effect is difficult to describe. The light was intense enough to bring out fully the darkest colored foliage decorations, while it mellowed the apparently glaring daylight colors of the bunting and harmonized fully the combined decorations.

In the middle of the court the former severely plain fountain had been metamorphosed. Rocky



GENERAL VIEW OF INAUGURAL BALLROOM.

Above them came a double row of frosted lamps in six-inch pagoda reflectors, placed six inches center to center horizontally, and three inches perpendicularly. The lamps were so placed that the tips of the top row pointed directly to the eye of a person in the center of the court, while those in the bottom row were set to an angle to point one-fourth across, securing, in this way, an even, soft, mellow light over the entire court. Above the double row of lamps was a broad three-foot band of smilax whose lower streamers partly covered the lamps.

The ceiling of the first balcony and part of the side wall were covered with dark red bunting, that on the side wall being nearly covered with broad green streamers gathered in graceful loops. Facing the wall were frosted lamps in pagoda reflectors, to brighten and bring out the colors. Above each column of the second balcony was an 18-inch disk containing 50 white and yellow tinted lamps closely clustered. The disks were constructed of Elblight arches had been constructed, and covered with moss and ferns, and electric lights were applied to make the central feature worthy of its central position.

The president's room at the ball was lavishly decorated by the florist, and was lighted by six lamps in Holophane globes, suspended in the center of the room.

Victor Mindeleff was the designer of the decorations and E. C. Graham the constructor. The electrical work was done by the National Electrical Supply Company of Washington, D. C.

## Another Municipal Lighting Experiment Abandoned.

A newspaper dispatch dated at Sterling, Ill., March 5th, says: "The municipal-lighting plant of Rock Falls, Ill., is to be discontinued, as it was a losing venture. The city's light will be furnished by a private company." The plant began operation in 1893 and cost $20,000.

## Street-railway Changes in Buffalo.

[illegible] secretary-treasurer, J. F. Slocum of Buffalo; [illegible] Arthur [illegible] Philadelphia.

NIMBUS BACK OF BAND-STAND IN INAUGURAL BALLROOM.

Robinson, Louisville, Ky.; Pendennis White, Buffalo; William B. Rankine, Niagara Falls; L. J. Hayden, Park Ridge, N. J.

The retiring directors are Francis Lynde Stetson, Charles McVeagh and Richard Trimble of New York, W. Caryl Ely of Buffalo and Burt Van Horn of Newfane, N. Y.

The new officers of the International Railway Company are: President, Henry J. Pierce; vice-president, Daniel S. Lamont of New York; secretary-treasurer, J. F. Slocum; directors, H. J. Pierce, G. L. Boissevain, Arthur Robinson, Pendennis White, T. E. Mitten, T. Dewitt Cuyler, Daniel S. Lamont, A. M. Robinson, Charles Steele, E. B. Osler, Thomas Blackstock, Robert L. Fryer, Henry M. Watson, Daniel O'Day and E. T. Stotesbury.

The retiring directors are Temple Bowdoin of New York, W. Caryl Ely of Buffalo, Porter Norton of Buffalo and William B. Rankine of Niagara Falls.

On Friday, March 3d, Van Horn Ely, assistant to President W. Caryl Ely; Richard F. Rankine, secretary-treasurer; Edward McDonnell, assistant to the general manager, and H. M. Pease, auditor, retired. Thomas W. Wilson, chief engineer of the International Railway Company, has been appointed general manager. In this position Mr. Wilson succeeds T. E. Mitten, who is now the operating head of the Chicago City Railway Company.

Thomas W. Wilson was graduated from Lehigh University in 1890, when he went to work for the Pennsylvania Steel Company of Steelton, Pa., as an engineer, and was with the company for five years. In 1896 he was appointed chief engineer of the Charleston (S. C.) Street Railway Company. He enlisted in the army during the Spanish-American war and was chief topographer of the Second Army Corps. In 1899 Mr. Wilson accepted a position as assistant engineer of the International Railway Company, and was made superintendent of construction in 1900, being later promoted to the position of chief engineer.

The Pocahontas, Graham and Tazewell Electric Belt Line of Pocahontas, Va., has been incorporated to build an electric railway. J. S. Browning is president.

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## DATES AHEAD.

Iowa Telephone Association (annual meeting), Chamberlain Hotel, Des Moines, March 14th to 16th.

Ohio Independent Telephone Association (annual meeting), Columbus, March 30th.

Iowa Electrical Association (annual meeting), Hotel Julien, Dubuque, Iowa, April 19th and 20th.

National Electric Light Association (annual convention), Denver, June 6th, 7th and 8th, and Colorado Springs, June 9th and 10th.

National-Interstate Telephone Association (first convention of consolidated telephone associations), Chicago, June 21st, 22d and 23d.

International Association of Municipal Electricians (annual convention), Erie, Pa., August 29th, 30th and 31st.

Ohio Electric Light Association (annual convention), Hotel Victory, Put-in-Bay, August 16th to 18th.

American Electrotheraneutic Association (annual meeting), Academy of Medicine, New York city, September 19th, 20th and 21st.

TRACK BONDING is a matter of much importance in street-railway operation, and the paper by Mr. C. W. Ricker before the New York meeting of the American Institute of Electrical Engineers, given in abstract in this issue, throws considerable light on a subject to which hardly enough attention is given. The problem of securing a good and permanent electrical contact betwen the copper bonds and the steel rails is a difficult one, especially where the tracks are laid in city streets, where the bonds are beneath the surface and subject, almost constantly, to the action of moisture. As pointed out in the discussions at both the New York and Chicago meetings of the Institute, the problem of electrolysis is a serious one, always confronting street-railway companies, and it is almost invariably due to poor bonding of the track. This subject, therefore, which is of such timeliness, should receive the most careful attention of engineers, and valuable data like that compiled by Mr. Ricker will always be received gladly.

WHILE the American consular service is not perfect, it is a pleasure to bear testimony to its general usefulness and efficiency. It has been greatly improved in the last few years, both in the matter of collecting and disseminating information—that branch of its work to which we now particularly refer. The Daily Consular Reports issued by the Department of Commerce and Labor are particularly valuable and timely, and show a diligence in securing data and intelligence in presenting them that are alike creditable to the consuls living in foreign parts and the department at Washington. This fact is realized abroad, even though it is sometimes overlooked at home. For example, the London Globe has this:

> Why should not the British consular service be as alert as that of the United States in obtaining and publishing information of the highest commercial value? It cannot be pretended for a moment that there is equality or anything approaching equality between the services in that detail of efficiency. Where, for instance, is there any British consular report on the wonderful expansion of German trade and influence in China which can be compared with the exhaustive summary just issued at Washington? Intelligently compiled from the publications of the Central Union of Berlin, it pieces together a mass of authentic information of the utmost consequence, both politically and commercially, to this country. The whole field of competition is presented at a glance, whereas in the case of our own consular reports there is rarely any attempt at Downing Street to frame a similarly exhaustive digest.

We may add that on technical subjects the consular reports often exhibit discernment and discrimination that are entirely praiseworthy.

IT IS an interesting if rather complicated situation described by the London correspondent of the Western Electrician this week in his summary of the history of telephone operation in the United Kingdom, apropos of the recent agreement between the British Postoffice and the National Telephone Company. The upshot of the matter, as we understand it, is that in a little less than seven years all public telephone business in Great Britain will be conducted by the government or by municipalities. Private telephone operation will be a thing of the past in that country after December 31, 1911. In the United States this would be viewed as a momentous change and one which would be regarded with considerable apprehension. But almost from the beginning the government in England has been mixed up, to a greater or less extent, with the telephone business, and the present agreement simply comes as the culmination of a long series of negotiations. We trust that when the Postoffice is in entire control of the telephone service it will be able to show better results than a similar government monopoly in France. In relation to quality of service, it is undoubtedly a fact that the private companies of the United States provide the best quality of telephoning in the world.

Our correspondent refers, very naturally, to the Glasgow telephone situation and says that the municipal exchange in that city has reduced the rates and that while the people seem satisfied with the financial results, independent experts consider that the true condition of affairs is hidden by the system of accounts in use. How familiar that sounds! It might apply to the municipal street-lighting plant in Chicago with equal truth. But if, as is undoubtedly the case, the service of private companies, as exemplified in the United States, is the best obtainable, and if the feasibility of rate reduction is questionable, as the experience of Glasgow seems to indicate, where is the advantage of public ownership in telephone operation?

IN the selection of electric cables, the authors of a paper recently read abroad have pointed out that the specification of any standard cable should state the effective sectional area of the whole conductor—that is, the area of a solid wire having the same conductivity—and the number of wires in the strand. The minimum conductivity allowable should be defined. In rubber-insulated cables the copper conductors should always be tinned, according to the authorities quoted. For chemical reasons, rubber and copper should be kept apart, and the coating of tin on the wire acts as the necessary separating medium. The pure-rubber layer between the rubber compound and the conductor should be of absolutely pure rubber; but it is observed that there is hardly any article of general commerce in which the buyer places himself so largely in the hands of the seller as he does in the matter of india rubber. Even in pure rubber strip, made solely from fine Para rubber, appreciable differences in the tendency to oxidize may be noticed. In relation to fire-resisting qualities it is said that they cannot be secured by modification of the dielectric but must be attained by special treatment of the tapes, braidings or lappings which form the usual mechanical protection to rubber cables. During and after the process of lapping, braiding, etc., a suitable fire-resisting compound is served on the coverings. Any degree of fireproofing can be obtained by adding to the number of braidings or lappings. This last assertion is especially interesting in view of recent newspaper dispatches from London giving an account of a fire in which aerial telephone cables played a conspicuous part in spreading the flames. Very likely the telegraphed reports were exaggerated, but it is satisfactory to have the assurance of experts that any required degree of fire-resistance can be had by treating the cable coverings.

ALTHOUGH we have seen no authoritative announcement of the fact, there ought, surely, to be no question of the electrical operation of trains in the practically completed Simplon Tunnel. This tunnel is the longest in the world and connects Switzerland and Italy under the Alps, which tower over 4,000 feet above it. It is 12 miles and 440 yards long and connects Brigue in Switzerland with Iselle on the Italian side. Very elaborate means were taken to secure ventilation and to pump out the water, often hot, which was encountered. The actual piercing of the main tunnel was finished on February 24th, when the Italian workman who had fired the first blast in 1898 fired the last. The highest altitude of the tunnel is 2,310 feet above sea level, or considerably lower than the famous St. Gothard Tunnel, which is nine miles long and ranks next in length to the one which is now attracting the world's attention. When the two boring parties met in the Simplon Tunnel the event was signalized throughout Switzerland by the ringing of church bells and the firing of cannon. The president of the Swiss Republic sent a congratulatory message to the king of Italy. Thus one of the greatest engineering achievements of the time is virtually accomplished. The Swiss and Italian governments jointly financed the undertaking, and, according to the contract, the tunnel should be ready for traffic on May 15th of this year. This limit will probably be extended. The railroad through the tunnel should be electrically operated, of course. It would seem that in a 12-mile tunnel steam locomotives would not be tolerated, even with the most elaborate ventilation that the ingenuity of the engineers could invent, if a practicable substitute could be obtained. Fortunately, there is such a substitute in the electric system, which, it is not to be doubted, will be employed. But there are many interesting electrical features, such as the use of alternating-current or direct-current motors, overhead wires or contact rail, electric locomotives or motor cars, methods of train control and operation, safety appliances and the like, which demand engineering attention. It is curious that one does not hear more of these details, now that actual railroad operation is near at hand.

## On Track Bonding.[1]

By C. W. Ricker.

The first condition to determine the character of the bonding is the rail joint, which in turn is determined by the roadbed. Track joints are of two general types, rigid and flexible. The first is applicable only to track laid on continuous rock or concrete foundation, with the rails buried in hard pavement, and includes electrically welded, cast-welded and riveted joints. Electrically welded joints require no secondary electrical connection, but their availability is limited and they have not attained great use. Cast-welded joints are widely used in large cities, and unless the current density is high, need no additional bonding. Riveted joints, used somewhat abroad, are similar to cast-welded. The majority of all track, including all not buried in pavement, must have flexible joints of either bolted or wedge types, and the electrical conductivity must depend upon bonds installed for that sole purpose, that of the rail joint itself being slight.

To get the necessary conductivity, bonds are nearly always of copper, about the only exception being those of tin amalgam. To reduce cost and resistance they must be as short as practicable and the manufacturing cost must be kept low to preserve the scrap value as near the first cost as possible. For durability they must be flexible enough so as not to break or lose contact by the allowable relative motion of the rails. They must be formed so they may be applied to the types of rails in ordinary use; in such position as to be protected from accidental damage and from theft. They should be readily accessible for inspection and repair. The cost of application must be kept low, and to this end it is very important that the process shall be so simple and easy that no highly skilled labor or extraordinary care is required to install them with certain and uniform results. The bond that satisfies all these conditions has not yet been devised.

The ordinary process of selection has developed a form of bond made of annealed copper and consisting of a flexible stranded or laminated shank about eight to 12 inches long, welded to solid terminals of considerable mass, which are attached to the rail-web under the joint plates or less frequently under the base of the rail. Accessibility for inspection and repair, however, is almost wholly sacrificed and the importance of good work in manufacture and application is thereby greatly increased.

The failure of a bond is that condition in which the resistance of the joint is seriously increased, which may occur without interruption of the continuity of the bond itself. The general cases are:

1. Breakage of bonds.
2. Disintegration of the bonds.
3. Impairment of contacts.

Breakage.—Breakage may occur because of defects in manufacture, as in copper bonds with welded terminals, the strands may be weakened by overheating where they enter the terminal; and a slight but continuous motion of the joint will cause them to break, one by one, at this place. Long-continued jar and repeated flexures will produce fatigue in the metal (what has been called the Bauschinger effect in steel). Such breakage in the case of either welded or solid bonds is of course most frequent, where the flexure of the bond due to rail movements is too great for its flexibility, which means ill-selected bonds or badly kept track.

Disintegration.—The surfaces at the imperfect welds in composite bonds corrode, increasing the resistance greatly and loosening and weakening the bonds so that they may be pulled apart.

Tin amalgam used at contacts or in masses hardens and shrinks, losing flexibility and contact with the bonded surfaces. In the case of amalgam plugs enclosed in cork boxes the cork sometimes breaks, allowing the soft amalgam to run out.

Impairment of Contact.—By far the most important cause of impaired contact is oxidation. This is greatly facilitated by the presence of moisture, so that the slightest crevice into which moisture may penetrate and lodge is dangerous. Soft-soldered contacts underground are not to be trusted, especially on track laid in streets, which is sure to be wet with dirty water, though there is no apparent reason why soldered contact entirely above ground should not be durable if all traces of corrosive flux are removed. Brazed joints seem to give no trouble.

The heat capacity of the rail is so great that it is difficult to get any considerable part of it to soldering temperature by external heat application without excessive expense and possibly damage to the rail, so the edges of the terminal surface are usually well soldered and the middle portion but imperfectly.

Large flat surfaces held in contact by bolts have been tried, though they have never attained great vogue. The cost and bulk of any arrangement of bolts and plates which could maintain intimacy of contact similar to that of an ordinary compressed terminal, together with the cost of finishing and fitting the flat surfaces, would be prohibitive. In some cases such bonds have been used in joints where there is supposed to be enough motion to keep the surface rubbed bright, but here there would seem to be little advantage in [illegible] as the joint plates fill the same [illegible]. The following data illustrating the foregoing may be of interest:

A track laid with 87-pound 60-foot girder [illegible] concrete base in unusually substantial manner [illegible] joints driven tight and made as rigid as possible, was bonded with two No. 0000 bonds with [illegible] terminals expanded with a steel drift left in the hole. On account of the rigidity of the joints the bonds were very short, of horseshoe type, four inches and 2.5 inches between terminals. Bond holes were punched at the mill and reamed bright with taper reamers just before applying the bonds, which were set with the shank at the small ends of the taper holes. Measurements of 15 joints by comparison of fall of pressure through the joint with that in 10 feet of rail made with a millivoltmeter showed the mean joint resistance equal to that of one foot of rail. The same joints measured in the same manner with the same instruments one year later showed no perceptible increase in resistance.

A double-track railway laid with 60-pound T-rails, rock-ballasted and maintained unusually well for an electric railway, was bonded with masses of tin amalgam enclosed in washers of treated cork, pinched between the rail-web and joint-plates. After the road had been in operation about 4½ years and parts of it one and two years less, measurements were made upon joints in the various sections by the same method as the preceding test, with the following results:

| Number of Joints. | Years in Service. | Mean Resistance of Joints. | | Res. Too High to Read. (Over 500 Ft. of Rail.) |
|---|---|---|---|---|
| | | Number Measured. | Equiv. Ft. of Rail. | |
| 13 | 4.5 | 8 | 15.7 | 5 |
| 6 | 3.5 | 5 | 12.4 | 1 |
| 18 | 2.5 | 17 | 8.4 | 1 |

In a single-track interurban electric railway laid with 70-pound T-rails on private right-of-way the joints were each bonded with one No. 0000 copper bond 10 inches long with 0.875-inch welded terminals. In the earlier part of the work the bond holes were drilled with oil lubrication and the bond terminals were upset with a screw compressor by one man using a wrench about 36 inches long. To estimate the improvement possible the resistance of 633 feet of one rail containing 20 joints was determined in the condition described; then the bond terminals were thoroughly compressed with a similar compressor, using a wrench about 66 inches long with a heavy man on the end applying the pressure slowly and steadily. Then a similar section of one rail 425 feet long containing 14 joints was drilled with soda-water lubrication, the holes carefully wiped and the bonds compressed thoroughly as above. The sections of rail when measured were disconnected at both ends and the ballast scraped clear. The readings were taken at night in dry weather and very nearly uniform temperature. Pressure readings were taken with a low-reading voltmeter. Only switchboard ammeters were available for current measurements, but they were new and three were connected in series and the mean readings used. They checked very closely and were reliable enough for comparative measurements.

| | Ohms. Per Foot Rail. | Per Cent. Increase R. |
|---|---|---|
| Drilling with water, bonds well compressed | $1.29 \times 10^{-5}$ | 0 |
| Drilling with oil, bonds well compressed | $1.47 \times 10^{-5}$ | 14 |
| Drilling with oil, bonds poorly compressed | $1.96 \times 10^{-5}$ | 53 |

Cost of Applying Bonds.—Two cases are presented in detail, as it is proposed to try to derive from them some conclusions regarding the most economical expenditure for bonding in two typical roads.

On a single-track interurban railway quoted herein, it was necessary to organize a bonding gang of entirely green men, none of whom had ever seen a bond before. It contained 12 men at $1.75 per day and a foreman at $3, a total of $25 per day. The work consisted in unplating the joints which were half bolted up, drilling two 0.875-inch holes in the rail web, compressing one bond per joint, and replating and bolting up the joints in permanent shape with four bolts each. The equipment consisted of three portable rotary track drills, three screw compressors, about 60 0.875-inch twist drills and the necessary track tools, costing altogether about $350, on which the salvage was about $150. The capacity was 100 bonds a day, making a labor cost of 25 cents per bond. Grinding drills cost about $1 a day, and repairs to compressors, about $1.50, making total cost 27.5 cents per bond, of which five cents was chargeable to plating and 22.5 cents to bonding. The work was continually interrupted by construction trains and the temperature was so high that several men were overcome by heat. With clear track and decent temperature the daily output could be increased 20 per cent. at the same total cost.

On a larger installation in somewhat more favorable conditions, the bonding gang consisted of 10 or 11 men and a foreman, with a total payroll of $23 to $25 a day. The drilling apparatus consisted of a gang drill driven by an electric motor, which made two 0.875-inch holes at once, piercing the rail web in one minute and drilling an average of 30 [illegible] tion of the drills was determined by a rig, so that [illegible] cost per bond. The drilling machine was built especially for [illegible] changes after work was begun [illegible] was rather large—about $2,000—on which the salvage was probably $1,000.

Economical Bonding.—It is at once evident that the proportion of the resistance of the rail circuit due to the bonds is small; in the first case cited, using 60-foot rails, it is a little less than two per cent.; in the third case it is about 13 per cent., and as the resistance of the rail circuit is usually not over 25 per cent. of the whole resistance, the saving by a considerable increase in bonding is relatively small.

In order to reach some general conclusions regarding the economical expenditure for bonding, in cases similar to the two described, by means of Kelvin's law, it is necessary, in order to make the law apply, to make certain assumptions, which are not strictly true, but which, if carefully adjusted to the case taken up, may be near enough for the purpose.

The following data of equipment may be taken as typical of the interurban electric railways of moderate size and capacity, built extensively in the Middle Western states. The No. 0000 copper bond, 12 inches long, with solid 0.875-inch terminals, is selected as a unit, because it is a convenient market size and well adapted for use with the rails assumed.

| | |
|---|---|
| Single track | Two 75-pound T-rails. |
| Cost of power in line | [illegible] per kilowatt-hour. |
| Mean current in track | [illegible] amperes. |
| One joint bond | [illegible] per 1,000 cir. mils. |
| (Based on No. 0000 by 12-inch bond at [illegible]) | |
| Applying same | [illegible] per 1,000 cir. mils. |
| (Based on 20c. per bond.) | |
| Scrap value of bond | 0.056c. per 1,000 cir. mils. |
| Net cost of bond | 0.23c. per 1,000 cir. mils. |
| Useful life of bond | 10 years. |
| Annual cost of bond at 15% | 0.034c. per 1,000 cir. mils. |
| Resistance of bond | 0.0116 per 1,000 cir. mils. |
| (12-inch 0000 copper + 8% for contacts.) | |
| Annual (7,300 hours) loss in one bond | 847 kilowatt-hour per 1,000 cir. mils. |
| Cost of same at 2c. | $16.94 per 1,000 cir. mils. |

$$\frac{0.00034 \text{ cir. mils}}{1{,}000} = \frac{16.94 \times 1{,}000}{\text{cir. mils}}$$

$$\text{cir. mils} = 223{,}000$$

The equipment described would correspond to that of a road operated by synchronous-converter substations having an average traffic of two 40-foot cars per section. Such a road would usually have one No. 0000 bond per track joint, which would seem to be a little too small.

For a road of somewhat heavier construction and traffic and operated at high speed the following data may be assumed; items which are the same as in preceding case are not repeated:

| | |
|---|---|
| Double track | Four 80-pound T-rails. |
| Mean current in track | 800 amperes. |
| One joint bond | 0.19 per 1,000 cir. mils. |
| Applying same | 0.057c. per 1,000 cir. mils. |
| (Based on 12c. per bond.) | |
| Scrap value of bond | 0.056c. per 1,000 cir. mils. |
| Net cost of bond | 0.203c. per 1,000 cir. mils. |
| Annual cost of bond at 15% | 0.0304c. per 1,000 cir. mils. |
| Annual (7,300 hours) loss in bond | 3.387 kilowatt-hour per 1,000 cir. mils. |
| Cost of same at 2c. | $67.76. |

$$\frac{.000304}{1{,}000} = \frac{67.76 \times 1{,}000}{\text{cir. mils}}$$

$$\text{cir. mils} = 472{,}000.$$

This case is fairly comparable with the Aurora, Elgin and Chicago railway, which is bonded with two 250,000-circular-mil bonds per joint.

Discussion (in Abstract).

William Pestell, New York: I have had occasion during the last few years, in the construction and reconstruction of electric railways, to observe various kinds of bonds applied under various conditions, and know to some extent the difference of corrosion of bonds under different conditions. The compressed or expanded terminal bond on a track exposed to moisture and street conditions, such as in street-railway service and girder track, and where the streets are paved and enclosed in macadam, deteriorates more rapidly than where the track is on a private way, the bonds in the latter case not being exposed to the action of moisture to as great an extent as where buried in the ground. In addition to this, I have noted that bonds which had been recently tested and shown to be of good conductivity, after the falling of the wire, and an excessive amount of current passing through the track, showed a great deterioration, sometimes as much as 50 per cent. of the original conductivity of the bond. I have also noted, in taking out some

1. Abstract of a paper presented at the meeting of the American Institute of Electrical Engineers, New York, February 24, 1905. Mr. Ricker is assistant engineer in the electrical department of the New York Central and Hudson River Railroad Company.

of the earlier types of bonds, particularly in New England, where the steel terminal riveted bond was used, with a great percentage of them in service for 12 or 14 years, the terminals appear to be as clean as when put in, the only corrosion being between the copper wire and the terminal. This was also the case with the so-called West End or Brown bond, used in and around Boston, consisting of a tapered steel sleeve, through which is soldered the copper wire, the steel expanded in the hole in the rail. These bonds were usually in good condition and showed practically no corrosion between the steel terminal and the rail.

Calvert Townley, New Haven, Conn.: I offer one thought in connection with the latter part of Mr. Ricker's paper, where he formulates the economical bond. There is one factor in the situation which is not taken account of, and that is the effect of the increased bonding in reducing electrolysis. The greater the capacity of the bond, of course, the greater the conductivity of the track and the smaller the tendency for the current to seek a channel through a water pipe. I have a feeling that the electrical engineer of the future, and his client, the street railway, has a considerable factor of danger to face in the question of electrolysis, and anything we can do to lessen that danger is very important. So that, in calculating the value of the capacity of the bond, account should be taken of the electrolytic action. That, of course, makes it very difficult to put the matter in mathematical shape, because in a locality where there are numerous water pipes the electrolytic factor would be large, and in cross-country running, where there would be no water pipes, or adjacent metal to be damaged by electrolytic action, the effect would be negative.

Ralph D. Mershon, New York: I would like to ask Mr. Ricker a question in the line of securing a little more information, and that is to discover if he has any data bearing on the contact resistance itself in relation to the resistance of the bond. I notice he has eight per cent. for contacts. It would seem to me that that question of contact resistance might be a very important factor in any economical calculations, such as he has made, as, instead of basing his calculations on the circular-mil cross-section of the bond he perhaps ought to take account of the area of contact as well; in other words, with the same cross-section of bonds, we might get better results with two or three or four bonds than we would get with a lesser number.

H. A. Lardner, New York: I do not want to anticipate Mr. Ricker's reply to Mr. Mershon, as he doubtless has some information which will be of interest; but I have had some experience in trying to measure the contact resistance of bonds, and although we frequently run across bonds in which the contact resistance is so great that it cannot be measured—it is 500 feet of rail or more, perhaps—in a bond newly placed I have never yet been able to measure the contact resistance, because with any bond, I do not care much what the character of it is, the contact resistance is below anything it is possible to measure with the instruments generally available. I know of no method of measuring contact resistance of a bond except by the fall of potential from some point on the rail to some point on the bond terminal. That necessarily takes into account a small portion of the rail and a small portion of the bond. No matter how small it is, even if you could measure it, I believe it is largely in excess of any resistance in the contact piece usually in newly placed bonds, and I do not believe you could figure or calculate the resistance of the contact.

Mr. Ricker: In regard to the contact-resistance point which the gentleman makes, in some cases where I have tried to compute the probable contact resistance of compressed or expanded terminal bonds by measuring the actual resistance of a length of track and subtracting from that the resistance of the rail to the length of copper between centers of terminals, the resistance per contact averaged, among a considerable number of contacts, in the case of No. 0000, seven-eighths terminals or contacts in good condition, somewhere in the neighborhood of one-half inch of copper per contact. In Foster's Pocket Book Mr. Burton, of the J. G. White company, is quoted as stating, as the result of some experiments he made, three-eighths of an inch of the bond shank, under similar conditions, and, if I remember correctly, Mr. Burton once told me a value which corresponded very closely to that. I am not able to give very much data on that, unfortunately, because most of the tests which I have been able to make were made under service conditions, and, while they were made as carefully as possible, it was not usually practicable to get all of the different measurements that I should like to get to make the work complete.

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One of the features of the new street-railway system which J. A. Moore and his financial backers propose to build in Seattle, Wash., will be an elevated road on either First or Second Avenue. The "L," according to the statement of Mr. Moore, will be built on steel piers, and stations will be provided at every alternate street along the entire route. The structure itself will be on an average of about 30 feet above the level of the street.

## Absorption of the National Telephone Company by the British Government.

[From the London correspondent of the Western Electrician.]

An agreement [briefly referred to in Western Electrician of February 25th] which has just been entered into between the postmaster-general and the National Telephone Company, if ratified by Parliament, should set at rest, once and for all, the various fears entertained as to the future of telephony in the United Kingdom. Perhaps to recapitulate some of the history of the subject will not be out of place just now.

Early in the '80's, when it was definitely laid down that the Postoffice possessed the monopoly for telephones, as well as telegraphs, it was not thought advisable by the government to secure the patents from those holding them—a proceeding about which, naturally, several opinions are now, and were then, held. A license was granted to a company termed the United Telephone Company for a long period of years. Since that date each successive postmaster-general has found the "telephone question" a constant source of increasing anxiety. Many efforts have been made to put the matter on a sound and practical basis from the national point of view, but with only very limited success. The United company had not been very long in existence when the government thought it would be to everyone's interest to allow free competition. This led to the formation of some other companies, but in a short time the question of patent rights brought all the companies into the law courts. Telephone lawsuits filled the public eye from time to time as new companies came on the scene, and the United company, successful all along the line in having its view upheld that its patents were the master patents, eventually extinguished all possibility of competition until, at any rate, the expiry of its patents. Having done this, and in the meantime assumed the title of the National Telephone Company, a business was quickly developed of such a nature that competition at the expiry of the patents became a practical impossibility.

At the end of about 10 years the government felt it incumbent upon itself to take some further action. After considerable discussion, lasting over several years, the trunk telephone lines—i. e., those forming the means of communication between the various towns of the United Kingdom—were acquired by the postmaster-general from the company. This took place in 1896. From that date a greater cry than even against the company has been heard. In many cases inadequate service was complained of; in others, exorbitant subscription rates; in others, still, a combination of both these evil circumstances, was urged upon the government as a reason for competitive telephony in some shape. The question of the purchase of the undertaking of the company, too, formed many an interesting theme for discussion, but to those intimately acquainted with the whole subject, this appeared very early to be out of the question. The license which the company held from the postmaster-general will expire December 31, 1911, automatically, so to speak, for the company would be obliged at that time to cease operations and at the same time would be called upon to hand over the business to the postmaster-general as a going concern. The postmaster-general was, however, to purchase the undertaking for the value of the wires and fittings. At the same time, the option was given to the postmaster-general to purchase the company's undertaking at certain defined periods at a valuation, which, of course, would have meant that a large sum would have to be paid for good will. This was the position in 1899. At that period the telephone question was at a very acute stage in Glasgow, a large section of the population as well as the corporation being on very bad terms with the company.

Thus it came about that strong representations were made to the government either to buy out the company or to introduce some sort of competition. After a long inquiry on the spot into the conditions obtaining in Glasgow, the whole matter was once more referred to a committee of Parliament, which resulted in the introduction of a bill in Parliament by the government to permit of competition with the National company, either by the local authorities or private companies. As a recompense for this the National company was offered an increase of its license in any district where competition was set up, to correspond with the terms of such particular competitive license.

For a time, it was thought that a more or less satisfactory solution of the difficulty had been arrived at. The Postoffice prepared model forms of licenses for both municipalities and companies, and several were applied for. But it was quickly realized that the position of the National Telephone Company was far too strong to be seriously threatened by such competition. Up to the present less than a dozen licenses, probably, have been applied for. Glasgow opened a municipal exchange and quickly reduced the rate of subscription, and while up to the present the people of that city appear to be well satisfied with the financial result, independent experts consider that the true condition of affairs is hidden by the system of accounts which is made use of. Tunbridge Wells also opened a competitive exchange, charging the same excessively low rates as at Glasgow, but within 12 or 18 months this town had to capitulate to the company, so that—curious state of affairs!—the company forced back to itself that very monopoly which the 1899 act was drafted to counteract. Other municipal exchanges have been opened at Brighton, Swansea, Portsmouth and Hull, but in all these places the rate of expansion of the National company's business has exceeded that of its competitors. Hence, it can be said, quite accurately, that competition with the company has failed. In London the Postoffice authorities took upon themselves the erection of a competitive exchange, and at the same time entered into an agreement with the company with a view to free intercommunication between the subscribers to the two systems, and this agreement has been responsible for the large measure of success achieved by the government system in London, as compared with the municipal systems in the provinces, where no such intercommunication was to be relied upon. This is only another instance of the strength of the company's position. Briefly, the particulars of the agreement concerning the London system are as follows:

The agreement was dated November 18, 1901, between the National Telephone Company and the postmaster-general, and provided for the purchase of the plant of the company in the London exchange area on the termination of the company's license, viz., on December 31, 1911. The plant was to be purchased at its value in situ, and no payment was to be made in respect of compulsory purchase, good will, or past or future profits; in other words, the purchase was to be made on what are known here as "tramway terms." The agreement also provided for intercommunication between the systems of the postmaster-general and of the company in London, during the continuance of the company's license, and for uniformity of rates.

Some resentment was felt that the government, in the above agreement, had confined itself to London, and since it was ratified by Parliament on January 27, 1902, there have never ceased to be agitations in favor of some such policy as applied to the provinces. The position was that some precautions had to be taken in order to provide that, at the expiration of the company's license, the telephonic business of the country should undergo no change, and that, as far as the actual working operations were concerned, the transfer should be unnoticed. It was urged that this could only be secured by the absorption of the company before the termination of the lease, and the postmaster-general was asked to exercise his last right of purchase, viz., to give six months notice to the company to this effect on June 30, 1904. It was anticipated that this course of action would be taken, but it was not, and, in spite of many questions, the only satisfaction vouchsafed throughout last session was that before any binding agreement with the company was entered into, Parliament would have an opportunity of discussing it. Hence it was not surprising to find that on the first day of this session of Parliament an agreement, dated February 2d, between the company and the postmaster-general, was placed before the members. With the more minute details of the document readers of the Western Electrician are not, perhaps, greatly concerned, but the following gives an outline of what is proposed:

The agreement is on similar lines to that relating to London, and entered into, as referred to above, in 1901. On December 31, 1911, the postmaster-general will take over the whole business carried on up to that date by the company, and will acquire the plant of the company on "tramway terms." No payment will be made in respect of good will or profits except in the case of the private-wire business of the company (which can be carried on without the postmaster-general's license) and in the very few cases where the company's license has, under the provisions of the telegraph act of 1899, been extended beyond 1911.

At the option of the government three-fourths, and with the consent of the company, the whole of the purchase money may be paid by way of annuity for a term not exceeding 20 years.

Certain powers of objecting to plant as unsuitable for purchase are reserved to the postmaster-general, and rules for the construction of plant are laid down.

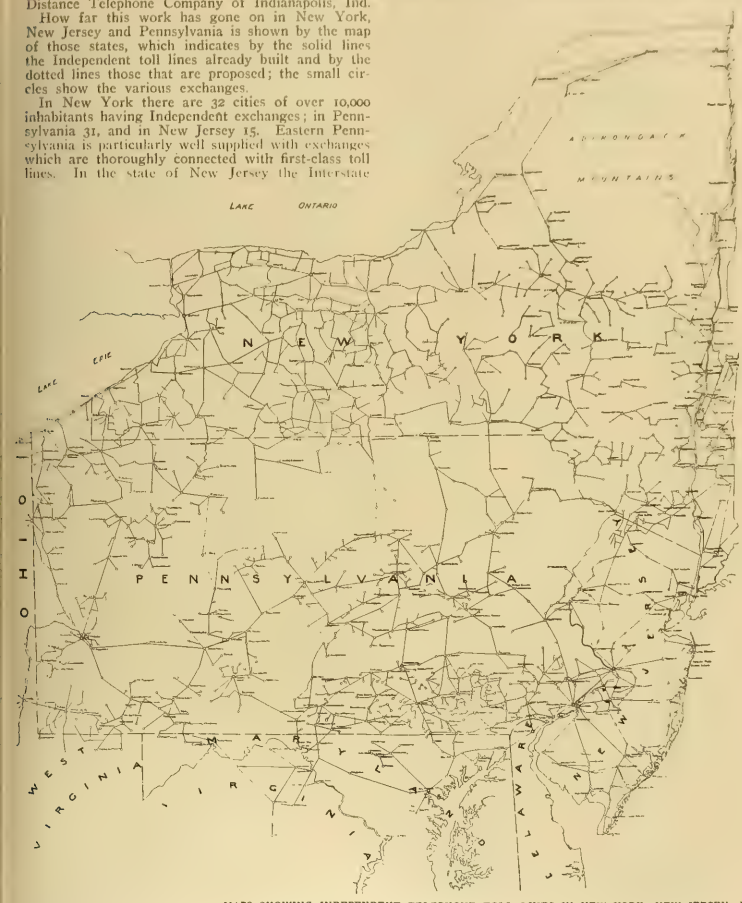
During the continuance of its license the company is to allow intercommunication without additional charge between municipal systems and its own. The company will be precluded from showing favor or preference as between subscribers (which is not now the case), and the rates it may charge are to be confined within certain limits. If, on complaint, and after full inquiry, it is proved that the company is giving inefficient service in any district, the postmaster may at once take over the company's business in that district without any payment for good will. Certain provisions of the London agreement, which are not of general application, remain in force. In other respects the provisions of that agreement have been assimilated to those applicable to the rest of the country. The agreement becomes binding when confirmed by a resolution of the House of Commons, or on August 31, 1905, if not disapproved by Parliament before that date. G.

## Independent Telephone Development in New York, New Jersey, Pennsylvania and Indiana.

Two recent publications of interest as showing graphically the development of Independent toll lines in New York, New Jersey, Pennsylvania and Indiana are two maps which are reproduced herewith. One of these appeared in a pamphlet distributed by Mr. Vinton A. Sears of Boston, entitled "Telephone Development," illustrating the toll line development in the three states mentioned first. The other map is one which has just been issued by the New Long Distance Telephone Company of Indianapolis, Ind.

How far this work has gone on in New York, New Jersey and Pennsylvania is shown by the map of those states, which indicates by the solid lines the Independent toll lines already built and by the dotted lines those that are proposed; the small circles show the various exchanges.

In New York there are 32 cities of over 10,000 inhabitants having Independent exchanges; in Pennsylvania 31, and in New Jersey 15. Eastern Pennsylvania is particularly well supplied with exchanges which are thoroughly connected with first-class toll lines. In the state of New Jersey the Interstate



MAPS SHOWING INDEPENDENT TELEPHONE TOLL LINES IN NEW YORK, NEW JERSEY, PENNSYLVANIA AND INDIANA.

Telephone Company operates over 10,000 telephones and has built hundreds of miles of toll lines.

In the state of New York the Independents have occupied the principal cities and towns of importance outside of New York city itself. The estimate of the number of Independent telephones in the state is 110,000. The toll-line and long-distance construction is modern. Especially is this true in the western part of the state, where the poles used are principally of 30-foot cedar with eight-inch tops carrying copper circuits not smaller than No. 10 wire.

Indiana is a veritable network of Independent toll lines, as shown by the map, which indicates all the lines owned by the New Long Distance Company, besides the connecting toll lines and county toll lines which are operated in connection with the long-distance lines. The company owns 10,000 miles of wire and there is 12,000 miles of wire subject to its use by the connecting lines besides 8,000 miles of county toll lines. The Independent telephone lines in Indiana have 368 exchanges, 1,560 toll offices, 30,000 miles of toll-line wire and 166,255 telephone subscribers. There are 27 counties in the state having over 2,000 Independent telephones: Allen, 4,530; Bartholomew, 2,485; Boone, 2,865; Cass, 2,957; Clay, 12,355; Clinton, 3,555; Delaware, 2,920; Elkhart, 4,030; Fountain, 2,395; Grant, 3,140; Hamilton, 2,196; Hancock, 2,120; Hendricks, 2,827; Henry, 3,390; Howard, 2,746; Kosciusko, 2,570; Madison, 3,239; Marion, 11,591; Montgomery, 3,761; Putnam, 3,383; Randolph, 2,841; St. Joseph, 3,215; Shelby, 2,842; Tippecanoe, 4,195; Vigo, 3,717; Wabash, 2,401; Wayne, 3,768.

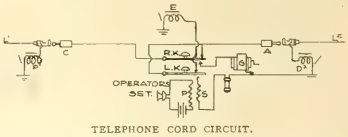
The New Long Distance Company has [illegible] largely into the competitive circuit business [illegible] now doing nearly all of the Associated Press telegraphing in Indiana.

## QUESTIONS AND ANSWERS.

A reader of the Western Electrician in Nebraska asks the following question: "In an article entitled 'Development of Telephone Exchange Circuits,' page 106, current volume Western Electrician, Mr. Coar says: 'Thus the induction coil acts as a step-up transformer by reproducing the current changes from low intensity in the primary to changes of high intensity in the secondary, and consequently in the line.' I have been led to believe that a step-up transformer is used to convert current of high intensity at low voltage into current of low intensity at high voltage. Please inform me as to whether or not I have a wrong impression? Also please explain Fig. 4 under same heading. The cord circuit appears to me to be permanently open."

Answer.—The author of the article, Mr. C. H. Coar, makes the following observations in connection with these questions:

"In its strictest sense the word 'intensity' is improperly applied in the quoted sentence, as by its use my intention was to convey the idea of a change in voltage or pressure.




TELEPHONE CORD CIRCUIT.

"The cord circuit (Fig. 4) as printed is erroneous in both the key and generator connections. A correct circuit is shown herewith, and with this the description as printed holds true.

"There are also a few discrepancies in the trunk [illegible] descriptive of circuits during their preparation for the press."

[illegible] right resistance and core, for my relay. The circuit [illegible] Also, the style of battery preferable for such work and why. What I wish is the general laws applying here."

Answer.—In order to determine the best resistance of a relay and the best voltage to use upon a circuit having a given line resistance, the general law is to make the resistance of the relay equal to the combined resistance of the line and batteries. In order, however, that this law may be applied, it is necessary to know the sensitiveness of the relay available. For instance, take a 100-ohm pony relay of the Western Union type, and say that it takes 0.025 of an ampere satisfactorily to operate this relay. This, then, gives the current requirement, and, knowing the line resistance to be 100 ohms and considering the battery resistance negligible, this gives 100 ohms as the most suitable resistance for the relay. Then, according to Ohm's law, the line and relay connected in series measuring 200 ohms, and the relay requiring 0.025 of an ampere to operate it, we secure the most economical voltage, viz., five volts.

Now, in order to determine the number of cells to use, we must divide the voltage required by the voltage of the battery selected. Thus: If we take the ordinary gravity battery of the crowfoot type, this battery gives a voltage of about one, which makes five cells of crowfoot batteries necessary for operating the correspondent's circuit in the most economical manner. In the same way, if we select, say, the Gordon battery, this has a voltage of about 0.7 for each cell, which would give about seven cells of Gordon battery necessary for handling the service, though it is always best to add an additional cell to the battery when the resulting voltage does not come up to the requirements of the rule, as seven cells of Gordon battery would only give four and nine-tenths (4.9) volts.

In conclusion, therefore, first determine your line resistance; then secure a relay wound to the same resistance, and learn the amount of current this relay requires to draw up its armature. Multiply the current by the combined line and relay resistance, and secure the voltage. Then divide the voltage by the potential of one cell of battery selected, which will give you the total number of cells needed.

It may further be mentioned that the local conditions, when known, generally determine the best type of cell to adopt. Closed-circuit batteries may be secured possessing almost any desired amperehour capacity, but, as stated, the type of cell to be used will depend largely upon the local conditions.

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The city of Bangor, Me., has granted permission to the Bangor Automatic Telephone Company to install an automatic telephone system in the city.

## Ohio Telephone Notes.

The Hamilton Board of Education has awarded the contract for furnishing eight telephones to the Home Telephone Company. Bids were asked some time ago and both this company and the Cincinnati and Suburban Telephone Company of Cincinnati made propositions. They were thrown out and new bids asked. This was repeated the second time, and finally the Cincinnati company offered to put them in free, provided the instruments of the other company were not used at all. The offer was turned down, and the Home company's instruments were installed.

Notice has been filed with the secretary of state by the Cincinnati and Suburban Telephone Company of an increase in capital stock from $4,000,000 to $5,000,000.

A meeting of districts No. 4 and No. 9 of the Ohio Independent Telephone Association was held at the Hartman Hotel in Columbus last Tuesday. The topics discussed were of much the same nature as at other points where meetings have been held within the last two weeks. Delegates were chosen to the state convention.

Contracts have been awarded the American Electric Telephone Company of Chicago for new equipment for the office of the Bucyrus Telephone Company at Bucyrus.

The equipment for the new exchange of the Citizens' Telephone Company, Columbus, has been shipped from Chicago, 30 cars being required to carry it. The new building is ready for the installation of the switchboard, which will have a present capacity of 8,000 and arrangements by which the number may be doubled. The exchange will be automatic and it is thought it will be ready for operation about the middle of June.

It is reported that the Urbana Telephone Company of Urbana will advance its rates about 25 cents a month, with rebates for prompt payment. The management has found that the plant cannot be operated at the present figures with any margin for profits.

A lot has been purchased at the corner of Linn and Third streets, Columbus, by the Central Union Telephone Company, on which an exchange and office building will be erected. The ground is 35 by 160 feet in size. The structure will probably be six stories in height and will be sufficient for the needs of the territory for some time to come.

The New Knoxville Telephone Company of New Knoxville has been incorporated with a capital stock of $8,750 by A. H. Steinecker, G. W. Hall and others.

J. B. Wiley, J. T. Knox and others have incorporated the Richland Telephone Company of St. Clairsville with a capital stock of $4,000.

E. E. Newman has resigned as manager of the Wood County Telephone Company and will be succeeded by Mr. Gillus, bookkeeper for the company. Mr. Newman has brought the company up to a high degree of efficiency.

The Windham Telephone Company of Windham has been incorporated with a capital stock of $10,000 by C. A. Landall, E. W. Mallett, J. W. Shank and others. C.

## Indiana Telephone Items.

The Fort Ritner Telephone Company will establish an exchange and telephone system in Fort Ritner in Lawrence County. E. E. Wieker, W. A. Holland and E. B. Dixon are the directors.

The Farmers and Mechanics' Mutual Telephone Company of West Terre Haute (capital stock, $5,000) purposes to establish an exchange and telephone system in West Terre Haute and will construct a few rural lines. The directors are W. T. Tippin, James H. Davis, M. T. Goodman and Edgar Philanbaum.

The Greentown Telephone Company (capital stock, $30,000) purposes to construct and operate telephone lines and exchanges in Howard, Grant, Tipton, Madison and Miami counties. The directors are W. L. Bott, A. A. Largent and J. M. Glenn.

At a recent meeting of the Camden Co-operative Telephone Company the stockholders and directors decided to construct three new lines—one direct from Camden to Delphi, one southwest and one southeast from Camden to afford service to thickly settled farming communities which are asking for telephones. The company will be in the market for wire and equipments as soon as the frost leaves the ground. S.

## New England Telephone News.

About 100 night operators of the New England Telephone and Telegraph Company had their annual meeting and banquet on February 27th at the American House, Boston.

When the directors of the American Telephone and Telegraph Company decided to call for bids for an issue of $25,000,000 bonds bearing four per cent. interest and maturing in 1929—the same time as the maturity period of the present outstanding issue of $28,000,000—there were financial interests that counselled the issuing of preferred stock instead. President Frederick P. Fish and other directors of the telephone company, however, were confident that the bonds could be readily disposed of and that a great saving would result from such a course as contrasted with the annual dividend expectancy on preferred stock. The result proves the wisdom of this procedure. There were numerous bidders for the bonds, these bids being opened March 1st, and the following day it was announced that a syndicate of the Kidder, Peabody & Co. and Baring, Magoun & Co. interests had purchased the entire issue. Already upward of $5,000,000 of the bonds have been placed with investors, and the balance will find a ready sale. It is understood that the price is in the neighborhood of 93 and 94, which means that the company borrows for its contemplated improvements and extensions at the rate of about 4½ per cent., to run 24 years. The net saving is about $800,000 annually, it is figured. B.

## Telephone News from the Northwest.

The Maple Lake Telephone Company has been formed at Maple Lake, Minn., to establish a local exchange. The capital stock is $10,000.

The Northwestern Telephone Exchange Company will make improvements to its toll service in Minneapolis. A new building is to be erected in East Minneapolis, to which all toll lines will run direct, and the operating service will be consolidated with the American Telephone and Telegraph Company. About 2,000 miles of copper circuit are to be constructed in Minnesota, North and South Dakota.

The Devils Lake (N. D.) Improvement Company will build a telephone line to Starkweather in the spring.

W. E. Cook of Harvey, N. D., has bought a majority interest in the Litchfield (Minn.) Telephone Exchange Company.

J. W. Scott has sold the city telephone exchange at Drayton, N. D., to A. V. Huff.

The Torah (Minn.) Telephone and Improvement Company has been formed and will install a local exchange at Torah.

A bill has been offered in the Minnesota Legislature by Representative W. C. Fraser of Rochester, which will make telephone and telegraph companies common carriers and subject to the regulation of the state Railway and Warehouse Commission.

W. J. Booth and Roy Anderson will install a telephone exchange and electric-light plant for Sherwood, N. D.

A. F. Morgan has been granted a telephone franchise at River Falls, Wis.

The Nebraska Telephone Company will let the contract shortly for the erection of a west-side branch-exchange building at Omaha, Neb. The building will be 36 by 92 feet, two-story and basement. R.

## Iowa Telephone Convention.

Secretary Charles C. Deering of Boone, Iowa, announces that the ninth annual meeting of the Iowa Telephone Association will be held at the Chamberlain Hotel, Des Moines, on March 14th, 15th and 16th, beginning at 2 p. m. on the first-named day. Papers will be read by W. H. Barth of Chicago, C. H. Judson of Council Bluffs, Oscar Knell of Perry, Charles E. Wells of Marion (Kan.), N. T. Guernsey of Des Moines, J. M. Plaister of Fort Dodge and R. S. Redman of Newton (joint authors), C. A. Hollis of Hudson, J. E. Shoemaker of Waterloo and James B. Hoge of Cleveland. The subject of Mr. Knell is "A Generator-call, Lampline Board" and that of Messrs. Plaister and Redman "Magneto Multiple versus Central-energy Multiple Boards for Small or Moderate-sized Exchanges." A banquet, to which ladies are invited, will be held on Thursday evening. The programme is a good one, and there should be a large attendance.

## NEW COMPANIES.

The Daily Telephone Company of Daily, Neb., has been incorporated with a capital of $1,000 by H. H. Grosvenor and others.

The Potlatch Telephone Company has been organized at Julietta, Idaho, and will operate in that city and Kendrick, Southwick and Leland.

Articles of incorporation of the Empire Bell Telephone Company, with a capitalization of $10,000, have been filed with the county clerk at Pocatello, Ida.

The Estacada Telephone and Telegraph Company has been incorporated at Oregon City, Ore., with a capital stock of $10,000. The company will build an Independent system in Clackamas County, Ore.

The New York Independent Telephone Company has been incorporated at Albany for the purpose of operating telephone lines between New York city and Albany, Boston, Jersey City, Philadelphia and other places in the states of New York, New Jersey, Massachusetts, Rhode Island, Connecticut and Pennsylvania. The capital is returned at $50,000 and the directors are O. S. Lee, Jr., J. M. Woods and B. S. Mantz of New York city.

The Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., has just closed contracts for switchboards to go to Columbus (Ohio), Grinnell (Iowa) and Tonopah (Nev.).

## Probate Courts May Not Fix Telephone Rates in Ohio.

Judge Price of the Ohio Supreme Court has explained that in the decision rendered in favor of the Toledo Home Telephone Company a few days ago, in relation to the fixing of telephone rates, the court did not hold that city councils have no power to fix rates, but instead that a Probate Court, in determining the manner in which streets, alleys and public highways are to be used for telephone purposes, had no authority to name the prices that a company should charge. The syllabus in the case is as follows:

1. In the proceeding instituted in the Probate Court by a telephone company under the provisions of Section 3461, Revised Statutes, which authorize and require the court to direct in what mode such telephone company may construct its lines along the streets, alleys and other public ways of a city or village, the court has no jurisdiction, as a part of its order, to prescribe or determine the rates to be charged citizens of the municipality for the use of the telephones, and so much of the order as is under taken to determine such rates is void for the want of jurisdiction.

2. In such an action in quo warranto to oust the telephone company from the use of the streets, alleys and other public ways in the mode directed by the Probate Court, on the ground that such company has established rates for the use of its telephones exceeding those prescribed by the court on the application of the company, the latter is not stopped from questioning and denying the jurisdiction of that court to prescribe the former or any rates.

Application was made for a franchise to the Toledo council in 1901 and the rates were fixed at $24 a year for residences and $40 for business purposes. The application was buried in the committee room and the company then asked the Probate Court for a franchise on the same terms. This was granted and accounts for a Probate Court fixing rates in this instance. In 1903 the rates were advanced $6 on residence and $8 on business telephones. Afterward quo warranto proceedings were brought to inquire into the right to make the increase and the lower courts sustained the contentions of the company on a demurrer.

The original idea was to have a capacity of 3,000 telephones. The company could have operated on the original prices with this number, but the demand for service became so great that 8,429 telephones are now connected to the exchange. The increase in rates has been made as fast as contracts are renewed, and it is not anticipated that any further increase will be made.

## GENERAL TELEPHONE NEWS.

The death is reported from Holdenville, I. T., of F. D. Hummer of the South Arkansas Valley Telephone Company.

Frank Bracelin of Minneapolis has been placed in charge of the Anoka (Minn.) office of the Northwestern Telephone Exchange Company, succeeding Mr. Campbell.

The annual report of the Rocky Mountain Bell Telephone Company covering the states of Utah, Idaho, Montana and Wyoming shows the net earnings for 1904 to be $171,761.09.

The Chicago Telephone Company reports for the month of February an increase of 1,664 in the number of telephones installed. The total number of instruments in use, city and country, is given as 121,233.

The New York Herald is continuing its campaign against the Bell telephone companies, alleging excessive charges, particularly in New York. It says that the New York Board of Trade is organizing a fight to bring about a legislative investigation of the "telephone trust." Frank B. Green of 117 Hudson Street, New York, is chairman of the committee in charge of the movement.

K. W. McKenzie, mayor of Edmonton, British Northwest Territory, recently paid a visit to the Grand Rapids (Mich.) Citizens' Telephone Company and investigated the workings of the automatic telephone system. The towns of Edmonton and Strathcona are divided by a river and have for a number of years maintained a municipal telephone plant. Mayor McKenzie is investigating the latest developments in telephone construction and operation.

The annual report of the New York and New Jersey Telephone Company for the year 1904 shows gross earnings of $5,393,708.76. The expense of operation was $3,729,335.35 and the earnings over expenses were $1,664,373.41, a gain of $193,025.89 over the preceding year. The number of stations January 1, 1905, was as follows: Long Island division, 39,544; New Jersey division, 40,780; total, 80,324. The total gain in stations over the preceding year was 13,760.

H. R. Mason, manager of the Michigan State Telephone Company at Ann Arbor, has been promoted to the position of district superintendent of the Saginaw district, and it is understood that he will move there immediately. Mr. Mason has been connected with the telephone business in various parts of the state for a number of years and has increased the business at Ann Arbor considerably. Thomas Harbaugh of Detroit will succeed him as manager of the Ann Arbor exchange.

## A New System of Space Telegraphy.[1]

By Alessandro Artom

Complying with the desire expressed to me with so much kindness and courtesy by the marine minister, Admiral Carlo Mirabello, and by you, Mr. Chairman, I have the honor to communicate to you the results obtained in the recent experiments accomplished with the efficacious concurrence of the Royal Italian Navy regarding my wireless system of telegraphy with elliptical or circular rays of electric power.

From the very first days when the initial experiments of wireless telegraphy with Hertzian waves were made by Guglielmo Marconi, I had thought of the great utility which might have accrued to this grand application of Hertz's discoveries from the use of circularly or elliptically polarized oscillations.

And in truth, since the electromagnetic theory of light arranges in order and closely binds together the luminous with the electromagnetic phenomena, it did not appear to me out of place to hold that the principle of the rotating magnetic field, which had sprung from optics, might find a logical application in the corresponding phenomena produced by the electric oscillations.

I have therefore proposed to produce by means of suitable oscillators such class of circularly or elliptically polarized rays of electric power as, according to the theory of Professor Righi, must present around a determinate direction the properties of the electric and magnetic rotating fields. The solution of this problem had not till then been attempted by anyone.

In the preliminary note presented to this academy on the 14th of March, 1903, "On the Production of the Circular or Elliptical Rays of Electric Power," I have partly described an experimental disposition which permitted of the proposed object being attained.

Following upon long researches made in the laboratory of the Royal Industrial Museum of Turin, I have greatly perfected the method described in the above-mentioned note, and it was thus possible for me to render more clear the properties of the circular waves produced; that is, to ascertain around a determinate direction the effects of the electric and magnetic rotating fields.

Having exceogitated the way of producing the circular or elliptical rays of electric power, I proceeded in my mind to make the application thereof in the wireless telegraphy, being clearly of opinion that, in the theoretical and practical respects, the employment of such rays in the electromagnetic signals was to present the following advantages:

First.—The characteristic property of its being possible to generate a more intense electromagnetic field in a determinate direction.

Second.—The possibility of availing oneself of all the rules of syntonic wireless telegraphy—rules already so admirably studied and perfected by Guglielmo Marconi.

Third.—The peculiar property of such rays of electric power whereby they can be better collected along that particular direction by a system of aerial-receiving conductors opportunely disposed and of suitable form.

The experiments I have hitherto executed had for their aim to verify the first-named properties; therefore I have contrived appropriate radiating apparata.

On the second and third-named properties of the electromagnetic field constituted by circular or elliptical rays of electric power there can exist no doubt, and the experimental researches to make them clear will form the object of subsequent trials.

The results achieved in the experiments executed in the years 1903-1904 with the efficacious concurrence of the Royal Italian Navy for the purpose of confirming the first one of the stated properties, namely, the unsymmetry of the electromagnetic field produced, may be summed up by recalling those of the four following periods in which the experiments were carried out.

First Period.—Experiments executed in the Gulf of Spezia in February, 1903. The possibility was ascertained of signaling from the radio-telegraphic station of St. Vito to that of St. Bartolomeo (a distance of four kilometers) without its being possible for the lateral stations of Varignano and Palmaria, situated a few kilometers outside the junction of the transmitting station of St. Vito with the receiving one of St. Bartolomeo, to receive any signal.

Second Period.—Experiments executed between the radio-telegraphic station of Monte Mario (Rome) and Anzio (a distance of 60 kilometers) in the months of August, October, November, 1903. It was proved that when the radiator was turned toward Anzio the signals were effected perfectly, while they ceased when, the energy employed being equal, the radiator was turned towards Sardinia.

Third Period.—Experiments executed in the months of March and April, 1904, between the radio-telegraphic station of Monte Mario (Rome) and that of Ponza (a distance of 120 kilometers). It was ascertained that it was possible to send very clear signals to the receiving station of Ponza and that one could also treble the energy wherewith such electromagnetic signals were produced without its being possible for the receiving station located in the island of Maddalena and placed [illegible] out in the junction of Monte Mario with the island of Ponza to perceive any signal.

Fourth Period. Experiments executed in the months of August, October, November, December, 1904, between the radio-telegraphic station of Monte Mario (Rome) and that of the island of Maddalena (a distance of 300 kilometers). These experiments served still further to confirm the preceding ones. Clear electromagnetic signals were at last sent to the receiving station placed in the island of Maddalena without its having been possible for the receiving station of Ponza situated laterally and outside the Monte Mario-Maddalena junction to perceive any signal.

In these conditions of observations the electromagnetic effect was therefore still perceptible at about 300 kilometers in the available direction of Monte Mario-Maddalena, whilst it practically ceased to be so in the direction of the island of Ponza at about 100 kilometers outside the junction of the radio-telegraphic station of Monte Mario with the receiving station of Maddalena.

These experiments were repeated with splendid success in the presence of the King of Italy and of the minister of marine on the 16th of December, 1904.

It was moreover ascertained that in the radio-telegraphic system invented by me it is possible to lower by much the height above the ground of the aerial conductors; thus it enabled the transmission between Monte Mario and Maddalena to turn out clear with aerials elevated to 30 meters above the level of the ground.

Other trials confirmed the great difference between the Marconian electromagnetic field and that produced by circular or elliptical rays of electric power.

In the above-mentioned experiments there was always employed the continuous current as energizing source for the induction coils; but the use of the alternate current would have availed much to obtain still more sensible effects of dirigibility, because the production of the compound waves would have been made regular and complete.

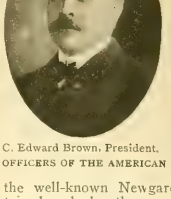
Moreover, the experiments were carried out with purely temporary plants, and it is obvious to conclude that with plants made with greater care of details better and better results will be obtained.

In conclusion, all the above trials will clearly demonstrate the great advantages that will be realized in wireless telegraphy by the use of circularly or elliptically polarized oscillations, principally for the purpose of transmitting greater energy in a predeterminate direction and securing a convenient independence of working between the various radio-telegraphic stations.

[1] Extracts from a letter addressed to the chairman of the Royal Academy of Lincey, Italy.

## A New Chicago Supply Company.

The American Electrical Supply Company of 83-87 Fifth Avenue, Chicago, has entered the field of manufacturing and selling all kinds of electrical supplies. It has purchased the stock and good will of the supply department of Henry Newgard & Co., to which considerable new stock has been added, giving the company a line of electrical supplies that is complete in every way, and from which shipments can be promptly made. The sole selling agency for



C. Edward Brown, President. F. D. Phillips, General Manager.
OFFICERS OF THE AMERICAN ELECTRICAL SUPPLY COMPANY.

the well-known Newgard receptacle has been obtained and also the agency for the Fostoria incandescent lamp.

C. Edward Brown, who is president of the company, is widely and favorably known by the trade, having been connected with the electrical business for the last 10 years, serving as secretary of Henry Newgard & Co. for half of that time.

F. D. Phillips is general manager, and brings with him a large acquaintance, that should prove a valuable asset, having been for several years connected with the sales department of the Electric Appliance Company and later being treasurer and sales manager of the Crescent Company, both of Chicago.

Through the energetic administration of these two gentlemen the new company gives promise of taking a prominent position in its field.

To compete with an interurban electric railway which is about to be built in Northwestern Iowa, it is said that the Great Northern steam road has announced that it will build 70 miles of road in the same valley, connecting Merrill, Rubel and Perkins, Iowa.

## Micanite Canopy Insulator.

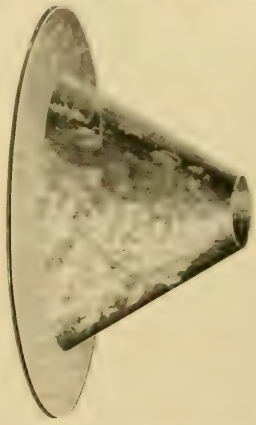


FIG. 1. MICANITE CANOPY INSULATOR.

designed as a remedy for the trouble. It is manufactured by the Mica Insulator Company of New York and Chicago and the accompanying pictures illustrate the details of the device.

Fig. 1 shows the canopy insulator and Fig. 2 the method of mounting it in connection with the ornamental brass canopy. The flange of the insulator

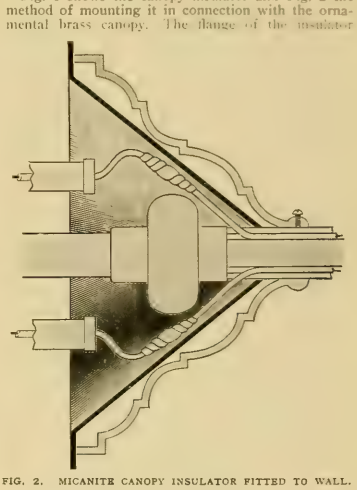


FIG. 2. MICANITE CANOPY INSULATOR FITTED TO WALL.

gives protection to the brass canopy from the surface of the ceiling or wall, thereby removing any possibility of a short-circuit between the two conducting wires, between either of the conducting wires and the canopy, or between the wires, through the canopy to the ceiling. The insulator is made from Micanite, made up from large laminations of mica, and molded with both flange and taper into one solid whole.

## Board of Engineers to Investigate Fire Risks.

The National Board of Fire Underwriters, in order to further the work of the introduction of improved and safe methods of building construction, recently appointed a committee charged with the duty of organizing an engineering department composed of engineers of recognized ability to investigate conditions and make recommendations for improvements that will minimize fire hazards. Such a staff of engineers has been organized and data is being collected in four different cities. The chief engineer is Mr. E. G. Hopson of New York. Capt. Greely S. Curtis of Boston is engineer in charge of the investigations of the fire departments and their auxiliaries. The entire work of the committee is under the direct supervision of Mr. Herbert Wilmerding, the secretary, with offices at 135 William Street, New York.

The federal government has detailed two engineers of the United States Army to investigate and review the reports from each city. These men are in no way connected with the business of fire insurance, and their criticism will be valuable to the department.

## BOOK TABLE.

TRANSACTIONS OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Vol. XXII. (July to December, 1903). New York: Published by the Institute. 1904. Pp. (six by nine inches), viii., 807, with many illustrations.

This volume of the Institute proceedings contains the transactions of the Niagara Falls convention of June 29-July 3, 1903, and of meetings held in New York and elsewhere during the remainder of the year. During this time Charles F. Scott retired as president and Bion J. Arnold succeeded him. Like all volumes of the Transactions of the Institute, the book embodies in permanent form papers and discussions of great value to electrical engineers and others. The recent death of Mr. E. H. Mullin will cause a melancholy interest to attach to the paper on "Training an Artist in the Forces of Nature," written by that gentleman and included in this volume as a contribution to the "Engineering Education" symposium of the Niagara Falls convention.

FERRIC AND HELIOGRAPHIC PROCESSES. By George E. Brown. New York: Tennant & Ward. 1904. Pp. (4¾ by 7¼ inches), 149, with 20 illustrations and eight prints. Price, $1.

For those having to do with the reproduction of designs by the blue print or kindred processes, this little manual will be found convenient and representative of the latest practice in the art. Formulas for preparing chemicals and methods of preparing paper for printing, toning processes, methods of brightening and intensifying colors, etc., are explained in the first chapter devoted to the ferro-prussiate process. Other chapters are given up to the various heliographic processes, the preparation of heliographic paper, methods of obtaining white lines on a blue ground and blue lines on a white ground, black lines on a white ground, printing-house memoranda, paper sizing, chemistry and other subjects "too numerous to mention", the whole making a complete reference book on the subject. The book is intended to serve two classes of people: Amateur photographers with a taste for experiment, and draftsmen, engineers, architects, etc. Only reliable processes are given and those that are not liable to result in disappointment to the operator who is fairly proficient in the work. The aim of the manual is to be practical, and as such, matters of a theoretical nature have been omitted.

THE DISEASES OF ELECTRICAL MACHINERY. By Ernst Schulz (edited, with a preface, by Silvanus P. Thompson). London: E. & F. N. Spon (New York: Spon & Chamberlain). 1904. Pp. (4¾ by 7¼ inches), 84, with 42 illustrations.

Adhering strictly to his title, the author has endeavored, within a limited space, to teach the reader how to diagnose and prescribe for the more common ills to which electrical machinery is subject. There are enumerated in the book, in a form convenient for the engineer, the cause of faults and breakdowns in electrical machines and how to remedy them. The everyday troubles which are liable to occur in this class of apparatus one hardly finds mentioned in electrical pocket books, neither in the more bulky treatises on technical subjects and for this reason the book will be of additional value, particularly to operators of electrical machinery. The work is divided into four principal sections: "Continuous-current Machines," "Single-phase and Polyphase Alternators," and "Single-phase and Polyphase Motors" and "Transformers." In addition there is a chapter on "Efficiency" which gives the simplest and most easily comprehended method of finding it. This is given, for the reason that a certain efficiency is often stipulated in buying a machine, and a test is demanded to show that its value has been attained.

## "Broncho Busting" for Denver-Colorado Springs Convention.

The most expert of the cowboys of the West will participate in a "bronco-busting" contest during the week of the convention of the National Electric Light Association, which will be begun in Denver on June 6th. The committee in charge of the arrangements of this feature is trying to secure the worst broncho in Colorado and other states in the vicinity, so that the visiting delegates may be able to get a good idea of one incident in the life of the cowboy. The contest will be typical of the West, and will no doubt interest the large number of visitors who have only read of life in mountain and plain.

The committees in charge of the work of mapping out the features of the convention are shaping their plans carefully and with a view to making the convention the most successful ever heard. The attendance will be large. Several special trains from eastern states have been arranged, and many private parties are being organized to make a sojourn to Denver during the week of the convention. The financial support of the convention will be all that could be desired. The subscriptions are coming in liberally from people in Denver and Colorado Springs, and all indications point to an entertaining as well as instructive week.

# CORRESPONDENCE.

## Great Britain.

London, February 22.—What discussion the agreement which has been entered into between the postmaster-general and the National Telephone Company will evoke in Parliament it is difficult to say, and up to the present no opportunity has been foreshadowed for its consideration. The general tone of the daily papers is one of satisfaction that the company is to be bought out on what are known over here as "tramway terms," i. e., nothing is to be paid in 1911 for good will, future profits and so on. But this is only as it should be, seeing that the license of the company expires absolutely at the end of 1911. In connection with the agreement, it is curious to find one, at any rate, of the financial papers ignorant of the origin and meaning of the term, "tramway terms." It is this: When the first tramway company was purchased by a local authority under the terms of the tramway act of 1870, the matter went to arbitration to determine the precise meaning of the purchase clause in that act. After a very careful consideration, the arbitrator laid it down that the purchase clause of the 1870 act simply meant that at the end of any tramway company's concession, i. e., 21 years, the local authority was to purchase the undertaking for the value of the plant as material. The concession having expired, the company had no business to sell, and so nothing could be claimed for good will or future profits. As will be seen from a short article elsewhere in this issue, these are the terms, with certain variations, upon which the postmaster-general has agreed to purchase the undertaking of the National Telephone Company on December 31, 1911. Thus, the many fears expressed that the government would have to pay a ruinous price for the telephones of the country are proved to be without foundation.

A meeting of the members of the Electrical Manufacturers' Association was held a few days ago to consider the advisability of organizing a general electrical exhibition upon an extensive scale. A scheme of organization was formulated and a committee is to be appointed. If the matter is carried to a head, it will be the first exhibition of its kind ever held over here. The only thing approaching to it will have been the electric tramway exhibitions, of which two have already been held, and another is to be opened in London in June this year.

Metaphorically speaking, the whole of the electrical industry in London is just now up in arms against the numerous bills affecting its interests which have been placed before Parliament. The most important ones, of course, are the electric power bills, and the number of oppositions that have been lodged against them are simply enormous. In the case of one bill alone there are over 30 local authorities and a similar number of companies concerned, to say nothing of private owners, etc. There are eight of these bills, all of which are opposing each, as well as all the other opponents above mentioned in each individual case. Once more the lawyers and expert witnesses will reap a golden harvest. Then there is the bill of the London County Council which seeks powers for the London local authorities to wire premises for electric lights by direct labor. To this the Electrical Contractors' Association is bitterly opposed, and the prospects of the council are not so very bright, seeing that two years ago a similar proposal was rejected in the House of Commons by a large majority. There is something more than the mere question of rate-aided competition here, for, among others things, there is the question of testing the installations before connecting up. It is not inconceivable that the officials of a London borough council, who are the electric-supply authorities, would be less stringent in the case of wiring carried out by their own workmen, than if the installation was the work of a private contractor. This, among others, is put forward as a reason for rejecting the proposal.

Since the beginning of the year several horse-bus companies, as the result of much experiment, have placed a number of petrol-driven omnibuses upon the streets of London. This has been seized upon by the anti-municipal journals as an opportunity for carrying on a violent crusade against the London County Council and its policy in respect to electric tramways. In a remarkably short space of time, the public has been informed, petrol-driven omnibuses will sweep every other form of public conveyance off the streets, and the many millions of pounds invested in the electric tramways in London will become a total loss. Strange to say, all this unstable prophecy, based upon mere theory, seeing that there are only half a dozen such buses running yet, has had a certain effect upon the tramway-investing public, and the trade papers have found it necessary to go to considerable trouble to compile statistics to refute the wild statements made by the daily papers. The motor-bus question is also receiving considerable attention just now in other quarters. Many of the main-line railway companies seek powers this year to employ such a means of communication, in order to reach some of the more remote districts not touched by their railway systems. To some extent they will compete with many local authorities who wish to do the same thing, as an extension of their electric-tramway systems to the less populated districts. Hence a cross opposition is likely before Parliament on this question.

A highly successful motor-car exhibition has been held in London during the last 10 days, and the amount of business done is said to have been greater than at any previous show in England. The electrical cars, however, once again made a poor show, although there were a few more exhibits than usual. An interesting electrical car was an ambulance wagon shown by the Electromobile Company. It is equipped with two stretchers, sliding into the back of the van, one above the other, on one side, the other side being reserved for the passage of the attendant. There is telephonic communication between the attendant and the driver. The wagon will travel 25 miles upon one charge of the batteries, and the accumulators are easily exchanged.

J. G. White & Co., who have received a large contract for the conversion of the Belfast horse tramways to electric traction, have been experiencing trouble with their men on the job, and a strike took place a day or two ago.

The serious competition of electric tramways with railways has been the one result reported by practically all the great railway companies at their annual meetings, which are held at this time of the year. Even the Liverpool overhead railway, which is worked electrically, is not free from this competition, and the huge system of electric tramways owned by the corporation there has wrought such havoc that a director is reported to have said that could they have foreseen the effect of the tramways, the overhead railway would never have been built.

G.

## New England.

Boston, March 4.—Stockholders of the Boston Elevated Street Railway Company have authorized an issue of $11,000,000 debenture bonds bearing four per cent. interest, and the matter now goes to the state railroad commission for that body's approval.

Further details of the Boston, Providence and Pawtucket electric-railway project are given out, from which it appears that the original promoters, who own the Boston and Worcester road, will be joined by the Boston and Suburban railway owners and other interests identified with existing systems, and that the Boston Elevated company's overhead tracks will be utilized out to Forest Hills instead of the Boston and Worcester tracks out to Newton Highlands as was at first proposed. The new arrangement is expected to effect a saving in the running time and make a two-hour run from this city to Providence possible.

Stockholders of the Boston and Worcester Electric Companies, a holding corporation owning the stock of the Boston and Worcester Street Railway Company, have authorized an issue of 1,000 new shares of preferred stock and 1,500 new shares of common stock to retire the floating debt of the corporation.

Among the bills pending before the Massachusetts Legislature this year is one to permit the Boston Elevated Street Railway Company to acquire ownership of the West End Street Railway Company, now under lease to the former. The lease does not expire until 1922.

A decision of considerable importance came last week from the United States Supreme Court relative to the right of the state of Massachusetts, through its Legislature, to change a contract between a street-railway company and the city. The case was one in which the city of Worcester and the local street-railway company differed, and the company won, the right of the state to such action being affirmed.

The Greenfield and Turner's Falls, the Deerfield and Northampton, and the Northampton and Amherst street-railway companies have voted to consolidate. The three companies operate 50 miles of road and the net earnings last year were $175,000. Their combined capital is about $500,000. The name of the new company will be the Connecticut Valley Street Railway Company. In the proposition laid before the stockholders of the various companies it is stated that the chairman of the directors will be E. C. Crosby of Brattleboro, Vt.; president, F. E. Pierce of Greenfield, Mass.; superintendent, John A. Taggart, Montague, Mass.

Since the demonstration of the success of the East Boston Tunnel under a part of Boston Harbor there has been a revival of the scheme to tunnel under Beacon Hill and to substitute a subway for electric-traction purposes in Cambridge for the proposed elevated structures authorized by the Legislature a few days ago. Still another project which has obtained support is a scheme for a subway connecting the northern and southern steam-railroad terminal stations in this city. The tunnel from Scollay Square, under Beacon Hill and the state capitol, to the Back Bay district has influential backing in a petition signed by upward of 100 of the wealthiest and most prominent people of the business section.

Six suits, tried as one, were begun February 28th in the Superior Court against the Boston Elevated Street Railway Company. It is one of the biggest claims for damages ever brought against the company and is the outcome of an accident which took place in South Boston, September 13, 1903, two cars colliding and severe injures to many passengers

resulting. The total damages are placed by the plaintiffs at $88,000.

It is reported from Bangor, Me., that Boston and New York capitalists have purchased the stock of the Bar Harbor and Union River Water Power Company, and the project of building a dam to reet high on Union River will be carried out with a view to supplying electrical power to Bar Harbor and other points accessible to the power plant.

E. Moody Boynton of "bicycle-railway" fame has petitioned the Massachusetts Legislature this year for the incorporation anew of his long-projected Boston, Quincy and Fall River Bicycle Electric Railway Company. It will be remembered that Mr. Boynton had a charter for the road some years ago, but did not make use of it before the expiration of the time-limit set thereon. He wants an authorized capital of $5,000,000. He asks also a state appropriation of $1,000,000 in aid of the scheme. B.

## New York.

New York, March 4.—The rapid-transit commissioners, after protracted sittings, have recommended the construction of new subways in various parts of the city, estimated to involve a total expenditure of $250,000,000. The proposed routes exceed a dozen, some of which are alternatives, and the plans affect all the boroughs, including Staten Island. It is not thought that the schemes finally selected will cost more than $120,000,000. The routes have been laid out with a view to attract either combined or independent bids. A novel feature of the plans is a proviso for a moving platform across town on Thirty-fourth Street.

Plans were approved yesterday for the expenditure of $5,000,000 for the construction of an elevated loop of a temporary character (five years is named) to connect the Brooklyn and Williamsburg Bridges. The Brooklyn Rapid Transit Company has already promised to lease such a loop on a basis of 4½ per cent. on the cost, but the Brooklyn Rapid Transit offer was originally made on a proposal for a permanent line.

The franchise for the McAdoo Sixth Avenue subway was repassed unanimously by the Board of Aldermen on Tuesday. Alderman Gaffney, whose single adverse vote against the franchise at the former hearing led to the necessity of the matter coming up again, was not present at Tuesday's meeting when the vote was taken.

Official announcement is made of the appointment, on January 19th, of Alfred Craven, as acting deputy chief engineer to the Board of Rapid Transit, at a salary of $7,000 a year. Mr. Craven will be right-hand man to Acting Chief Engineer George S. Rice, who is now fulfilling the duties of William Barclay Parsons, resigned.

The Bush Terminal Railroad Company has received its franchise for a short electric surface railroad in Brooklyn for a period of 25 years, with privilege of renewal. This company is to all intents and purposes a dock company, which, as already noted, is putting up a model factory and warehouse building, wherein tenants will be supplied with electrical power.

A strong recommendation is made in the annual report of Superintendent James P. Farrell for the building, or rather rebuilding, of a new power house at the Brooklyn Training School for Boys. Boys in this school who pass an educational test and are over the age of 14, are afforded an opportunity to undergo preliminary training in electrical engineering, concerning which Mr. Farrell says, that the boys soon adapt themselves to the cleaning of the switchboard and the many intricacies of currents and wires.

The appropriation of $70,000 for the extension of the fire-alarm telegraph service to all parts of the borough of Queens makes provision for the expending of $62,800 for lead-covered cable, laying same, signal boxes, central-office equipment, switchboard, repeaters, transmitters, etc. The working staff is to consist of six operators at $1,200 a year each, working two at a time in three shifts. The head office will be at Jamaica, L. I., and the cables will be extended to 10 adjacent towns.

Some electric work is required at the power house of the New Harlem hospital at One-hundred-and-thirty-sixth Street, together with other engineering items. Bids are returnable on March 21st, and plans may be seen at 419 East Twenty-sixth Street.

Contracts for furnishing telegraph and telephone supplies for the New York Police-telegraph Department have been awarded in various details to Frederick Pearce, W. R. Ostrander & Co., the Western Electric Company, and to the Carleton-Chase Electric Company. The amounts involved in the individual contracts are not very large. D. W. W.

## Dominion of Canada.

Winnipeg, Man., March 4.—During the last year over 1,909 permits were issued for electric power in Winnipeg, covering the installation of 85 arc lamps, 1,808 horsepower for motors, and wiring for 28,316 incandescent lamps. For street illuminations a number of 50-candlepower series incandescent lamps on 7½-ampere current were installed last year, being used on the same circuit with the arc lamps. These have been so satisfactory that an additional supply will be purchased and installed during the coming summer. About 100 additional arc lamps will also be purchased and installed, the latter being made necessary by the rapid growth of the city. The installation of 10 additional fire alarm boxes will also be done this spring.

Tenders are being called for up to March 10th for all the work and material necessary for the installation of a complete electric light plant in Calgary. The work is divided into the following contracts: "A," Electrical equipment in power house; "B," engines and connections; "C," boilers and connections; "D," power house and chimney; "E," poles; "F," all outside work; "G," arc lamps, wire, insulators, etc. Specifications may be obtained from F. W. Thorald, city engineer, Calgary. The citizens of Calgary have voted by a large majority to do their own lighting.

W. H. Shillinglaw, city engineer of Brandon, Man., has been instructed to prepare plans and specifications for an electric plant to light the streets and public buildings.

A large planing mill is to be built in Brandon, Man., to be run by electric power. A. W. McDiarmid is one of the owners.

A by-law is to be submitted to the ratepayers of Duncans, B. C., to empower a company to install an electric-light system during the coming summer. H.

## Ohio.

Cleveland, March 4.—At Columbus it seems to be the opinion that the mortgage on the Central Market Street Railway Company will be closed by the bondholders and the property sold to the highest bidder.

An ordinance has been introduced at Springfield to give the Home Heating, Light and Power Company a blanket franchise in the city. The company will compete for the street lighting.

The Toledo Interurban Railroad Company has been granted a franchise out Monroe Street to the county line, so that the line may be built to Ottawa Park and Sulphur Springs, connecting with the Ann Arbor line.

The Cadiz Electric Company, Cadiz, has been incorporated with a capital stock of $12,000. J. V. Conner and others are interested.

The Ohio Valley Electrical Supply and Construction Company of Steubenville has been incorporated with a capital stock of $50,000 by H. P. McGowan, John Kidd and others.

J. A. Hanna, representing the Niles Car Works at Cleveland, has received an order from the Fort Wayne and Springfield line for four large interurban cars.

The Electrical Appliance Company of Cincinnati has been incorporated with a capital stock of $10,000 by W. C. Pierce and others.

The Forde Lighting Company of Garrettsville has increased its capital stock from $25,000 to $50,000.

The Supreme Court of Ohio has reversed the Superior Court of Cincinnati and declared the Rogers law, giving the Cincinnati Street Railway Company a 50-year franchise, valid. The fight made on this law was a bitter one, and there were doubts as to its being upheld. Under the decision the franchises will expire in 1946.

The Ohio Quarry Company is engaged in building a railroad from Lorain through Wellington to Oberlin. It will be known as the Lorain, Amherst and Wellington road. The passenger cars will be hauled by electric locomotives, eight trains a day each way, while large steam engines will pull the freight trains.

Efforts are being made to lift the receivership of the Sandusky Southwestern Railway Company. It is reported that preliminary arrangements have been made for financing the company.

Harry M. Daugherty of Washington C. H., Senator S. L. Patterson of Waverly and D. J. Ryan of Columbus are engaged in financing the Springfield, Charleston, Washington C. H. and Chillicothe road. They have made arrangements to lift the debt of $166,000, it is said, and have also negotiated the sale of bonds, amounting to $1,500,000, to complete the construction.

Various methods of doing away with the crowded condition of the streets in Cleveland have been advanced, but the one that has been received with the greatest favor by the people is a system of subways running through the business section to the Public Square. This method is now being investigated by the officials of the city road. O. M. C.

## Indiana.

Indianapolis, March 4.—It is expected that the work of the coming season will add five or six new electric roads to the 26 now in operation in this state. The Indianapolis, Danville and Rockville Interurban Railway Company will begin the work of completing a line between Indianapolis and Danville next week. The grading is most all completed, bridges built and the concrete work in, hence the laying of the track and the trolley installation can be pushed as soon as the frost leaves the ground. The officials say they will have cars running into the terminal station by July 1st.

One of the largest works in electric-railway construction now under way in Indiana is that of the Louisville and Southern Indiana Traction Company in building its line over The Knobs, Indiana's highest range of hills, to Corydon. The company has taken control of the tracks of the old Highland railroad, [illegible] Bedford Street railway line from Bedford to Oolitic, the quarry district [illegible] It is the purpose to complete the line as speedily as possible.

The Vincennes Street Car Company will begin laying a double-track system in that city next week, 75-pound rails being used. All of the cars will be mounted on double trucks. This company has leased the fair ground for a number of years and a pavilion is under contract for construction.

During the present month subsidy elections will be held in Spencer County in aid of the Evansville and Rockport road and also in Wabash County in aid of the Winona line. A peculiar condition exists in the latter county. The Indiana Central Traction Company, headed by V. J. Drayer of Dayton, Ohio, is contesting with the Winona people for a line through the county and is also asking for subsidies. The people want an electric railway, but some favor the Winona and others the Indiana Central line. The competitive campaign is growing warm.

Two new electric lines were projected during the last week. The Townsend-Reed Company, which constructed the Indianapolis and Northern Traction Company's road, has gone into the interurban business on its own score and now proposes a line between Lafayette and Chicago. The engineers have arranged a route not paralleling any steam road for any considerable distance and touching some of the most important places between the terminal cities. This will be one of the longest lines in the state.

An electric railway is projected to run from Lafayette to Fowler and thence to Hoopston, Ill. The business men of Fowler held a meeting last week and took steps toward the securing of the road.

C. F. Knowlton, representing the Indianapolis and Chicago Air Line Traction Company, is arranging for surveys of the line through Clinton and Carroll counties. His plan of soliciting money from the citizens to pay for the survey is not well regarded, but the people appear willing to aid in the building of the line.

The Indiana Northern Traction Company, operating between Wabash and Marion, has just issued a new book, the tickets being interchangeable with those of the Fort Wayne and Wabash Valley line. The new books sell for $8 for each 210 five-cent rides, making a deduction of 20 per cent. The interchangeable-ticket question will be taken up at the next monthly meeting of the Indiana Electric Railway Association.

The Indiana Legislature adjourned without effecting any legislation of consequence to the interurban roads. The bill which would have bestowed on electric and interurban railroads the right to acquire and operate electric-light, steam-heating and gas plants in cities under 30,000 population was killed by the Senate. It was asserted that such a law would give interurban roads too much power in cities and towns. The railway commission bill exempts interurban and street-railway companies from its provisions or jurisdiction except that the commission has the power over them as to crossings, interlocking devices, etc. This power was formerly lodged with the auditor of state.

An interstate trolley theater party is somewhat of an innovation, but the first production of the "Gentleman from Indiana" at English's Theater brought a special car loaded with society people from Dayton, Ohio. Valentine Winters, president of the Dayton and Western, conducted the affair, and all agreed that the trip was very enjoyable. They were delighted with the new terminal station in Indianapolis.

The promoters of the proposed Tipton, Frankfort and Attica traction line have asked for a subsidy election at Frankfort. Six hundred taxpayers have signed the petition. The petition provides that the power house and car shops shall be located in Frankfort. A number of townships have already voted aid to this line and it will carry in Clinton County. S. S.

## Michigan.

Detroit, March 4.—The fruitgrowers of Norton Township, near Muskegon, have inaugurated a movement for the extension of the Muskegon Traction and Lighting Company's electric railway from the city to a point about three miles in the country, called the Float Bridge, at which point fruit could be transferred from boats. General Manager Freshney of the traction company has the matter under consideration. At present most of the fruit is handled from this part of the country by small boats and then transferred to the steam line or to the Goodrich line at Muskegon.

Louis Berg and Edward Moore of Detroit have been elected delegates to the annual state convention of electrical workers to be held in Battle Creek,

March 14th. The electrical workers are discussing the advisability of having a series of lectures given by expert electrical engineers, with a view of establishing a permanent school of instruction.

Henry G. Wells, formerly of the Great Lakes Engineering Company and for some two or three years connected with the Westinghouse company at Pittsburg, has asked for an electric-lighting franchise in Detroit in competition with the Detroit Edison Illuminating Company.

At the special meeting of the citizens and aldermen of Ann Arbor, who were investigating the waterworks situation, it was decided that the Ann Arbor Water Company has violated its contract with the city and that its franchise is void. It is probable that more definite action will be taken with regard to this matter later on.

A bill authorizing the issue of $150,000 of improvement bonds for the Detroit Municipal Lighting Commission has been approved by Mayor Codd and sent to Lansing to be taken in hand by the Wayne County delegation.

Springwells, a suburb of Detroit, has accepted the bond of John A. Russell for $3,000. Mr. Russell has a franchise for commercial lighting within the township and he must have his plant in working order by September 1st.

There seems to be an opinion among some of Detroit's citizens that the offer of $1,000 by Alex Dow of the Detroit Edison Electric Company for the purpose of an investigation of the municipal electric-lighting plant should have been taken advantage of, as it appears that there is a question as to whether the plant has been run at the cost claimed.

The city of Ann Arbor has granted a franchise to the Toledo, Ann Arbor and Detroit Electric Railway Company, which will enter the city over the Hawks-Angus line. The road must be completed in 21 months or a forfeit of $10,000 will have to be made. The Adrian and Ann Arbor Railway Company franchise was also given a reading in the council.

It is understood that everything is now ready for active building operations on the Grand Rapids and Iona electric railway and that work will be commenced by the middle of April. This line will connect with the Iona and Owosso line, which is projected to run between these two towns and also with the Owosso and Pontiac road, which is still upon paper. The Grand Rapids and Iona line will enter Grand Rapids over the Reeds Lake line, coming downtown either via Cherry Street or Wealthy Avenue.

Application has been made by the Lansing and Suburban Traction Company of Lansing for franchises in the villages of Leslie and Mason. Several companies have contemplated building a Lansing and Jackson line, but the Lansing company may be the first one to start the actual construction.

C. G. W.

## Northwestern States.

Minneapolis, March 4.—The Twin City Rapid Transit Company has filed an indemnity bond for $5,000 as a guaranty that it will build the proposed electric railway from Minneapolis to Excelsior this summer. The right-of-way is now being secured.

The city of St. Paul and the Twin City Rapid Transit Company have finally come to an agreement after a fight extending over nearly a year. By it the company agrees to pay a total tax of six per cent. on its gross earnings and to build several new lines, including a crosstown line. The city agrees not to appeal from Judge Lochren's decision.

A franchise has been granted at Iowa City, Iowa, to the Iowa City-Davenport Interurban Railway Company.

The case of the state of Wisconsin vs. the Duluth-Superior Traction Company for the annulment of the latter's franchise has been begun. The state's point will probably be that the company, a foreign corporation, could not legally be granted a franchise by the city of Superior.

An electric-light system will be installed at Boyd, Wis., the power plant at Cadott to furnish the current.

The Public Service Company has been reorganized at St. Cloud, Minn., with $500,000 capital. It is proposed to dissolve the receivership of the street-railway company and to incorporate it with the Public Service Company. About $230,000 will be expended on improvements to the electric-light and street-railway plants.

J. E. Barnard has purchased the Osceola (Iowa) electric-light and power plant and is now sole owner.

The Edison Sault Electric Company will let the contracts at once for the construction of a new power plant at Sault Ste. Marie, Mich. Two thousand four hundred horsepower will be developed and additions will be made to the plant as more power becomes necessary.

R.

## Rocky Mountain States.

Salt Lake City, March 2.—Work is progressing rapidly on the Oxbow Tunnel on the Payette River in Idaho, where later a large power plant is to be installed. The cost of the tunnel when completed is estimated at $125,000, and the total cost of the plant when thoroughly equipped and prepared to supply electrical energy to Boise and other cities will be about $1,500,000. The machinery for the plant will be on the ground in August, although it will be some months later before the plant will be ready for operation.

The city attorney at Salt Lake City has submitted an opinion to the council, holding that that body cannot legally grant the application of the Utah Light and Railway Company for a 50-year extension of its franchise.

It is reported that a large electric plant is to be erected in Huntington Canyon, near Price, Utah. The projectors, D. C. Robbins and associates, are also getting rights-of-way over the roads of the county for an electric road.

I. B. Perrine of Blue Lakes, Idaho, has returned to that city from Chicago, where he purchased two turbine waterwheels and left an order for electric generators to be shipped May 1st, for the power plant at Post Falls. Power and light will be furnished Twin Falls City, Idaho, as soon as possible.

A site has been selected at Crane Falls on the Snake River for the establishment of the proposed power plant of the Mountainhome Light and Transit Company of Mountainhome, Ida. The construction of an electric road between that city and the Snake River Valley is among the projects of the company.

G.

## Pacific Slope.

San Francisco, March 3.—A party of Denver capitalists who are interested with Lawrence Phipps in the Bishop Creek project to supply Tonopah and Goldfield, Nev., with electric power have been in San Francisco completing arrangements for the carrying out of the enterprise. Among the party are Rodney Curtis, interested in the street-railway service of Denver; Samuel Woods and F. J. Campbell. The proposed plans of the company include the establishment of a generating plant at Bishop Creek in California. From the natural flow of the creek the company expects to develop 400 horsepower and will increase the capacity to 20,000 horsepower by the construction of three small dams along the stream at a cost of $100,000.

The Oro Water, Light and Power Company has been incorporated at San Francisco by R. C. Medcraft, J. Alexander, L. A. Redman and others. The capital stock is $3,500,000.

The Battle Creek Power Company has filed articles of incorporation at San Francisco with a capital stock of $1,000,000. The incorporators are Walter E. Carre of Colma, Cal.; Henry Ward Brown, Dudley C. Bates and others.

Fred Sander, the trolley promoter, promises the people around Lake McAleer, back of Edmonds, Wash., that his trolley line between Seattle and Everett, Wash., will reach that point by September 1st next. The work of extending the line northward from Ballard is proceeding rapidly.

The electric-light committee has presented a report to the City Council at Victoria, B. C., recommending the purchase of the following: One new dynamo, 230-light capacity, approximate cost $2,940; one exciter, $145; one switchboard, $305; three transformers, 50-light capacity each, $1,800; one belt, pulley and clutch and fitting for same, $500; 150 arc lights, $4,500; rearranging circuits, $810.

The Grays Harbor Electric Light and Power Company is planning an extension of its electric road to Cosmopolis, Wash., if arrangements acceptable to the company can be made. It is possible that the road may be extended as far as Elma and Montesano and possibly to Tacoma. J. D. Crary has returned to Aberdeen, Wash., from the East, where he purchased the equipment and machinery for the company, costing over $75,000.

The trustees of Bakersfield, Cal., are advertising for sealed proposals for furnishing all material and appliances and installing a complete electric fire-alarm system in that city, according to plans and specifications on file. A. T. Lightner is city clerk.

A.

## PERSONAL.

Wesley R. Mason of Detroit, Mich., assistant district manager of the American Car and Foundry Company, has been appointed manager to take the place of George Hargreaves, resigned.

Charles G. Lohman, formerly a division superintendent of the Indianapolis Traction and Terminal Company, has accepted a position as superintendent of transportation for the Indiana Railway Company, with headquarters in South Bend, Ind.

B. A. Schroder, for some time attached to the St. Louis office of the Crocker-Wheeler Company, has been placed in charge of the New Orleans office of the company. Mr. Schroder succeeds W. P. Field, who has been transferred to the Boston office.

Arthur Williams of the New York Edison Company, whose reports on sign and decorative lighting attracted so much favorable notice at the last two conventions of the National Electric Light Association, has been appointed by President Davis to report on "Municipal Ownership" at the twenty-eighth convention, to be held at Denver-Colorado Springs, June 6th to 10th. Mr. Williams has already collected a large amount of data regarding the management and operation of municipal plants, both in this country and abroad, and with his usual skill and thoroughness is sure to make this report most complete and interesting—a valuable addition to the literature on this subject already possessed by the association.

Henry W. Sage has resigned as secretary of the Cincinnati Gas and Electric Company. He is 65 years of age and has been with the company since 1870, having become secretary in 1882. Mr. Sage is a devoted church worker, and it is probable that a large part of his efforts in the future will be spent in that direction.

Forée Bain, the well-known consulting engineer and expert in electricity, mechanics and patent causes, announces that about the first of May he will occupy a more commodious suite of rooms at the south end of the ninth floor of the Monadnock Building, Nos. 947, 948 and 949. Mr. Bain is one of the "Old Guard" in the electrical business, having been located in Chicago since the '80's.

Charles R. Underhill, formerly chief electrical engineer of the Varley Duplex Magnet Company, has engaged in consulting engineering on his own account, with headquarters at 55 Liberty Street, New York. He will make a specialty of the design of electromagnets and solenoids in general, but particularly for heavy-duty work. Mr. Underhill is the author of a book entitled, "The Electromagnet," which treats the subject from the viewpoint of design.

W. H. Patton, for some years identified with the gas-engine industry and one whose work is well known in connection with the development of a type of gas-engine electric locomotive, has accepted a position with the Otto Gas Engine Company. For six years previous to this he was employed with the National Meter Company, in charge of the installation of Nash gas engines in the middle and western states. With the Otto company Mr. Patton will devote himself to the installation of Otto gas engines and to the development of his gasoline locomotive.

There has been some discussion in Birmingham as to where the principal of the university, Sir Oliver Lodge, might most properly be classed. It is pointed out that although he is obviously a great scientist, his activities are by no means restricted to the domain of physics, and in proof of this a recent week's programme is cited. He commenced on the Sunday by lecturing at a theater on "Old and New Views in Regard to the Universe." Then he presided at a lecture by Mr. Anthony Hope, the novelist, and after attending several important committees he gave the first of a series of lectures on "Teaching." Between these engagements he found time to write to the press on such themes as "Sun-spots," "Warley Woods," "Water-finding" and "The Russian Revolt."

Frank H. Gale, who for several years has conducted miscellaneous publicity matters for the General Electric Company, has succeeded the late Edward H. Mullin in charge of the company's advertising. Mr. Gale's headquarters have been in Schenectady, but he will now spend part of each week in New York city. Mr. Gale is very well and pleasantly known to members of the electrical fraternity both east and west. He managed his company's exhibits at the Pan-American, Charleston and St. Louis expositions and has also appeared in its behalf at many electrical conventions. At St. Louis Mr. Gale was president of the Exposition Electrical Club and assisted in receiving and entertaining many distinguished guests. During the International Electrical Congress it was he who introduced the guests to President Francis at the brilliant reception in the Palace of Electricity. Mr. Gale is keenly interested in all forms of electrical development and is an associate of the American Institute of Electrical Engineers.

## ELECTRIC LIGHTING.

W. R. Harrison is said to be contemplating the installation of an electric-light plant at Loan Oak, Texas.

At a special election in Mexico, Mo., the Mexico Electric Light Company was granted a franchise for 20 years.

The direct-current lighting system of the city of Dunn, N. C., is to be changed to alternating current for commercial use.

F. W. Porter of Whitehall, Wis., has been granted the franchise for which he applied recently to construct an electric-light plant in Madill, I. T.

Fort Valley, Ga., has voted affirmatively on the proposed issuance of $12,000 bonds to establish an electric-light plant and improve the waterworks.

A new boiler, engine and alternating-current dynamo are to be installed in the municipal electric-light and power plant at Fayetteville, N. C., to increase the output.

I. Schontendorp of Batavia, Java, has obtained a concession for erecting a large electric power station at the falls of Toentang, which is to supply the city of Saerabaya, Java, with light and power.

Arrangements has been made for the continued operation of the Stafford Springs (Conn.) Electric Light and Gas Company, and the announced intention to close down the plant has been reconsidered.

In the Fairfield County Superior Court Mr. Warner of Bridgeport was appointed receiver of the company, and he was authorized to continue the operation of the plant. A reorganization of the company will probably be effected.

The lower house of the Missouri Legislature has passed Senator Ely's bill authorizing light and power companies in cities of 10,000 inhabitants and less to extend their business to include that of street railways, with the consent of such cities, towns or villages.

The Merchants' Power Company of Memphis, Tenn., has been organized and has secured a 30 year franchise to furnish light and power for the city of Memphis. The company will shortly be in the market for general equipment, the franchise granting the right to build and operate both gas and electric-lighting and power systems. The company is at present engaged in a study of producer-gas and suction-gas systems. Its office is in the Rogers Building.

## ELECTRIC RAILWAYS.

The legislation under which street-railway companies are required to carry pupils of the public schools to and from school at half the regular fare has been declared constitutional by the full bench of the Massachusetts Supreme Court.

The Swiss government has granted permission for the building of electric railways from Castagnola to Lugano, Menziken to Emmenbrücke, Münster to Rothenburg, Au to Berneck, Altorf to Fluelen, and a cable railroad from Interlaken to Heimwehfluh.

The Nashville (Tenn.) Railway and Light Company reports gross earnings of $1,010,181 for the year ended December 31, 1904. Operating expenses were $542,047; net earnings, $468,034, and the surplus, $103,958. Gross earnings increased $138,118 and net $114,158.

President C. W. Sells of the Manitou and Pike's Peak cog road is authority for the statement that the system will not be electrified, as intended, this year. Mr. Sells has made an extended trip to New York, Philadelphia, Boston and Chicago, where he made a thorough investigation of the electrical systems in use.

An electric railway is proposed from Atlanta, N. Y., to Cohocton, with an ultimate connection with Naples and Canandaigua Lake. The promoter is George Switzer, who has previously constructed electric lines in West Virginia, and was formerly in the employment of the Westinghouse company at Pittsburg. He is the son of Col. A. J. Switzer of Bath, N. Y.

The Oxford, Cochranville and Parkesburg Electric Railway Company is about to begin the construction of its road between Oxford and Parkesburg, Chester County, Pa., a distance of 14 miles, all the necessary rights-of-way and ordinances having been secured. Plans and specifications are now being prepared at the company's office, 808 Girard Trust Building, Philadelphia.

It is again reported that the street railways of Chattanooga, Tenn., have reached terms effecting a consolidation. The merger includes the Chattanooga electric railway, the Rapid Transit and the Lookout Mountain Incline. The negotiations have been carried on at New York. The Newmans of New Orleans and New York are to have the controlling interest in the new company, it is said.

A bill has been introduced into Congress asking permission by the Missouri Central Railroad Company to construct two bridges across the Missouri River in Missouri, one at St. Charles and one at Glasgow. These bridges are to be for the use of the proposed electric railway between Kansas City and St. Louis. The company has been incorporated with a capital of $12,000,000, which is largely paid up. It will be the longest electric railway ever built.

During the fiscal year 1903-04 the street railways of Berlin, Germany, carried 456,902,488 passengers. Of this number the elevated steam road carried 36,038,553, the circular electric railway 23,240,173, and all the other surface and underground electric lines 397,578,062. To these are to be added 85,878,957 passengers carried by the several omnibus lines, which, notwithstanding the steady extension and improvement of the electrical tramway system, continue to handle an increasing traffic from year to year. The whole number of accidents during the year was 2,146, of which 31 were fatal.

The excise tax which municipalities may levy upon street railways on the basis of a percentage upon the gross receipts for each mile of track operated by the company was held by the full bench of the Supreme Court of Massachusetts in the case of the Greenfield and Turners Falls Street Railway Company vs. the town of Greenfield to be got at by dividing the annual gross receipts of the company by the total length of track both on private lands and in the public highways. The town had claimed that the total length of the company's track in public highways only was intended by the statute as the divisor, which, being smaller, would have made the gross receipts per mile more [illegible] it to collect on [illegible]

Estimates for a power house to be of reinforced concrete construction for the United Railways and Electric Company of Baltimore, Md., are considered too high, and the plans and specifications, prepared by P. O. Keilholtz of Baltimore, will be revised and new estimates taken on brick construction.

Property valued at $80,000 has been bought at Spokane, Wash., by the three electric railways entering Spokane, which will be used as terminal grounds, and a site for a fine station and office building. The property is on Ferry Avenue and includes five blocks of lots, from Division Street to the river. Two hundred miles of track will be laid in the terminal grounds and a freight depot, 250 by 30 feet, will be constructed. The terminal station and office building is to be six stories high and will cost $200,000. A terminal company, with a capital of $750,000, is being formed to own the freight yards and the office building, and its stock will be held jointly by the Spokane Traction Company, the Cœur d'Alene and Spokane Railway Company and the Spokane and Inland Railway Company, all electric roads.

It has been announced that the formal transfer to the New York, New Haven and Hartford Railroad Company of the Heft system of electric railways has been accomplished, the properties having been formed into a new organization of which Col. N. T. Heft is the head. The roads included in the transfer are the Greenwich Tramway Company and the Stamford and New York Railway Company, which has lines running from Stamford to New Rochelle. The entire trackage of the roads is about 50 miles and 100 cars are in operation. This is understood to be part of the plan of the New York, New Haven and Hartford management to combine all its trolley interests between Stamford and New York into one system, similar to the Consolidated Railway Company.

Traffic on the four elevated railways of Chicago, except the South Side elevated, for the month of February, show good gains as compared with the corresponding month last year. The daily average of passengers carried by the various roads during February is as follows: Metropolitan, 121,177; South Side, 88,173; Northwestern, 78,773; Oak Park, 47,149. The figures for February, 1904, were, respectively, 118,693, 90,330, 73,193 and 44,306. There is said to be a dissatisfied element among the stockholders of the Metropolitan Elevated. A committee from this number has sent out circulars inviting proxies for the annual meeting on April 5th and stating their belief that it is to the best interest of all concerned that four new directors be elected. The dissatisfied element will endeavor to elect a successor to Dickinson MacAllister, who has announced his resignation as president.

The Philadelphia Rapid Transit Company has virtually completed plans and specifications for the extension of the Market Street Subway around the City Hall and bids for the work will be asked soon. In the application to list its stock on the New York Stock Exchange it is said that it will be a two-track subway, covering about one-half mile. The cost is estimated at $1,000,000. A special meeting of the stockholders of the company has been called for April 25 for the purpose of authorizing the company to join as surety and guarantor of principal and interest in a mortgage of the Market Street Elevated Passenger Railway Company to secure an issue of $10,000,000 gold bonds, such mortgage to cover also the leasehold interest of the Philadelphia Rapid Transit Company in the Market Street Elevated Passenger Railway Company and the power plant to be erected on Delaware Avenue.

## PUBLICATIONS.

Flexible steel-armored hose for steam or compressed air as manufactured by the Sprague Electric Company of New York has its advantages pointed out in bulletin No. 105, which contains numerous illustrations showing the hose and various applications which may be made of it.

Two small Westinghouse publications are devoted to type F induction motors and type R direct-current motors. Among the machines which the former may drive are centrifugal pumps, rolls in steel mills, mine hoists and elevator equipments. The direct-current motor is of a type already described in the Western Electrician.

The Valentine-Clark Company, Chicago, dealer in cedar poles, has issued a little pamphlet calling attention to the extent of its stocks of poles and the facilities which it possesses for furnishing poles promptly in all sizes and for all purposes. The main yards of the company are at Pinconning, Mich.; Green Bay, Wis.; New London, Wis., and Prentice, Wis.

Centrifugal pumping machinery forms the subject matter of an excellent catalogue just issued by the De Laval Steam Turbine Company of Trenton, N. J. This machinery is especially adaptable to electrical drive, and many fine illustrations are given of electrically driven units. The speed necessary for the higher lifts was, however, unavailable until the advent of the steam turbine, the perfection of which [illegible]

[illegible] resters, etc.

The Central Electric Company is distributing an attractive four-page leaflet containing pictures of its old building [illegible] ters at 207, 209, 211 [illegible] cago. Some details of the company's recent fire are given, but the most of the space is occupied in thanking the [illegible] for their generous support and in emphasizing the fact that the company has now a complete new stock and is in a position to make shipments with promptness and dispatch.

A publication of much technical interest is that issued by J. W. Rickey of Minneapolis, Minn., entitled "Modern Hydro-electric Power Stations." The purpose of the pamphlet is briefly to describe and summarize the merits of a type of open penstock construction particularly adapted to meet the exacting requirements of the modern hydro-electric power station. It contains a good description of the hydraulic features of the new power station of the Michigan Lake Superior Power Company at Sault Ste. Marie, including diagrams and a table indicating the saving in cost following the use of concrete-steel construction for the penstocks over that of masonry.

A handsome piece of electrical advertising literature is that due to S. A. Douglas of the American Vitrified Conduit Company. This little work, entitled "Pointers," contains in a remarkably condensed form information that may be required for preliminary estimates in laying out plans for conduit work. Mr. Douglas has done a large business for the American Vitrified Conduit Company, having been closely identified with electrical transmission for years, and is well qualified to edit "Pointers" for those desiring to lay conduits. His experience with the large amount of work that has been carried on by the American Vitrified Conduit Company has been so varied that these pointers may be taken to mean something. The little brochure, too, is so remarkably handsome in its appearance that it will unquestionably be preserved. Mr. Douglas' "Pointers" will be mailed to any conduit company or electrical engineer or to anyone interested in conduit work, on application.

## SOCIETIES AND SCHOOLS.

Science Hall, at the Virginia Polytechnic Institute, Blacksburg, Va., which was destroyed by fire recently, will be rebuilt at once. The Virginia Polytechnic has reached a high plane of efficiency under the administration of President McBryde.

On March 10th W. I. Ely of the Murphy Iron Works, Detroit, addressed the Society of Engineers of the University of Minnesota on "Smoke Prevention." On March 17th C. E. Downton of the Westinghouse Electric and Manufacturing Company will give an illustrated lecture on the Pittsburg factory and its products. On March 24th Benjamin Waller, resident engineer of the Northwestern Telephone Exchange Company at Minneapolis, will lecture upon "Some Engineering Features of a Modern Telephone Exchange."

## TELEGRAPH.

The Fort Worth Long-distance Telephone Company of Fort Worth, Texas, has been incorporated by D. C. Cogdell, J. N. Nutt and associates.

The Zion City lace industries have instituted suit against the Western Union Telegraph Company for the recovery of $15,000, said to have been the amount of loss sustained by an alleged error in the transmission of a message from New York to Chicago involving a large sale of lace.

Improvements amounting to $40,000, it is said, have been authorized for 1905 for the telegraph system of the Pennsylvania railroad. Included in the proposed improvements is a private telephone line connecting Dennison and Steubenville, Ohio, which, with a line already constructed from Steubenville to Pittsburg, will give direct connection between Pittsburg and the shops of the company at Dennison.

The Canadian minister of railways has announced that the government has given the Anglo-American Cable Company $5,000 increase in subsidy for an improved cable service between Prince Edward Island and the mainland. By the agreement the company has reduced its rates on messages from points in Prince Edward Island to Nova Scotia, New Brunswick, Quebec and Ontario from 50 cents to 30 cents for 10 words, and from three cents to two cents for each additional word. A proportionate reduction is made for press messages. Rates to Manitoba, British Columbia, the territories and the

United States are reduced from 50 cents to 25 cents for 10 words, and from three cents to two cents for each additional word. To this the rates of connecting lines must be added under the new agreement.

Excellent opportunities are just now offered in the United States army service for telegraphers and men with a knowledge of electrical work. At the New York recruiting station word has been received from headquarters to secure the enlistment of as many telegraphers and electrical workers as possible, as just now there is an urgent demand in this department of the service. Master signal electricians receive $75 a month in the United States and $90 when abroad. Enlistments in the Signal Corps are for three years.

An important extension of telegraphs is about to be made in Southern Nigeria, it is said. The work involves the laying of 400 miles of wire. Starting from a point on the Calabar-Bonny system, the line will strike inland to Onisha, on the Niger, and will continue west across that river to Benin. At present there are no lines in the interior of Southern Nigeria, but when the work now about to be taken in hand is complete a great portion of the known part of the British protectorate will be tapped. At Lagos the new line will join the interior telegraph, which at present extends to Kano and is being pushed on to Sokoto.

## SPACE TELEGRAPHY.

It is said that communication was established recently by space telegraphy between Chicago and Key West, a distance of 1,060 miles. Messages were received best at night and were very distinct at Key West.

As a result of space-telegraph tests in connection with experiments in naval warfare now in progress at Culebra it is reported, among other things, from Washington, D. C., that the discovery has been made that it is impossible to transmit wireless messages to as great distances in the warmer zones as farther north.

In a recent lecture before the Royal Institution of London, William Marconi announced that he has constructed a magnetic detector which will enable wireless messages to be recorded on tape by an ordinary Wheatstone recorder, at a rate of 100 words a minute. The speaker hinted at further improvements in receiving which he is elaborating in conjunction with Professor Fleming.

## MISCELLANEOUS.

Napoleon Durant of North Adams, Mass., has invented a contrivance for preventing snow and frost from accumulating on the lookout glass of the motorman's cab on street cars. A thin strip of wood mounted with rubber which presses against the glass is slidably mounted on two slender rods fitted to the sides of the window. Two strings permit the strip of wood to be drawn up or down semi-occasionally over the glass to remove the frost.

Judge Seaman, in the United States Circuit Court for the Eastern District of Wisconsin, in an opinion handed down on February 24th after a preliminary hearing granted an injunction against the National Electric Company in the suit brought by the General Electric Company alleging infringement of the Erben brushholder patent No. 705,055 in the manufacture by the defendant company of brushholders for generators and motors. The Westinghouse Electric and Manufacturing Company was interested in the suit as licensee under the Erben patents.

In the exhibit of the Electric Launch Company at the New York Motor-boat and Sportsmen's Show was shown one of the General Electric Company's mercury arc rectifiers in full operation. It is used to charge 44 cells of battery in the electric launch "Rest Awhile," the current being 30 amperes at 110 volts, direct current; the alternating current used is 220 volts, 60 cycles. This presents an interesting field for the use of mercury arc rectifiers, and it is probable that the use of electric launches may be materially increased because of the simplicity of the charging outfit now offered.

Judge Buffington, in the United States Circuit Court for the Western District of Pennsylvania on February 24th handed down a decision dismissing the plea of estoppel interposed by the Diamond Meter Company of Peoria in the suit brought by the Westinghouse Electric and Manufacturing Company against the Jefferson Electric Light, Heat and Power Company of Punxatawney for infringement of the Tesla split-phase patents Nos. 511,559 and 511,560 in the use of Scheeffer induction meters for alternating currents, manufactured by the Diamond company. An injunction was granted on the following day restraining the Jefferson company from the further use of these meters.

## TRADE NEWS.

The Flint-Lomax Electric and Manufacturing Company of Denver, Colo., has sustained a considerable fire loss.

According to the Cincinnati Post, Jos. C. Boone, a stockholder, has applied for a receiver for the Barriett Electric Company of that city.

The Clark Electric Meter Company of Chicago, which proposes to deal in electrical machinery, has been incorporated by E. J. Clark, F. W. Robett and M. A. Gorman.

The Bellingham Electric Supply Company of Bellingham, Wash., has been incorporated with a capital stock of $25,000 by J. A. Hinck of Portland, Ore., and Albert Rives of Spokane. The new company has purchased the business of the Frizell Electric Company.

The American Battery Company, Milwaukee, Wis., has been incorporated to manufacture electric batteries and other mechanical appliances and instruments. The capital is $25,000 and the incorporators are Louis Axelsen, C. Christensen and Arnold Gabrielson.

Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until three p. m., March 25th, for the installation of an electric passenger elevator in the courthouse and postoffice at Waco, Texas, in accordance with the drawings and specification, copies of which may be obtained of the supervising architect.

The Bureau of Yards and Docks, Navy Department, is inviting sealed proposals until April 1st for furnishing the Portsmouth (N. H.) navy yard with three electric traveling cranes. On April 25th the bureau will open bids for furnishing the Puget Sound navy yard with a five-ton electric traveling crane. Specifications can be seen at the bureau or will be furnished on application to the commandants of the yards named.

The Bureau of Supplies and Accounts, Navy Department, is inviting sealed proposals until March 21st for furnishing the New York and other eastern navy yards with electric cable, under schedule 99, and electrical supplies of various kinds, under schedule 100. Blank proposals can be obtained at the navy pay office in New York or at the bureau in Washington. Applications should designate the schedules desired by number.

The Central Electric Company, Chicago, announces that its stock at the present time is very nearly as complete as the one in its warehouse which was recently destroyed by fire. The company says that it is gaining each day in the number of shipments made and is giving entire satisfaction to its many customers. The company is well known for its push and enterprise, and its rapid progress in overcoming its recent misfortune is certainly worthy of praise.

Sealed proposals will be received at the office of the business manager of the Board of Education, 730 Tribune Building, Chicago, up to March 24th for furnishing, setting and connecting, two three-light, government standard, bronze electroliers, with globes, for the Wendell Phillips High School, and for two three-light electroliers, with globes, for the William McKinley High School. Plans and specifications may be had of the chief engineer, 710 Tribune Building.

At the annual meeting of the stockholders of the National Carbon Company at Trenton, N. J., a few days ago, the old directors were all re-elected. The net earnings for the year amounted to $846,306.85. Dividends of preferred stock at seven per cent. amounted to $315,000, and 1½ per cent. on common stock was $82,500. For depreciation $376,280.89 was charged up. The company sets aside a large amount each year for this purpose, in order that all machinery may be replaced when necessary and new additions be made when the business demands. Just now a plant is being built near Pittsburg. After charging off a certain amount for doubtful accounts there remains to the profit and loss account $65,470.71.

The Crouse-Hinds Company's western headquarters are now located in the store at 70 West Jackson Boulevard, Chicago, where F. F. Skeel, the western sales agent, carries a full line of the company's products. It will be remembered that on February 13th the building in which the western office of the company was then located was partially destroyed by fire. The company's home office and factory are at Syracuse, N. Y., and of course the fire in Chicago has not interfered with the output of the factory, which has continued uninterrupted. The new Chicago store is in the Stromberg-Carlson Building and the telephone number is Harrison 5288.

F. S. Palmer, formerly electrical engineer for the Consolidated Engine Stop Company, and well known in the electrical trade generally, has recently associated himself with the Locke Regulator Company, Salem, Mass., and is devoting all his energy and skill toward increasing the demand for the latter's automatic engine stop, which has been received so favorably since being placed on the market. The Locke Regulator Company feels that its stop is all that could be asked, both mechanically and electrically, recognizing its being absolutely essential that a perfect stop should be thoroughly trustworthy and reliable. The combined method of wiring and testing used by it in connection with its automatic engine stop and speed limit is one applied to automatic fire-alarm work and earned the highest awards at the World's Fair in Chicago and also at the Louisiana Purchase Exposition in St. Louis.

## BUSINESS.

The Weber Gas and Gasoline Engine Company of Kansas City, Mo., is installing a 50-horsepower two-cylinder vertical producer-gas engine and suction-gas producer in the electric-light plant at Pierce, Neb., and a 60-horsepower outfit of the same type in the electric-light plant at Davenport, Iowa.

Transite asbestos fireproof lumber is a product of the H. W. Johns-Manville Company of New York in the manufacture of which the company has put forth its efforts to produce a material which can be adopted by the modern architect, builder, engineer and mechanic, to take the place of wood and other inflammable and non-heat, acid and moisture-resisting materials.

The South Shore Gas and Electric Company has ordered from Allis-Chalmers Company of Milwaukee one heavy-duty 24 by 48-inch engine for direct connection to a 425-kilowatt alternating-current Bullock generator, to be installed in its power plant at Hammond, Ind. The People's Power Company of Moline, Ill., owing to an important extension to its business, has also found it necessary to make some additions to its plant, and the Allis-Chalmers Company has been awarded the contract for one horizontal-compound Reynolds-Corliss engine, 24 by 50 by 48 inches, for direct connection to a generator. This engine will be practically a duplicate of one previously made by the same company which has been giving excellent satisfaction. An interesting novelty in its construction is the fact that the cylinders have valves in their heads.

The Westinghouse Electric and Manufacturing Company is building for the People's Power Company of Moline, Ill., two engine-type generators. The company has built up an extensive business in lighting and power work. The addition to its present equipment will be a 1,100-kilowatt two-phase alternator of the revolving-field type, operating at 2,400 and 4,800 volts, and a 600-kilowatt 600-volt direct-current machine. The alternating-current generator is a duplicate of a machine which the company put into service about a year ago. An order for three 300-kilowatt alternating-current generators has also been placed with the Westinghouse company by the Barber Lumber Company of Boise, Idaho. These machines will generate current at 440 volts, which will be transformed to 23,000 volts for transmission. The necessary transformers, switchboards and lightning arresters are included in the apparatus to be furnished. Another order is from the Mammoth Copper Mining Company of Salt Lake City for a large addition to its electrical equipment. A total of nearly 800 horsepower, in induction motors of different sizes, together with a motor-generator set, transformers, switchboard and three mining locomotives, is included in the order.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued (United States Patent Office) February 28, 1905.*

783,409. Frame for Dynamo-electric Machines. Bernard A. Behrend, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company, Cincinnati, Ohio. Application filed November 6, 1903.

A stationary frame comprises two end shields and a main frame is supported between them. The main frame comprises segmental supports placed end to end and laminæ are supported by the segmental supports.

783,419. Telephony. Edward A. Buell, DeKalb, Ill., assignor to the Selective Signal and Telephone Manufacturing Company, Sycamore, Ill. Application filed May 2, 1904.

Parallel branches of the line extend to the telephone receivers and switch hooks, one having normal connection with the telephone receiver and the other with the switch hook. Switching mechanism at each of the subscriber's stations controls the connection of the branches with the party line. Electromagnetic mechanism provides for effecting the operation of the switching mechanism.

783,430. Insulating Base Block for Electric Equipment. Monroe Guett, Hartford, Conn., assignor to the Hart & Hegeman Manufacturing Company, Hartford, Conn. Application filed June 13, 1904.

Insulating material adapted for the support of electric equipment comprises the base block proper, having a channel formed across its face, a projection from the base, but of less width, and having a channel formed wholly within it and clamping devices in the channels.

783,458. Trolley James A Norton, Wilkesbarre, Pa., assignor of one half to William L. Raeder, Wilkesbarre, Pa. Application filed December 23, 1904.

The trolley wheel is provided with a sectional hub, which is carried upon a harp having a swinging side member to permit of the easy removal of the wheel.

783,462. Time-limit Starting and Controlling Rheostat. Robert H. Read and William C. Yates, Schenectady, N. Y., assignors to the General Electric Company, Schenectady, N. Y. Application filed July 21, 1904.

Starting and running resistances, a circuit breaker and means for tripping the circuit breaker within a predetermined time if the operator fails to move off the starting resistance within the time are the prominent features of the rheostat.

783,480. Starting Means for Gas or Vapor Electric Apparatus. Percy H. Thomas, Pittsburg, Pa., assignor to the Cooper Hewitt Electric Company, New York, N. Y. Original application filed February 3, 1903. Divided and this application filed May 6, 1903.

A starting band is near one of the electrodes, also conductors leading to the electrodes. A transformer derives current from the source, the secondary of the transformer being connected to the starting band and to one of the mains. Devices interposed in the transformer circuit accelerate the electromotive force delivered by the secondary thereof with relation to the electromotive force of the source.

783,481. Starting Means for Gas or Vapor Electric Apparatus. Percy H. Thomas, Pittsburg, Pa., assignor to the Cooper Hewitt Electric Company, New York, N. Y. Application filed February 3, 1903.

Terminals are connected with a source of current and auxiliary electrical energy is required for breaking down the reluctance to starting, which consists in applying to the terminals electromotive force from the source. This produces an electric strain at one of the electrodes, and the starting is then accomplished by applying to the apparatus during each alternation electromotive forces having a predetermined phase relation to the electromotive forces of the source. (See cut.)

783,482. System of Electrical Distribution. Percy H. Thomas, Pittsburg, Pa., assignor to the Cooper Hewitt Electric Company, New York, N. Y. Application filed February 7, 1903.

A method of securing a variable relation between a system of electrical supply and a receiving circuit when current rectifiers characterized by a reluctance to starting are interposed in the system at a suitable point, consists in transmitting to the receiving circuit periodic electrical impulses of varying magnitude and selecting the portions of the several periods during which portions electrical energy shall be delivered to the circuit.

783,483. Adjustable Vapor-discharge Device. Percy H. Thomas, Pittsburg, Pa., assignor to the Cooper Hewitt Electric Company, New York, N. Y. Application filed February 20, 1903.

The device is characterized by the property of requiring the application of a critical strain in order to break down its initial reluctance to starting. A number of starting bands are arranged at varying distances from the surface of one or both of the electrodes and means make appropriate electrical connections with any one of the several starting bands at will at either or both electrodes.

783,495. Oscillator for Electric Machines. Edwin C. Wright, Newport, Ky., assignor to the Bullock Electric Manufacturing Company, Cincinnati, Ohio. Application filed May 26, 1902.

The essential features of the device are a shaft capable of end play provided with a pin rigidly secured at its end, a housing surrounding the shaft, an electromagnet secured to the housing, an electric circuit supplying current to the coil of the same and a swinging arm pivoted to the end of the magnet and provided with a set screw. A slidable rod is located in the core of the electromagnet and engages the set screw and the pin in the shaft at its opposite ends. Electrodes are placed in the electric circuit, one of which is fixed and the other secured to but insulated from the swinging arm.

783,498. Equipotential Connections for Armatures for Dynamos with Wave Winding. Engelbert Arnold, Karlsruhe, and Friedel Collischonn, Frankfort-on-the-Main, Germany. Application filed June 8, 1901.

In a wave or multiple-series winding are cross connections between the nodal points, the nodal points being separated from one another by approximately a double-pole pitch or a multiple thereof. A commutator has its segments connected to nodal points of the winding, the distance between the centers of two of the segments corresponding to the pitch of a nodal point.

783,503. Temperature - compensating Device for Thermo-electric Measuring Instruments. William H. Bristol, New York, N. Y. Application filed December 15, 1904.

Combined with a thermo-electric generator used as a pyrometer or thermometer and an indicating or recording instrument are means for compensating for changes of temperature at the so-called cold or outer ends of the generator.

783,509. Electric-lighting System. Albert G. Davis, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 4, 1899.

Combined with an illuminant which is non-conducting when cold and increases rapidly in conductivity when heated are means for heating it to conductance and an automatic source of constant-current supply for furnishing current to the illuminant, the automatic operation of which source enables the illuminant to operate with stability.

783,510. Telephone-exchange System. William M. Davis, Chicago, Ill., assignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed May 20, 1903.

A source of current at the exchange is permanently connected with both limbs of the line. A supervisory relay is connected in bridge with the cord [illegible] normally disconnected from the source [illegible] the cord circuit with the line [illegible] connected in bridge with the source and [illegible] the adjustment of the relay being such [illegible] is prevented by the continuity of the line [illegible] the substation apparatus.

783,513. Regulator. Richard Fleming, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 26, 1903.

In a device for regulating the voltage of an electrical circuit are a fixed coil and a movable coil, one of the coils being connected in shunt to the circuit, the other being connected in series with the circuit. [illegible] means vary the inductive relation between the coils by moving the movable coil toward or away from the fixed coil. (See cut.).

783,514. Regulator. Richard Fleming, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed April 25, 1904.

A pair of windings are movable with respect to each other. One of the windings has portions producing magnetizing forces acting in opposite directions, a circuit into which the other winding is connected, and means for bringing into proximity the other winding and one or the other of the portions to control the electrical conditions of the circuit.

783,526. Adjustable Support for Electric Lights or the Like. Charles D. Kemmerer, Weissport, Pa. Application filed October 25, 1902.

An attaching device for incandescent lamps has a rotatable supporting means and a projecting arm disposed in horizontal position and movable in a circular path about the attaching device.

NO. 783,481.—STARTER FOR MERCURY-VAPOR LAMPS.

NO. 783,513.—REGULATOR.

783,532. Transformer. Walter S. Moody, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 21, 1904.

In a fluid-cooled electrical transformer are a case therefor and a heater arranged in proximity to the case to dry the latter.

783,533. Transformer Protection. Walter S. Moody, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 25, 1904.

A transformer comprises a case, a core, a high-potential winding, a low-potential winding, an electrical connection between the low-potential winding and core and means for connecting the case and core to earth. (See cut.)

783,537. Motor Controller. William A. McTaggart, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 15, 1904.

The arc deflector in a motor controller comprises deflecting plates, each provided with a spacing boss, means for clamping the spacing bosses together, a backing uniting corresponding edges of the plate and a blow-out magnet adjacent the backing.

783,543. Electric Chain-welding Machine. Adolph F. Rietzel, Lynn, Mass., assignor to the Thomson Electric Welding Company, Lynn, Mass. Application filed October 15, 1903.

Mechanical features of a machine employing electrically developed heat for welding chain links are described.

783,546. Insulation for Edgewise-wound Coils. George H. Rupley, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 21, 1904.

A strip of insulating material is provided with a central lengthwise fold, and staggered transverse cuts extend from its edges toward the fold, the strip being interposed between the turns of the conductor with its cut portions displaced, thereby permitting the strip to conform to the helical formation of the conductor without buckling or tearing.

783,604. Art of Telegraphy. Marcus O. Anthony, Barberton, Ohio. Application filed May 10, 1902.

A single main conductor having undergrounded terminals is provided with a transmitting coil consisting of a single core and inner and outer layers or windings arranged in relatively opposite directions. The battery circuit includes a sending mechanism and the inner or primary winding of the coil, the outer or secondary of the coil having one terminal open and the opposite terminal connecting with the main conductor.

783,612. Electric Switch. Percy L. Clark, Bristol, Conn., assignor to A. L. Clark, Elgin, Ill. Application filed June 23, 1904.

An electric switch comprises a chamber containing an [illegible]

783,651. [illegible] Apparatus. [illegible] assignor to the Thomson Electric Welding Company, Lynn, Mass. Application filed [illegible] 4, 1903.

[illegible] currents. [illegible]

783,652. Electric Switch Contact. William C. Tregoning, Hartford, Conn., assignor to the Perkins Corporation, Hartford, Conn. Application filed May 24, 1904.

A post with an angular section at each end, a supporting plate located on the angular section at one end and a pair of plates with flanges and angular openings located on the other angular end of the post comprise the parts of the switch contact.

783,653. Electrical Plug Cut-out Cover. William C. Tregoning, Hartford, Conn., assignor to the Perkins Corporation, Hartford, Conn. Application filed June 13, 1904.

An electrical plug cut-out cover has a plug opening, a shutter movable beneath the opening and a [illegible] adapted to move the shutter from beneath the opening.

NO. 783,533.—TRANSFORMER PROTECTOR.

NO. 783,651.—METAL-WORKING TRANSFORMER.

783,666. Revolving Plate for Static Machines. Burton E. Baker, Hartford, Conn., assignor to himself, Foster E. Harvey and Robert H. Lewis, Hartford, Conn. Application filed December 31, 1904.

The plate is formed of alternate layers of fibrous material and shellac and united into a homogeneous mass.

783,687. Electric Railway. Alfredo Diatto, Turin, Italy. Application filed November 20, 1902.

Magnetic interrupters used in the distribution of current by road contacts are associated with a magnetic extinguisher consisting of an iron ring surrounding the apparatus, pieces connected to the ring and extending into the interior of the apparatus, a wire wound round the iron ring and electric connections to the ends of the wire.

783,696. Indicating Leaks in Electric Conductors. Isidor Kitsee, Philadelphia, Pa. Application filed June 5, 1902.

A tell-tale device consists of electrically actuated dials, a recording sheet on one of the dials, recording means in operative relation to the dials and electromagnetic means adapted to actuate the recording means. The electromagnetic means are operated through the closing of a circuit due to the leakage of the current.

783,708. Generating Low-frequency Currents. William Stanley, Great Barrington, Mass. Application filed November 11, 1903.

Means are supplied for exciting the field with alternating currents of the desired frequency and for revolving the armature. Other means impress upon the mains electromotive forces having the frequency of the exciting currents independent of the speed of rotation and producing thereby currents of the frequency of the exciting currents. (See cut on next page.)

783,712. Apparatus for Receiving Electromagnetic Waves or Other Feeble Alternating Signal Impulses. Frederick K. Vreeland, Montclair, N. J., assignor to the Wireless Telegraph Exploitation Company, New York, N. Y. Application filed November 12, 1904.

In a detector of electromagnetic waves or other feeble alternating impulses are two electrolytic cells having minute anodes with means for polarizing the cells. Other means pass the half-waves of impulses through the cells alternately and in the direction opposite to the polarizing currents, thereby wholly or partially depolarizing the cells. By observing the depolarization of one or both cells the waves may be detected.

783,715. Circuit Controller. Rollin A. Baldwin, New Haven, Conn., assignor to the Baldwin & Rowland Switch and Signal Company. Application filed September 29, 1904.

The controller is for trolley wires and comprises an insulating base with a passage for the trolley wire having an external longitudinal contact surface, arranged below the plane of the wire. Upwardly inclined ends extend beyond the line of the wire, the ends being cut away to allow the wire to pass.

783,730. Submarine Viewing Apparatus. Francis McMahon, Somerville, Mass. Application filed April 19, 1904.

An incandescent electric lamp is used in connection with the apparatus.

783,733. Electrical Measuring Instrument. Weston A. Price, Cleveland, Ohio, assignor to the Electric and Dental Specialty Company, Cleveland, Ohio. Application filed February 24, 1903.

An indicating pointer secured to the moving magnet is supplied with means for steadying it, means for moving it independently of the variations of the field of force and means for securing it against movement when the instrument is removed from a fixed support.

783,736. Electric Furnace. George O. Seward, Holcombs Rock, Va., assignor to the Willson Aluminum Company, New York, N. Y. Application filed May 3, 1904.

Combined with an electric furnace cover through which an electrode passes is a separate lid forming a complete ring around the electrode for holding it in position.

783,737. Electric Candelabrum. Charles E. Weeks, Providence, R. I., assignor to the Gorham Manufacturing Company, Providence, R. I. Application filed June 30, 1903.

The lamp is of fancy design and its socket is made to fit within an ornamental flaring part of the candelabrum, the wiring coming up from below.

783,741. Electric-lamp Adjuster. Henry D'Olier, Jr., Philadelphia, Pa. Application filed March 5, 1904.

The adjuster consists of a movable part attached to the lamp cord, a chain extending from it to the lamp, holding the latter in a horizontal position.

783,742. Balanced Cord-drop Attachment. Henry D'Olier, Jr., Philadelphia, Pa. Application filed March 8, 1904.

A gooseneck member on the lamp socket holds the lamp horizontal.

783,743. Electric-lamp Adjuster. Henry D'Olier, Jr., Philadelphia, Pa. Application filed April 2, 1904.

The adjuster consists of a frictional member sliding on the cord, with a fastening extending to the lamp and holding it horizontal.

783,744. Lamp-shade Attachment. Henry D'Olier, Jr., Philadelphia, Pa. Application filed May 10, 1904.

The shade for an electric incandescent lamp is described.

783,746. Electric Secondary Clock. Fred I. Getty, Chicago, Ill., assignor to the American Clock Company, Chicago, Ill. Application filed May 26, 1902.

Electromagnetic devices in the clock actuate the step-by-step mechanism of its movement.

783,751. Insulated Railway Rail Joint. Edward D. Lewis, Syosset, N. Y., assignor to the Continuous Rail Joint Company of America. Application filed June 1, 1904.

Connecting bars or billets of insulating material are rigidly wedged between the head and flange of the rail at opposite sides, the bars being extended laterally and downwardly beneath the flange of the rail.

783,802. Induction Coil. Harry Shoemaker, Jersey City, N. J., assignor to the International Telegraph Construction Company, New York, N. Y. Application filed September 1, 1904.

The transformer comprises a core and primary winding assembled as an independent member. The secondary consists of independently portable sections, each section consisting of a number of coils assembled in an envelope of insulating material.

783,809. Electric Elevator. Ernest H. Vogel, New York, N. Y. Application filed April 11, 1904.

The elevator motor is mounted directly upon the platform and drives, by means of suitable gearing, a horizontally rotating drum, which carries on its periphery screw threads which engage with rollers fastened at suitable intervals up the side of the elevator shaft. As the drum revolves the screw threads cause it to move up or down the shaft in accordance with the direction of the motion of the screw.

783,861. Telephone Switch. Albert W. Hammer, Willow, Ind. Application filed January 25, 1904.

One terminal of the telephone is connected with a common return and there is a point upon the switch with which the other terminal of the telephone is connected. A pair of contact points upon the switch are connected with the common return, another pair of contact points upon the switch are mutually connected and switch fingers are connected respectively with the continuous line wire and the sections of the sectional line wire at opposite sides of the subscriber's circuit. The switch fingers connected with line section are adapted to rest respectively upon any pair of alternate points, and the remaining finger is adapted to rest upon a ground point in conjunction with either of the other fingers or upon the point connected with the telephone when the other fingers are upon the mutually connected points.

783,876. System of Electric Lighting. John Lindall, Boston, Mass. Application filed October 17, 1904.

Incandescent lamps are arranged in series in the circuit and provided with thermostatic fuses which respond to external heat to open the lighting circuit.

783,911. Electric Push Switch. George B. Thomas, Bridgeport, Conn., assignor to the Perkins Electric Switch Manufacturing Company, Bridgeport, Conn. Application filed June 13, 1904.

Details are described.

783,923. Wireless Telegraphy by Electric Waves. André Blondel, Paris, France. Application filed December 3, 1900.

In a system of space telegraphy are a receiving circuit containing a self-restoring coherer, a battery and a number of electromagnetic devices, each selectively responsive to variations of current of a different frequency than the others.

783,965. Commutator. Hermann A. Knoener, East Orange, N. J., assignor to the Crocker-Wheeler Company, Ampere, N. J. Application filed July 25, 1904.

The commutator consists of a series of commutator bars, a central tube reversely threaded on its two ends, metal flanges screwed on the threaded ends of the tube and clamping the ends of the commutator bars and insulating material interposed between the flanges and the bars.

783,974. Electric Arc Lamp. Charles A. Nagel, Allegheny, Pa., assignor of two-sixths to William G. Anderson and one-sixth to Max E. Nagel, Allegheny, Pa. Application filed April 14, 1904.

A choke coil, an armature actuated by the choke coil and connected thereto at one end, a spring on the free end of the armature adapted to make contact with the choke coil when the armature is raised, a carbon clutch and means connecting the clutch and the armature are the essential features of the lamp.

783,977. Electric Switch. William H. Powell, East Orange, N. J., assignor to the Crocker-Wheeler Company, Ampere, N. J. Application filed November 28, 1903.

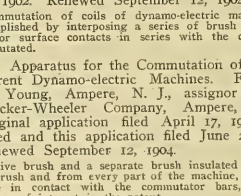
Switch arms of unequal length project in a plane perpendicular to the revoluble shaft carrying the arms. As the shaft is turned the switch-arm contacts complete various circuits.

783,978. Electric Switch. William H. Powell, East Orange, N. J., assignor to the Crocker-Wheeler Company, Ampere, N. J. Application filed November 30, 1903.

A cylindrical core of insulating material carries a reversing contact ring section formed in two branches, one of which is forked, each branch being provided with parallel rows of contacts. The forked branch has a row on each fork. A second reversing contact ring section is formed in two branches offset with respect to each other, each branch being provided with parallel rows of contacts, and one branch being fitted between the forks of the forked contact ring section.

783,979. Rheostat. William H. Powell, East Orange, N. J., assignor to the Crocker-Wheeler Company, Ampere, N. J. Application filed October 24, 1904.

A resistance element consists of a spirally coiled conducting ribbon, a movable contact member adapted to be moved above and parallel to the flat face of the spiral coil and contact blocks disposed in the path of the movable contact member and contacting with different convolutions of the ribbon.



NO. 783,708.—LOW-FREQUENCY GENERATOR.

783,980 and 783,981. Electric Switch. William H. Powell, East Orange, N. J., assignor to the Crocker-Wheeler Company, Ampere, N. J. Application filed October 24, 1904.

These two patents embody switch mechanism consisting of a rotatable cylinder, upon which the switch contacts are carried and adapted to engage contact pieces placed in their path.

783,988. Commutation of Direct-current Dynamo-electric Machines. Frederick W. Young, Ampere, N. J., assignor to the Crocker-Wheeler Company, Ampere, N. J. Application filed April 17, 1902. Renewed September 12, 1904.

Commutation of coils of dynamo-electric machines is accomplished by interposing a series of brush and commutator surface contacts in series with the coil being commutated.

783,989. Apparatus for the Commutation of Direct-current Dynamo-electric Machines. Frederick W. Young, Ampere, N. J., assignor to the Crocker-Wheeler Company, Ampere, N. J. Original application filed April 17, 1902. Divided and this application filed June 26, 1902. Renewed September 12, 1904.

A live brush and a separate brush insulated from the live brush and from every part of the machine, excepting where in contact with the commutator bars, are the features of interest in the patent.

783,992. Wireless Telegraphy by Electric Waves. André Blondel, Paris, France. Original application filed December 3, 1900. Divided and this application filed July 7, 1903.

A space-telegraph receiving station comprises a mast wire, circuits receiving electrical impulses from the mast wire, each electrically tuned to a different one of the frequencies of the generating stations, and a receiving apparatus for each of these circuits.

783,995. Test Plug for Protective Apparatus. Frank B. Cook, Chicago, Ill. Original application filed December 4, 1903. Divided and this application filed April 11, 1904.

A test plug for protective apparatus consists of a pair of contact members insulated from each other and suitably mounted and a pair of protectors suitably mounted, the contact members co-operating with like parts of the pair of protectors for the purpose of testing.

783,996. Burglar or Fire-alarm System. John W. Culp, Elkhart, Ind., assignor to the Modern Burglar and Fire Alarm Company, Elkhart, Ind. Application filed June 25, 1904.

An outer case and its tubular extension form a part of a protection circuit normally closed on an electromagnet, and includes an inner case. Its inner tubular extension, insulated from the outer case, contains an alarm device having an electromagnet in a normally open circuit, the armature of the electric magnet in the normally closed circuit moving to close the normally open circuit upon the de-energization of its magnet.

783,997. Electric Switch. Edwin R. Douglas, East Orange, N. J., assignor to the Crocker-Wheeler Company, Ampere, N. J. Application filed November 30, 1903.

A cylindrical core of insulating material, contact rings consisting of sections, a circumferential tongue between each contact-ring section and the core, and means for securing each of the sections to the surface of the core are the main features.

783,999. Apparatus for the Commutation of Direct-current Dynamo-electric Machines. Gano S. Dunn, Ampere, N. J., assignor to the Crocker-Wheeler Company, Ampere, N. J. Original application filed May 7, 1902. Divided and this application filed June 26, 1902. Renewed September 12, 1904.

The commutator brush is made up of a live brush and a number of dead brushes at one side of the live brush and operating in conjunction therewith.

784,000. Commutation of Direct-current Dynamo-electric Machines. Gano S. Dunn, Ampere, N. J., assignor to the Crocker-Wheeler Company, Ampere, N. J. Application filed May 7, 1902. Renewed September 12, 1904.

The method of commutation consists in increasing step by step the number of brush commutator contacts between the line and the advancing terminal of a coil which is being commutated as the coil approaches the position of a receding coil. This finally forms a path of current, with maximum resistance, which leaves and returns a multiplicity of times into the commutator surface.

784,001. Electric Switch-operating Mechanism. Frederick H. Gray, Leavenworth, Kan. Application filed March 12, 1904.

In the mechanism described a longitudinal bar is adapted to be depressed by a car passing in either direction, a horizontal lever is operatively connected at one end to the longitudinal bar and a short vertical lever is operatively connected to the opposite end of the longitudinal lever. An electric switch is connected with the lever.

784,006. Turn Button for Electric Switches. Ellsworth A. La Har, New Britain, Conn., assignor to the Perkins Corporation, Hartford, Conn. Application filed May 24, 1904.

Mechanical features are set forth.

784,009. Governing Continuous-current Motors. Gaston Sautter, Paris, France. Original application filed November 11, 1902. Divided and this application filed August 23, 1904.

Continuous-current motors are governed by a starting rheostat and a braking rheostat, each arranged in sections. Coils of main electromagnetic switches control each section of both rheostats, and auxiliary means bring successively into operation the switches to cut out the sections of the starting rheostat as the counter electromotive force of the motor increases, and to cut out the sections of the braking rheostat when the main circuit from a generator to the motor has been broken.

784,013. Method of Generating Low-frequency Currents. William Stanley, Great Barrington, Mass. Original application filed November 11, 1903. Divided and this application filed July 7, 1904.

Low-frequency alternating currents are obtained by setting up an alternating field by currents of the desired low frequency, inducing by aid of mechanical motion currents of different frequency and commutating the frequency of the currents to that of the exciting currents.

784,016. System of Electrical Distribution. Percy H. Thomas, Pittsburg, Pa., assignor to the Cooper Hewitt Electric Company, New York, N. Y. Original application filed February 7, 1903. Divided and this application filed May 6, 1903.

A supply circuit and a receiving circuit are supplied with means for automatically transmitting to the receiving circuit periodic electric impulses of varying magnitude. One or more current rectifiers are interposed at a point or points in the system, the rectifiers being characterized by a reluctance to starting. Means are provided for selecting the portions of the several periods during which portions electrical energy shall be delivered to the receiving circuit.

## EXPIRING PATENTS.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on March 6, 1905:

378,864. Apparatus for the Propulsion of Cars by Electrical Energy. A. H. Bauer, Boston, Mass.
378,876. Electric Ship Signal. J. W. Dooley, Wyoming, Ill.
378,892. Magneto Electric Machine. O. P. Loomis, Somerville, Mass.
378,913. Supporting Crane for Electric Lamps. L. J. Wing, Lexington, Mass.
378,927. Police, Fire and District Telegraph. E. T. Gibson, Minneapolis, Minn.
378,943. Carbon Battery. G. E. Terrell, Ansonia, Conn.
378,980. Electric Railway Car Brake. W. M. Schlessinger, Philadelphia, Pa.
378,983. Fire-alarm Signal Box. A. A. Smith, Newton, Mass.
378,990. Fire Alarm. J. West, St. Louis, Mo.
379,016. Electric Telegraph. D. Kunhardt, Aachen, Prussia, Germany.
379,037. Dynamo Electric Machine. O. Urban and M. J. Wightman, Hartford, Conn.
379,060. Telegraph Instrument. E. M. Hamilton, New York, N. Y.
379,061. Telegraph Sounder. E. M. Hamilton, New York, N. Y.
379,062. Pole Changer. E. M. Hamilton, New York, N. Y.
379,063. Telegraph Key. E. M. Hamilton, New York, N. Y.
379,064. Telegraph Sounder. E. M. Hamilton, New York, N. Y.
379,069, 379,070. Electric Railway. W. W. Hopkins, St. Louis, Mo.
379,073. Continuous and Alternating Transformer. F. Jehl, Paris, France.
379,074. Electrical Contact Maker and Breaker. C. Lambdin, Barranquilla, U. S. of Colombia.
379,081. Spring Jack for Electric Railways. S. H. Short, Denver, Colo.
379,082. Slot Switch for Electrical and Cable Railways. S. H. Short, Denver, Colo.
379,144. Burglar Alarm. C. H. Wright, Chicago, Ill.
379,203. Telegraphic Repeater. J. Kolzer, Duisburg, Prussia, Germany.

# WESTERN ELECTRICIAN

**EVERY SATURDAY**

Vol. XXXVI. CHICAGO, MARCH 18, 1905.

## Power Plant of the First National Bank Building, Chicago.

The First National Bank Building, one of Chicago's largest office structures, for the construction work of which the finishing touches are now being given, possesses an isolated light and power plant and other equipment comparable with the best modern practice. A short article was printed in the Western Electrician of July 30, 1904, descriptive of the temporary power plant of this building, but to continue a minute. The engine-room, [illegible] ning, the exhaust steam finding ready application for heating the building during the cooler months. The Michigan system of heating and ventilating is employed, the air being filtered in three different ways.

A switchboard of unusually attractive appearance has been installed, as shown in the next page. It, together with the switches, it was furnished by the Crouse-Hinds Company. The board is of slate and is finished and trimmed with copper. It contains 12 panels in all. The [illegible] and

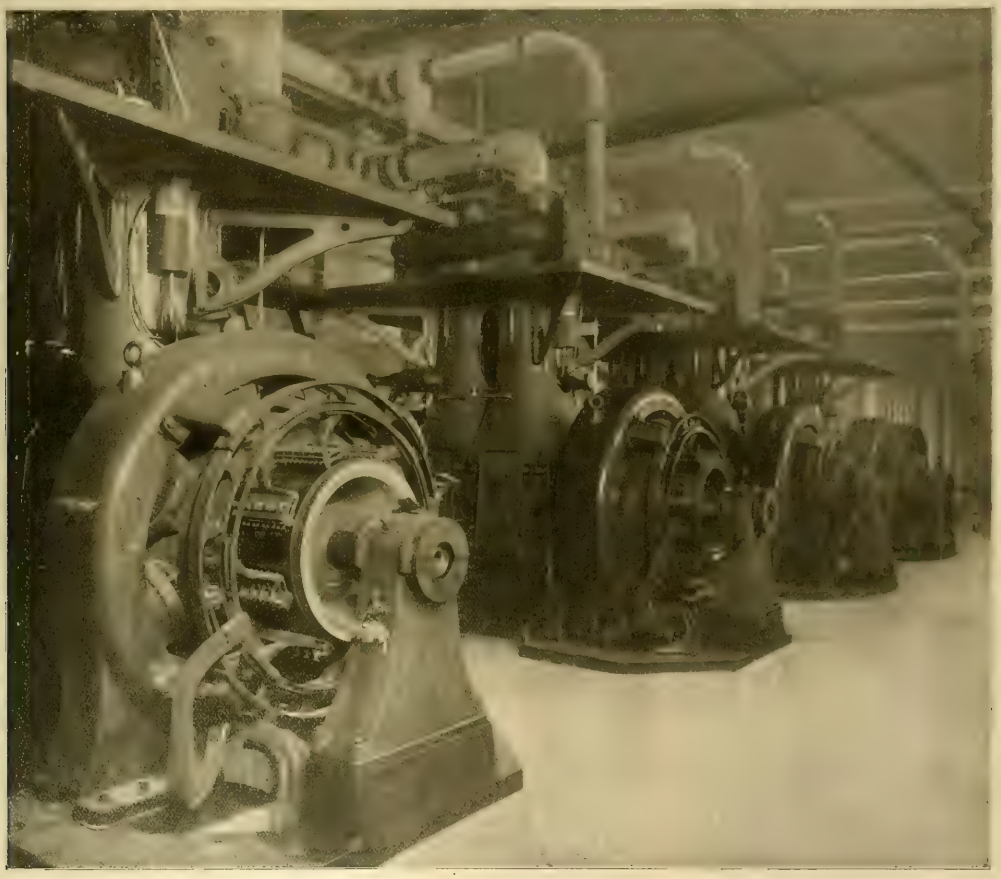


FIG. 1. POWER PLANT OF THE FIRST NATIONAL BANK BUILDING, CHICAGO.—VIEW SHOWING THE FOUR ENGINE-GENERATORS.

now that the edifice is completed and the permanent plant in place and practically finished, a description of the installation will be found of interest.

Located at the corner of Monroe and Dearborn Streets, the building itself is of imposing appearance, rising to a height of 17 stories above the street level. It has a frontage of 191 feet on Dearborn Street and 231 feet on Monroe Street and is finished on these two sides with a facing of granite blocks. The bank occupies the entire second floor besides space on several other floors, the remainder to be given up to offices, with stores on the first floor. The power plant is located in the basement.

Electric current is used for lighting and for power and it is developed by four direct-current generators, which, together with the motors used about the place, are of the Crocker-Wheeler make. The four generator units are shown in Fig. 1. The generators are of 150-kilowatt capacity each, generating current at 125 volts. They are direct-connected to Ball vertical cross-compound engines running at 225

in Fig. 2 are the generator panels and are equipped with Weston ammeters, a Weston voltmeter being mounted on a bracket on the end panel. Next to the generator panel is a panel containing two Thomson recording wattmeters and one Bristol recording voltmeter. The remaining panels are for the various feeders, motor circuits, etc. Back of the board, as can be seen, are auxiliary panels for testing out circuits, for the fuses and for the meters.

The circuits are all divided in shunt on the board, so that any of the circuits can be tested by test meters without interrupting the service. These tests are made to ascertain the cost of various operations, such as the pumping of water, the running of the ice machines, etc., and are useful to the operating engineer to enable him to run the plant in the most economical manner.

Five Stirling boilers supply steam for the plant. They are of 350-horsepower capacity each, and are equipped with Jones underfeed stokers. The coal bunkers are immediately in front of the boilers and

The arrangement of the steam piping is convenient and flexible. A divided boiler header in the boiler room connects with a 12-inch divided header in the engine room. This header is in the form of a loop passing down nearly the full length of the room and back again. The feeders for the pumping engines of the hydraulic-elevator service are cross-connected between the two branches of this loop, taking steam from either side. The feeders to the main engines are connected to one side of the loop only, but are separated by valves, so that if any trouble originates in this branch the valve nearest the seat of the trouble may be closed and steam sent around the loop from the other side, and thus the engines need not be put out of service. An auxiliary header supplies steam for the auxiliary apparatus.

There are four boiler-feed pumps, steam-driven, and two feed-water heaters. The exhaust from the engines passes into an expansion tank, from which it passes into the heating system of the building during the cold months. The water returning from

the heating system is led into the feed-water heater and heated by exhaust steam, to be again returned to the boilers.

Twenty-two elevators will be required to supply the needs of the tenants of the building. Twenty-one of these are hydraulic and one electric. The hydraulic elevators, supplied by the Otis Elevator Company, are on the high-pressure system, operating under a pressure of nearly 900 pounds to the square inch. There are seven pumps in all, furnishing the hydraulic pressure for the system. Two are of the flywheel type and two are compound-duplex pumps. The remaining three are a compound-duplex auxiliary, a duplex auxiliary and one safe-lift pump. The latter is for use in connection with any of the elevators for lifting heavy weights. An accumulator is used in connection with the hydraulic system, which consists of an 85-ton moving weight, which serves to keep the pressure constant in the system and relieve the elevators from any impulse which might be felt from the pumps. As the pressure in the system rises, it does work upon the weight, raising it, and storing up energy in the potential form. When the pressure begins to fall the potential energy of the weight is transformed into kinetic energy, doing work upon the system and reducing the fluctuations.

There are 25 electric motors used for various purposes about the building. These motors aggregate nearly 400 horsepower. Nine of these are for the ventilating system, two for the pneumatic service used by the bank for communication between various departments, one for the ammonia compressor, four for the ice-machine pumps, three for the house pumps, two for the air compressors, one for forced draft, one for the machine shop, one for the electric elevator, which goes up one floor only, and one for an agitator in the filter tank in which the drinking water for the occupants of the building is purified. Besides this motor load, the building is wired for 15,000 16-candlepower incandescent lamps.

For supplying compressed air for the injectors and also for the thermostatic heat-controlling system, there are two motor-driven air compressors, the motors being 7½ horsepower each. These are controlled automatically. The controlling apparatus for the motors is mounted on a board near the machines. As the air pressure in the system rises it actuates a device similar to the ordinary steam pressure gauge, a contact arm taking the place of the usual indicator. At a predetermined pressure the arm makes contact to close the circuit to a solenoid, which in turn controls the motor circuit, cutting the motor out. The pressure then falls and the arm travels back until it closes another circuit, which operates to throw the motor into circuit. In this manner the motors act independently to keep the pressure between certain defined limits.

Figs. 3 and 4 are some interesting curves of operation of the plant which give a fair idea of the variation of the load during the day and also for the month of January, 1905. Though the requirements upon the plant are at present not as great as they will be later when the building is fully occupied, still the curves show the character of the variations clearly. The solid and the broken lines in Fig. 3 show, respectively, the current curves for March 8 and March 9, 1905. Fig. 4 is a load curve for January, 1905. The Sunday load, as indicated by this curve, approximates 1,000 kilowatt-hours, less than half the ordinary weekday load.

D. H. Burnham & Co. were the architects for the building, while the operating engineer of the plant is Mr. W. L. Jackson.

FIG 2. POWER PLANT OF THE FIRST NATIONAL BANK BUILDING, CHICAGO.—VIEW OF SWITCHBOARD.

## Electrification of British Railroads.

A writer in the London Times, concluding an article on the possible application of electricity to railroads now using steam locomotives, says: "Railways, whether in America or England, dealing with this question of electrification, are dealing with a broad proposition, the ramifications of which are not always grasped at first, and which requires considerable experience and wisdom, and a careful analysis of all conditions before it is undertaken. There is every reason to believe, if the progress of the last few years is any criterion of the future, that the electrical engineer will in due time solve all these questions. It may, moreover, be true, as Mr. [W. B.] Potter [of Schenectady] contends, that 'there are few steam railways which would not find the partial electrification of their lines, in some cases the entire electrification, a profitable undertaking.' But even then will come the fact that it is 'essentially a financial problem' of altogether too great a magnitude to be undertaken without serious reflection. That British railway managers are giving very critical attention to the developments of electric traction may be gathered by a perusal of the last half-yearly reports of the chairmen of the principal railways to their shareholders, nearly all of which contain references to the subject. It is equally true, after even a cursory survey of the work of electrification of steam railways in progress throughout the world, that Great Britain is by no means behind other countries in actual installations or in experimental work looking to the substitution of electricity for steam."

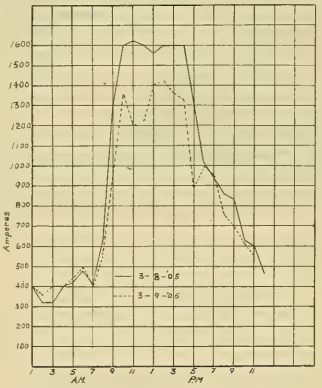



Fig. 3. Current Curves for Two Days in March.

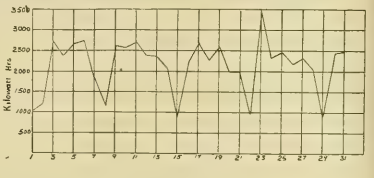



Fig. 4. Kilowatt-hour Curve for January

POWER PLANT OF THE FIRST NATIONAL BANK BUILDING, CHICAGO.

## Indiana Electric Railway Association.

The regular meeting of the Indiana Electric Railway Association was held at Lebanon on March 9th. The meeting was called to order by Vice-president J. W. Chipman, secretary and general manager of the Indianapolis and Eastern Traction Company.

The principal question for discussion was "Interchangeable Mileage of Interurbans of Indiana and Ohio." M. R. McKown, chairman of the committee appointed to investigate the possibilities of interchangeable mileage between Indiana and Ohio electric lines, made an extensive report, but prefaced it with the statement that the committee was not satisfied that it had arrived at the right conclusion From the report, it appears that the chief difficulty the committee encountered was in reaching a satisfactory basis for reduction, due to the difference between the rates on the lines in the two states. It was brought out that the Ohio lines average a fare of about two cents a mile and the Indiana lines about 1½ cents. It was stated that the Ohio lines will not consent to a reduction of their rate for coupon mileage books of less than 16⅔ per cent., which the committee had figured out would make their rate even then about 1¾ cents a mile. A reduction of 16⅔ per cent. for the Indiana lines would mean, according to the report, a fare of less than 1¼ cents, and this, the Indiana men insist, is lower than they can give without jeopardizing their interests. The committee submitted a supplemental contract which demonstrated the binding obligations incumbent upon the companies that became a party to the arrangements.

In the discussion Will G. Irwin, general manager of the Indianapolis, Columbus and Southern line, said that as the roads advance toward the methods of steam lines and make faster time the expense of operation becomes more and the companies should get more for carrying passengers per mile than they did in the beginning. Mr. Irwin criticized the practice of some roads in the cutting of rates for passengers and freight and the giving of special rates on special days. He said a standardization of rates for special cars, for freight and passengers, would be conducive to a better feeling among interurban managers. Mr. Irwin said he believed the five-cent coupon suggested by the committee's report was along the line of the proper solution of the question. He said Indiana interurban men felt that they can afford to give a reduction in fares of about 10 per cent., selling a book of 200 five-cent coupons at $9, but he was in doubt about such a reduction being agreeable to Ohio roads.

Chairman Chipman said the question was one of such great importance that no hasty action should be taken. He then called on E. C. Spring of Cincinnati, who suggested the getting of the traffic rate of every road in the two states, in order to form a basis, and then have a joint meeting of the two state committees. He said the interurban roads were coming to the conclusion that it is advisable to standardize their roads from the rails to the trolley, and the same in the matter of freight and passenger traffic. Charles Lohman of the Indiana Railway Company, South Bend, was added to the committee, which was instructed to pursue the investigation and bring in a report at a subsequent meeting, which will more nearly meet the approval of all the members of the committee.

Traffic arrangements with steam roads and the transportation of baggage were briefly discussed, and the question of a joint agency at Indianapolis was delegated to a committee composed of Messrs. Reynolds, Irwin, Brady and McGowan. After the meeting adjourned the members and visitors were taken to the Ritchie House, where they partook of an excellent dinner as the guests of the Northwestern Traction Company.

## Power House and Car Equipment of the Indianapolis and Cincinnati Single-phase Railway.

A general description was given in the Western Electrician of February 18th of the new single-phase railway owned by the Indianapolis and Cincinnati Traction Company. A more detailed description is here given of the power house and the car equipment of the system.

### Power House and Equipment.

The station building, at Rushville, Ind., is 113' by 120 feet and is of very heavy and substantial construction. The foundations are of concrete and the upper walls are of brick laid with cement mortar. The floors and other framework and roof structure are of steel. Floors are of concrete and a gravel asphalt roof is laid upon a concrete base with expanded metal, leaving nothing about the building that can burn except the doors and windows. The building is designed and constructed with a view to the installation of coal-crushing and automatic coal-handling machinery, with overhead bunkers feeding direct to the boiler grates. As natural gas is being used as fuel at the present time, the coal bunkers and carriers have not yet been put in, but everything is prepared for their installation, even to the punching of holes in the steel structure from which the coal bunkers will be suspended. Figs. 1 and 2 are a plan and section of the station, respectively, while Fig. 3 is a view of the exterior.

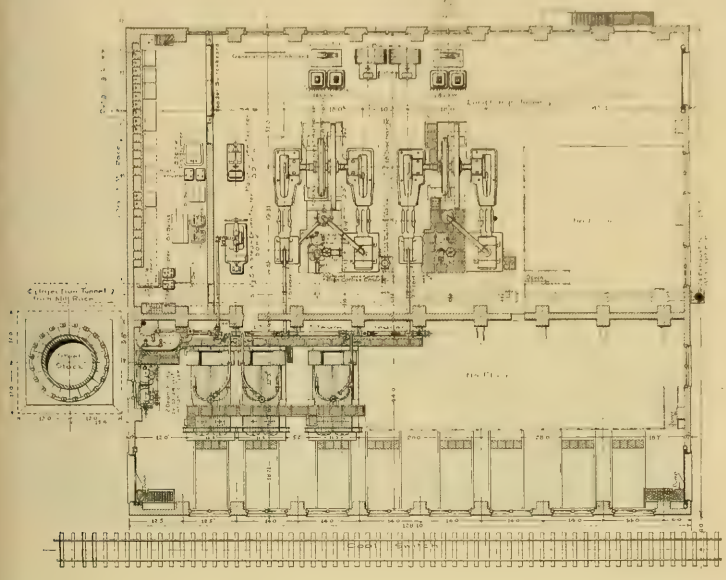


FIG. 1. PLAN OF RUSHVILLE POWER HOUSE OF INDIANAPOLIS AND CINCINNATI TRACTION COMPANY.

A concrete tunnel three feet six inches in diameter, running under the basement floor, conveys the water from a mill-race running along the east side of the station to the condensers, and a similarly constructed tunnel is provided to carry the water back again to the mill-race, connecting at a point some 300 feet below the intake. The supply tunnel is provided with an intake crib, which is equipped with an iron grill and removable screens.

At the east end of the power station, erected upon a heavy concrete base, is a self-supporting steel stack 180 feet high, lined its entire length with firebrick. The inside measurement of the stack is 11 feet. It is of sufficient size to take care of eight 350-horsepower boilers, space for which is provided in the present building. The present equipment, as stated in the previous article, includes three Babcock & Wilcox water-tube boilers of 350-horsepower nominal capacity each. Each boiler contains in the setting a Babcock & Wilcox superheater proportioned for about 100 degrees of superheat. The boiler room is equipped with a large open exhaust feed-water heater of the Stillwell-Bierce make, and with two vertical Atlantic type feed pumps.

The engine room is provided with a traveling crane, built by the Northern Engineering Works of Milwaukee, of sufficient capacity to handle all the machinery, and which greatly simplifies the work of installation. The present generating equipment includes two 500 horsepower Corliss type, tandem cross-compound, condensing engines. Each engine is equipped with an independent steam driven condenser. The condensers are set in the basement, but are arranged for operation from the main floor level.

Each engine is direct-connected to a 500-kilowatt, 2,300-volt, three-phase, 3,000-alternation, Westinghouse revolving-field, alternating-current generator running at a speed of 94 revolutions a minute. The engines are operated at a steam pressure of 140 pounds a square inch, and are guaranteed to deliver the maximum capacity necessary to drive the generators.

The generators are of standard Westinghouse construction. The frames of the stationary armatures are of cast iron and surround inner cores of laminated steel, which are built up with overlapping joints so as to form a circular ring, slotted with a temperature rise not exceeding 55° C. The generators have a close inherent regulation, but arrangement has been made to further control the voltage by means of Tirril regulators mounted on the switchboard. The present engine room provides sufficient space for the installation of two additional generating units.

Two exciter sets have been installed, one of which is driven by a Westinghouse compound steam engine, the other by an induction motor which, in turn, is driven from the main generators through transformers.

The generators are connected directly to two pairs of 250-kilowatt air-blast transformers, which are connected according to the Scott three-phase two-phase system, to transform the current from 2,300 volts, three-phase, to 33,000 volts, two-phase, at which higher potential it is delivered to the transformer stations along the line of the railway and to the lowering transformers in the power house which supply the portions of the trolley located in and near the city of Rushville. Air to cool these step-up transformers is furnished by a pair of 150-inch Sturtevant fans driven by induction motors.

The air-blast transformers are connected in pairs and each pair is connected in turn with its own generating unit. The high-tension coils of the transformers are divided so that they may be connected for either 16,500 volts, while the low-tension winding is designed for 2,300 volts, the potential of the generators. The insulation between the high-tension coils and core was submitted to a test of 66,000 volts alternating current for one minute, and for the same length of time a potential of 4,600 volts was applied between the low-tension coils and core. Between the high-tension coils of the step-up transformers and the main bus bars 33,000-volt, oil-insulated, electrically operated, two-phase non-automatic switches have been installed. On each outgoing feeder leading to the transformer stations a double-pole automatic switch of similar type has been inserted, and each outgoing feeder is also protected by disconnecting switches.

The generators are connected in parallel. The operating panels of the switchboard are located in the main engine room, forming two switchboards of blue Vermont marble. The first board is composed of five panels and provided with apparatus for the control of the two exciter sets, the motors which drive the ventilating fans for the step-up transformers, and the ammeters, voltmeters, wattmeters, Tirril regulators, synchroscopes and switch-control mechanism for the two 500-kilowatt main generators. As has been stated, all the switches are electrically operated, current for this purpose being supplied by the exciter set. As, however, the generators are governed by Tirril regulators, it has been thought wise to install a specially designed booster set in the switch-operating circuit in order that the electromotive force of the exciters may not be so reduced by the action of the Tirril regulators that the switch mechanism may fail to act. In this way all possibility of failure has been overcome.

The second switchboard is composed of 12 blue Vermont marble panels, designed to control the

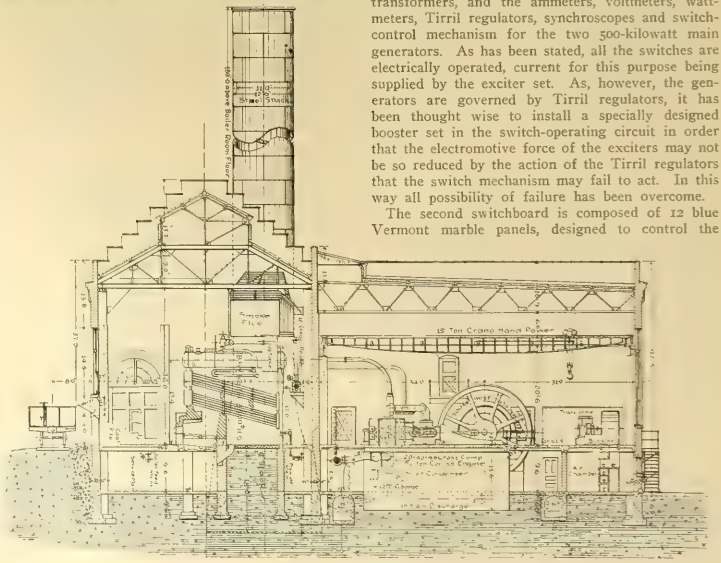



FIG. 2. SECTION OF RUSHVILLE POWER HOUSE OF INDIANAPOLIS AND CINCINNATI TRACTION COMPANY.

FIG. 3. RUSHVILLE POWER HOUSE OF INDIANAPOLIS AND CINCINNATI SINGLE-PHASE RAILWAY.

outgoing feeder circuits. Five of these panels are now blank, but will be equipped with the necessary apparatus when the operations of the road are more extended. The main bus bars occupy a portion of the basement. They are mounted upon heavy insulators which are supported upon a masonry structure which is heavy and substantial. Provision has been made so that the air from the transformer fans is carried through the bus-bar chamber. The bus bars are arranged in a double set, each of which is protected by a disconnecting switch.

The east end of the building constitutes what is called the high-tension chamber and is divided into four floors. The basement contains the bus bars, which are mounted similarly to those leading from the generators, together with the instrument transformers. On the main floor are installed the oil-insulated, electrically operated, high-potential switches, which are controlled from the panels in the engine room, the lowering transformers from which the 550-volt alternating-current trolley line in the city of Rushville is operated, the lowering transformers—33,000 volts to 3,300 volts—which feed the sections of the trolley immediately next to Rushville on either side, the lowering transformers for the operation of the motors which drive one exciter and the ventilating fans in the engine room and the static interrupters for the protection of the lowering transformers.

On the third floor have been installed the static interrupters which are connected to the main outgoing feeder lines, while the low-equivalent lightning arresters are mounted upon the fourth floor of the high-tension chamber.

## Car Equipment.

The present car equipment consists of 10 passenger cars constructed by the St. Louis Car Company. These cars measure 55 feet over all and are each divided into three compartments, the first of which is nine feet 10 inches long and is arranged for the accommodation of baggage and is provided with doors opening on either side. In front of this baggage compartment and separated from it by a strong railing is the space allotted for the motorman. The middle compartment has a seating capacity for 16 people and is fitted up as a smoker. The main compartment occupies the other end of the car and contains seating capacity for 38 people. Fig. 4 is a picture of a complete car, showing apparatus mounted underneath.

All the seats have reversible backs and are upholstered and covered with plush. Under normal conditions the cars will operate always in the same direction, though the equipment is such that they may be controlled from either end. At the rear of the car a vestibule is provided with space for ingress and egress of passengers.

These cars are finely finished in mahogany. The windows are of plate glass with art glass in the upper part and also in the ventilators. The toilet room is placed in the rear at the left side so as not to obstruct the view of passengers entering the car at the right side. The cars are heated with the Smith hot-water heaters, placed in the front compartment and under direct charge of the motorman, with pipe running through all the car. The framework is especially substantial, the floor and lower part being made of steel, with steel ribs running from the top. The roof is covered with sheet copper. The trucks are of the M. C. B. type, with steel-tired wheels 36 inches in diameter, with six-inch axles and five by nine inch journals, made by the Baldwin Locomotive Works. One of the trucks with motors mounted is shown in Fig. 5. The arrangement includes operation at 550 volts direct current within the city limits of Indianapolis and 550 volts alternating current in Rushville, and 3,300-volt alternating current on the other sections of the line.

The car equipment includes four alternating-current, commutator-type, series-wound railway motors, rated at 75 horsepower each; one main auto-transformer-wound for a primary potential of 550, 1,650 and 3,300 volts, and for a secondary potential of approximately 250 volts, reversing switch, motor cut-out switch, commutator or change-over switch to throw the equipment from alternating current to direct current and vice versa, a complete unit-switch system of multiple control with two operating controllers arranged for the operation of the cars either singly or in trains, rheostats or current diverters for use on either alternating or direct-current circuits, air compressors direct connected to both an alternating-current and direct-current series-wound motor, air reservoirs, two sets of storage batteries consisting of seven cells each, complete Westinghouse air-brake equipment with control valve on either platform, complete hand-brake equipment with controlling lever on one platform, one wheel trolley for low-potential service, and one bow-type trolley for high-potential service.

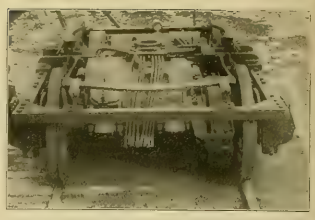


FIG. 5. TRUCK WITH MOTORS USED ON INDIANAPOLIS AND CINCINNATI SINGLE-PHASE RAILWAY.

The diagram, as shown in Fig. 6, illustrates the connections of apparatus forming the car equipment. It will be noted that the motors, which are wound for 250 volts, are connected four in series for direct-current service and four in parallel for alternating-current service. The motors are geared for a maximum speed of 45 miles an hour for local service.

The frames of the motors are made of cast steel surrounding a circular core built up of laminated punchings, which form four inwardly projecting poles. In addition to the main-series coils, which are mounted direct upon the poles, auxiliary coils are provided which are threaded through partially closed slots in the pole faces. The circular casting is made in one piece and is closed by circular end pieces, which form supports for the armature bearings. The bearings are mounted in separate housings, a construction similar to that adopted as standard in the latest practice of the Westinghouse Company in the construction of direct-current railway motors. Lubrication is by oil and waste. The axle bearings are supported by heavy lugs, which project from the motor frame. The armature is of the slotted drum type, with machine-formed coils imbedded in open slots and held in place by retaining wedges.

FIG. 4. CAR OF THE INDIANAPOLIS AND CINCINNATI SINGLE-PHASE RAILWAY.

The unit-switch system of multiple control as adopted is modified to suit the double operation by alternating and direct current. The unit switches are arranged in groups—one of eight and one of four units—which are mounted under the floor of the car. They are operated by compressed air, which, in turn, is controlled by magnet valves actuated by current from the storage batteries. The operating controllers are mounted one upon each platform.

The reverser is of the reciprocating type. The main auto-transformer is of the shell form, air-cooled type. Before shipment it was subjected to a test of 10,000 volts between winding and iron and was operated at double potential for 10 minutes. It is designed for operation at 25 cycles, a frequency which has been adopted as standard for single-phase railway service.

A peculiar form of bow trolley designed for high-potential alternating-current circuits is used. The trolley is mounted upon a thoroughly insulated platform and is raised, lowered and controlled by the motorman by means of compressed air. There is therefore no danger at any time of contact with live parts of the trolley. The bow carries a large, flat aluminum shoe, which makes contact with the under side of the trolley wire. For low-potential service, whether alternating or direct-current, a modification of the Union standard trolley is provided, as the bow type could not be used in the city of Indianapolis.

A novel feature of the equipment of these cars was installed at the suggestion of Mr. A. A. Anderson, general superintendent of the road. It consists of a speaking tube connecting the motorman's position with the rear platform so that the conductor

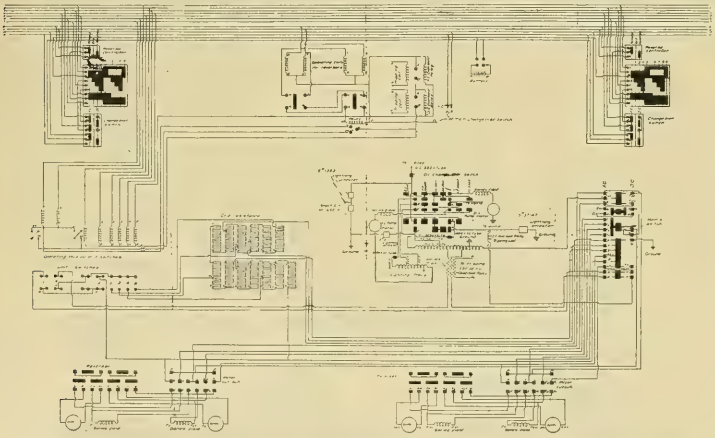


FIG. 6. CONNECTIONS OF CAR-EQUIPMENT APPARATUS FOR INDIANAPOLIS AND CINCINNATI SINGLE-PHASE RAILWAY.

and motorman may talk with each other at any time.

The entire electrical equipment of these cars was furnished by the Westinghouse Electric and Manufacturing Company and installed under the supervision of Sargent & Landy of Chicago, the consulting engineers, who also designed the power house.

## Fessenden's Selective Space-telegraph Apparatus.

Selective sending and receiving of space telegraph messages is a problem which still engrosses the attention of inventors, and is one which, when solved, will be a most significant advance in the progress of the art. In systems now in use difficulty experienced

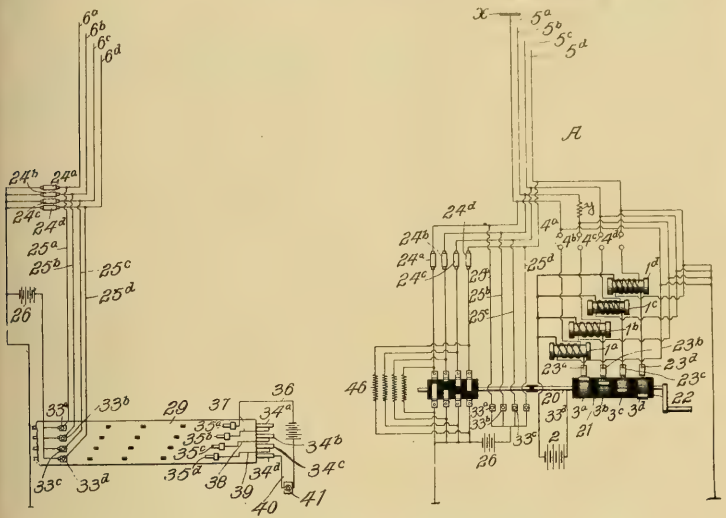


FIG. 1. FESSENDEN'S SELECTIVE SPACE-TELEGRAPH SYSTEM.—DIAGRAM OF CONNECTIONS.

in the selection of messages arises naturally from the fact that when magnetic waves are generated from one point they move equally in all directions and will be received at all stations reached by the waves. The object of an invention for which a patent was recently awarded to Reginald A. Fessenden of Allegheny, Pa., is to provide for the generation at the sending station, in varying order, of two or more series of magnetic waves or electrical impulses, the waves or impulses of each of the series differing from those of the other series, the selective reception and transformation or utilization of each of the differing series, and finally the recording at each receiving station of only such series of waves or impulses as are sent in a particular order. The selective reception of the differing series is obviously necessary and is secured by tuning or harmonizing various parts of the receiving system to the characteristic period of the particular series of energy fluctuations whereby they are designed to be actuated.

In the practice of the invention a series of two or more vertical generating wires or generating surfaces ($5^a$) ($5^b$), etc. (Fig. 1), is connected at the sending station (A) to a series of two or more terminals ($4^a$) ($4^b$) of a series of two or more induction coils. The secondary coils are connected, as usual, to both discharge terminals or knobs of the inductions and also to ground. The primary coils of the inductions are each included in circuits of a generator or series of generators (2), and in each such circuit is included a circuit make-and-break mechanism. A convenient form of make-and-break mechanism consists of metal disks ($3^a$) ($3^b$) dependent upon the number of generating or sending wires employed, mounted upon a shaft, but preferably insulated from each other by disks of insulating material. The shaft, which is rotated at a constant speed by a driving device of any suitable construction, is electrically connected to one pole of the generator, and the disks ($3^a$) ($3^b$), which are in electrical contact with the shaft, are provided with shoulders adapted when the disks are shifted to strike against plates ($23^a$) and ($23^b$), connected to the opposite pole of the generator. The disks are adjustably held in position on the shaft.

By the rotation of the shaft the circuits of the generator will be made and broken in any desired order or interval of time, dependent on the adjustment of the disks around the shaft and the speed of rotation of the shaft. The rate of rotation is not important, provided it be constant and not too low. It must be constant in order to avoid various objectionable if not inoperable complications in the receiving apparatus, for the rate must bear a fixed ratio to the rate of movement of the tape at the receiving station. As the periodicity of magnetic waves is dependent upon the

$$\sqrt{\text{self-induction}} \times \sqrt{\text{capacity}}$$

and as self-induction and capacity of the sending wires vary with the length and the diameter of the wires, the latter are so proportioned relative to each other that by varying their lengths the periodicity of the waves generated by one wire will differ from that of the waves generated by the other wires.

The receiver comprises a series of selective collecting wires or other suitable surfaces ($6^a$), ($6^b$), ($6^c$) and ($6^d$), projecting upward, preferably vertically, though they may be somewhat inclined. These collecting wires are equal in number and are respectively electrically equivalent in height to the corresponding discharging or radiating wires at the sending station—that is to say, corresponding radiating and receiving or collecting wires forming a pair are electrically tuned to each other and the

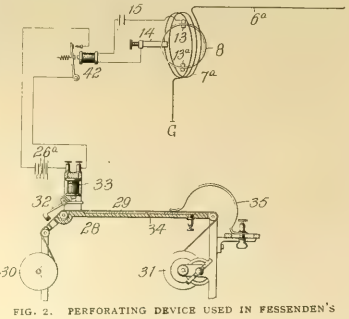


FIG. 2. PERFORATING DEVICE USED IN FESSENDEN'S SPACE-TELEGRAPH SYSTEM.

tuning or equality of time period of free electrical oscillation may be brought about by making the electrical constant of the two either equal or equivalent by changing the length or surface of one of them. They are obviously equivalent when the quantity represented by

$$\sqrt{\text{capacity}} \times \sqrt{\text{inductance}}$$

is equal for each member of a pair.

The mechanisms controlled by the voltages or currents induced in the receiving wires are also tuned to the period characteristic of the energy fluctuations to which they are subjected, so that the recording mechanism connected with each receiving wire will be acted on or controlled only by the voltages or currents induced by the corresponding wire at the sending station, the characteristics of the induced

[illegible] waves having the characteristics of those generated [illegible]

[illegible] to the frequency of the periodic flux to which it is subjected and that the specific well-known practices and rules adopted will be such as the nature of the case demands. Thus in tuning a collecting receiver wire to the frequency of the oscillations of the corresponding transmitting system, electrical tuning by properly proportioned inductance and capacity is specified.

Any suitable form or construction of mechanism may be employed for recording the signals or electrical impulses received. Tuning of the coherers has not been attempted; but in lieu of coherers mechanism may be employed for transforming the current or voltages induced by the magnetic waves into energy of motion, as described in a previous patent. This mechanism is a current-operated low-resistance, cumulatively acting, constantly receptive receiver adapted to transform the energy of the received electromagnetic waves directly into the energy of motion.

A convenient form of mechanism for receiving indications is illustrated in Figs. 1 and 2. This mechanism consists of a bed over which is drawn strip (29) of paper or other flexible non-conducting material. The strip is drawn from a spool by a drum driven at a regular speed by clockwork. A series of perforating mechanisms dependent on the number of receiving wires is arranged in such relation to the strip of paper that when actuated the paper will be perforated.

While any form of electrically controlled mechanisms may be employed, that shown in Fig. 2 is convenient for the purpose. Each of these mechanisms consists of a lever (32) having a punch at one end and having its opposite end attached to the armature of an electromagnet (33), which is included in the circuit controlled by the coherer. As each of the coherers are rendered conductive, the perforating mechanism included in the circuit will be operated and a hole formed through the strip. As the operation of the perforators corresponds in succession to the successive operations of the circuit make-and-break mechanism at the sending station and as the strip is in constant uniform motion, it follows that the relative positions of the perforations in the strip will correspond to the relative times of operation of the make-and-break mechanisms. As the paper strip moves along the bed it will pass over metal bands and under contact springs or in line with the bands. These bands are arranged in several paths of movement of the perforations, so that the springs or brushes will contact with the bands as the perforated portions pass between them. These brushes are adjustably supported so that they can be positioned in accordance with the consecutive operation of the make-and-break mechanisms at the sending station.

It is characteristic of the improvement that only such receiving stations as have their receiving mechanisms properly tuned and adjusted can receive intelligible indications. It is also necessary that the sequence of operation of the receiving mechanism should correspond to that of the sending mechanism, and also that the time interval between the operations of the elements of the receiving mechanism should correspond to the time interval between the successive operations of the elements of the sending mechanism. In other words, to produce a dot or a dash or any other signal or indication at the receiving station requires the conjoint action of waves from all the sending wires and consequent operation of each and all of the receiving mechanisms.

## Electrical Section of the Western Society of Engineers.

The regular meeting of the Electrical Section of the Western Society of Engineers was held March 10th, Chairman W. B. Hale presiding, and a very interesting paper was read by Mr. W. T. Benallack, special agent and electrician for the Western Factory and Insurance Association, on "The Electrical Fire Hazard." Some of the most important points brought out in this paper are given on page 211 of this issue. The subject for the next meeting was not announced.

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## DATES AHEAD.

Ohio Independent Telephone Association (annual meeting), Columbus, March 30th.

Iowa Electrical Association (annual meeting), Hotel Julien, Dubuque, Iowa, April 19th and 20th.

American Electrochemical Society (annual meeting), Boston and Cambridge, Mass., April 25th to 27th.

National Electric Light Association (annual convention), Denver, June 6th, 7th and 8th, and Colorado Springs, June 9th, 10th and 11th.

National-Interstate Telephone Association (first convention of consolidated telephone associations), Chicago, June 21st, 22d and 23d.

International Association of Municipal Electricians (annual convention), Erie, Pa., August 29th, 30th and 31st.

Ohio Electric Light Association (annual convention), Hotel Victory, Put-in-Bay, August 16th to 18th.

American Electrotherapeutic Association (annual meeting), Academy of Medicine, New York city, September 19th, 20th and 21st.

American Street Railway Association (annual convention), Bellevue-Stratford Hotel, Philadelphia, September 25th to 28th.

FREE LAMP RENEWALS are now supplemented in some of the larger cities by free electric signs. The central-station company supplies the sign, lettered attractively to advertise the customer's business, and furnishes it to the user free of charge under a contract by which the subscriber agrees to take the current to illuminate the sign for a specified length of time and at an agreed price. Title to the sign naturally rests with the electric-light company. By this arrangement the merchant gets the use of the most modern and striking of all signs simply by paying for the electricity needed to operate it after dark, although the sign is a good one in daylight as well. The central-station company, by the arrangement, creates absolutely new business.

SOMEBODY said once that Andrew Lang was a syndicate—that the output of books bearing his name could not proceed from any one person; but we believe Mr. Lang denied the charge. However, a serious contributor to an English electrical journal makes a plea for the writing of technical books, if not by a syndicate, at least by joint authors. He argues in the following strain:

There are very few books which do not contain some excellent chapters, and most contain, in addition, chapters not only not worth reading, but absolutely harmful on account of their faulty and rubbishy contents. Why cannot writers seek assistance from someone who knows those portions of the subject which they do not know, and yet which should be incorporated in the book to make it comprehensive and complete?

It is noticeable, too, that books of joint authorship are usually in greater demand than others, for the obvious reason that their contents are more general without being less particular.

There is an opportunity for some firm of publishers to go in for a series of technical books of joint authorship, more especially for such as would meet the requirements of the advanced classes in technical schools.

This is, perhaps, more interesting than convincing. The system proposed would probably result, if attempted as a system rather than as the result of occasional fortuitous association, in patchwork books, more valuable as works of reference than for consecutive study. The history of all literature, technical and otherwise, shows that successful literary partnerships are the exception rather than the rule. The great man makes the great book, and so on down through the scale to the little man and the little book. For instance, will it be contended that Clerk Maxwell's "Treatise on Electricity and Magnetism" would have been improved by the tactful assistance of a collaborator? In the making of dictionaries, cyclopedias and other reference books co-operation may be advisable or essential; but in most other books experience indicates that composite authorship is not especially to be desired.

FALCONER, N. Y., is a village contemplating the blandishments of municipal ownership of an electric-light plant, but before actually committing itself to the venture it thinks of trying municipal operation first. In other words, it contemplates the operation of an existing plant for one year, with an option of purchase at the end of that time. The deal is not a very large one; in fact, the plant seems to be run in connection with a manufacturing establishment, and the man who operates the dynamos at night is also to act as watchman of the factory. But the principle is interesting and may apply elsewhere. The local reasoning is as follows: "Even if the village loses money by it, a year's schooling in that subject will be well worth the tuition fee. It is pointed out that the village can never learn any cheaper whether or no it wants to own a municipal plant. At the end of the year all will be better qualified to vote on the question of the purchase of a plant. One disadvantage deserves also to be mentioned. If, by negligent management of the plant, anyone is killed or injured, the village would quickly be made a defendant in a negligence action." That's it. Look before you leap. All's not gold that glitters in the municipal-ownership propaganda. Much is simply sounding brass. 'Tis well to try running the outfit a year when this can be done, as in a village like Falconer. Then, if the 10 per cent. depreciation, the cost of insurance and water, lost taxes, interest on money invested and all proper and honest charges be added, the village will know more about the cost of running an electric-light plant than it does now. And of course it will make sure that all machinery and appurtenances are in good condition and will not need to be replaced in two or three years. For such things have been, and there are many considerations to engage the attention of one starting in the electric-light business.

ONE lesson of the great battle of Mukden is the value of the intelligence department of an army in the field. Field Marshal Oyama, the Japanese commander, had under his direction, in reality, several armies, and to the fact that he was almost constantly in touch, by telegraph and telephone, with his widely separated forces is due in no small measure his overwhelming victory. The Japanese are credited with being particularly effective in obtaining news by scouts, spies and other means, detailing the strength and disposition of the enemy and his probable intentions. Electrical communication is of the highest value in transmitting this intelligence quickly as well as in the transmission of orders, requisitions and general information between the various detachments of the forces which are battling for one common end under the direction of one intelligence, although perhaps 30 or 40 miles apart. In the use of the field telephone in particular the islanders appear, from a stray hint here and there that may be gleaned from the carefully guarded dispatches, to have been successful to an extent hitherto unknown in actual warfare on a large scale. But indeed in every detail of the intelligence department and signal service the Japs seem to have exhibited a quick intelligence in comprehension and a skillfulness and rapidity in execution which are sure to excite the admiration of military men, and in fact of all who appreciate excellence in technical achievement.

Commodore Perry of the United States Navy is believed to have brought the first telegraph instruments to Japan in 1854. The first telegraph line was, however, constructed between Tokyo and Yokohama in 1869, but there was not much progress until 1877, when the civil war broke out in the southern districts; this necessitated an increased use of the telegraph, and the lines were extended to the important places of the empire. By the end of 1903 there were 16,600 miles of land lines, 2,173 nautical miles of submarine cables and 2,178 telegraph stations, while the number of paid messages sent during that year was 16,987,760. English practice in general is followed in telegraph work and American methods in telephony. The Japanese have a cable ship, and themselves laid the deep-water cables connecting the islands of Kiushu, Liuchu and Formosa. Mr. Saitaro Oi, in his interesting paper on "Telegraphy and Telephony in Japan," prepared for the recent International Electrical Congress in St. Louis, has a paragraph on this subject which admirably illustrates the progressive and indomitable spirit which the Japanese have also exhibited in the present war:

It remained still a question with us [in 1896] whether our engineers could manage to lay cables in very deep waters, as their experience had been previously limited to comparatively shallow waters, and it was strongly suggested to engage some experienced foreign engineers for the work [of laying the cable to Formosa]. We wanted, however, to gain all possible experience, and so we took up the work ourselves. The cables were successfully laid, though not without some difficulties; they have been working well during the past eight years, being worked duplex with direct siphon recorders.

The Morse signals used in telegrams written in the Japanese characters are 50 in number, in addition to those representing figures and the points of punctuation, etc. These signals are partly composed of those representing the Morse alphabet and partly of additional combinations of dots and dashes.

The telephone was first brought to Japan from the United States in 1877, and the service is a state monopoly. At the end of 1903 there were 46 exchanges and 36,700 stations. These figures are not large, but it is to be remembered that the first exchanges, those of Tokyo and Yokohama, were started as late as December, 1890. Mr. Oi concludes his paper, referred to above, by saying: "The work is partly suspended for the present, owing to the outbreak of the war." No doubt many of the government telephone engineers transferred their energies to the plains of Manchuria, co-operating with the army signal service to obtain the results which have been achieved.

## Electrical Equipment for Drainage Canal Power Development Near Chicago.

The contract for the first installation of the electrical machinery for the power plant of the Sanitary District of Chicago, to be located at Lockport, Ill., and to derive its power from the Chicago Drainage Canal, was awarded on March 7th to the Crocker-Wheeler Company of Ampere, N. J. Work on the building itself has not been begun, although the plans are rapidly taking form. One-half of the machinery will be installed at first.

According to the specifications the first assignment of electrical machinery will consist of four 4,000-kilowatt alternating-current generators and two smaller ones of 350 kilowatts each for excitation. The large generators will be of the revolving-field type for direct connection to the horizontal shaft of the hydraulic turbines. They will furnish 60-cycle three-phase current at 6,600 volts effective pressure between any two legs. The poles will be 44 in number and the speed 164 revolutions a minute.

Each machine, to fulfill the requirements of the contract, must be able to deliver 4,000 kilovolt-amperes, 6,600 volts, at 80 to 100 per cent. power factor for 24 hours, the rise in temperature in no part to exceed 35° C. In addition each machine must be capable of standing an overload of 100 per cent. in current for five minutes without injury.

The armature frames will be provided with ventilating openings which will allow of a free circulation of air around the ends of the winding and also through ducts in the laminated core. In order to facilitate repairs the armatures will be so mounted that they may be moved parallel to the shaft to a position clear of the revolving field, giving free access to both armature and field. On non-inductive load the generators are to have efficiencies not less than 96 per cent. at full load; 95 per cent. at three-quarters load, and 93 per cent. at half load.

Exciting current will be obtained from two 350-kilowatt direct-current machines running at 300 revolutions a minute, compound wound and developing current at 250 volts. They are to be of the waterwheel type, provided with a shaft and two self-aligning and self-oiling bearings. The normal full-load rating of these generators will be 1,400 amperes at 250 volts with a speed of 300 revolutions a minute. After running at full load for 24 hours the temperature of no part of the armature of field coils is to exceed 40° C., or that of the commutator 45° C. above the surrounding atmosphere.

This interesting power development has been the subject of several articles in the Western Electrician. In the issue of August 6th last was given an abstract of a paper read by Mr. Thomas T. Johnston before the Western Society of Engineers, entitled "Hydro-electric Power Development at and Near Joliet, Ill., Using Chicago Drainage Canal Water." The available head at Lockport is 34 feet, with a maximum flow of 600,000 cubic feet a minute. This is calculated to be amply sufficient to develop 28,000 kilowatts, to be obtained from seven generators, the first part of the installation to be as described above. Added to this will be about 7,000 [illegible] when the Calumet-Sag Canal shall [illegible] the Drainage Canal. Altogether the total power developed when [illegible] will be about 70,000 horsepower.

The accompanying illustrations show the characteristic features of the power house, for which the bids will be opened on April 12th. This building will be about 350 feet long. The transverse section (Fig. 1) shows by the cross-hatching the concrete and masonry portions of the structure. The waterwheels mounted on the horizontal shaft are for driving one of the alternators above mentioned. The curved draught tubes are shown to the right and left of each waterwheel in this drawing. Turning to the plan view (Fig. 2), the draught tubes are shown by the circular and elongated openings placed in line in each compartment of the structure. The areas numbered 1, 2, 3 and 4 show where the generators just described will be installed.

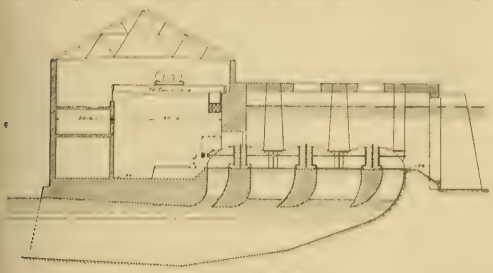


Fig. 1. Transverse Section.

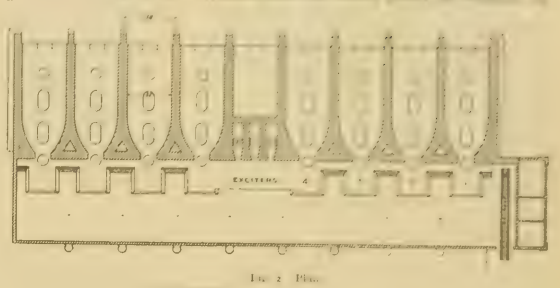



Fig. 2. Plan.

POWER HOUSE TO BE BUILT TO UTILIZE DRAINAGE CANAL WATERPOWER.

The remaining illustration (Fig. 3) is a reproduction of a photograph of the architect's drawing, representing the power house as it will appear when completed. The structure will be of concrete blocks, and though plain in design is substantial and pleasing in appearance.

What to do with this power when finally developed is still a question to be determined. The Sanitary District of Chicago, which owns the canal and is pushing the work, is divided on the question. The preponderance of opinion, however, among the directors and officials of the District is that the power should be transmitted to Chicago and then sold to the city for street-lighting purposes and to private consumers for the operation of induction motors. On the other hand, Mr. Isham Randolph, chief engineer of the Sanitary District, contends that the power could be used to better advantage on the spot. The Sanitary District now owns thousands of acres of land along the canal where industrial establishments might be erected and the power sold nearer the plant as in the case of a large amount of the Niagara Falls power, especially since parallel to the canal are two transcontinental railroad lines with other important railroads crossing at intervals. The canal itself is also one of the finest artificial waterways ever built, inviting the trade of the Great Lakes.

From Architect's Drawing.

FIG. 3. DRAINAGE CANAL POWER HOUSE.

## Susquehanna River Power Plant.

When spring opens work preliminary to the erection of an electric power plant on the Susquehanna River, about a mile and a half below McCall's Ferry, York County, Pa., will again be resumed. It is intended to supply electric current to Baltimore, Philadelphia and other cities and towns within a large radius. About $500,000 has already been invested by New York and Philadelphia men in buying up land along both sides of the river. This was necessitated, it is said, because the dam, which it is proposed to construct, will be 32 feet high. The work of engineering is under Messrs. Eby and Anderson, who are expected to return to York County in a few weeks.

## Chicago Street-railway Situation.

[illegible]

[illegible] thorizing the mayor to advertise for bids for the use of the streets now occupied by the Union Traction Company under franchises which have expired, held by the Chicago Passenger Railway Company. Full right to the streets is not to be given until Judge Grosscup decides the injunction suit which was instituted some months ago, when the council passed an order to the same effect as the present ordinance. It is intended by this procedure to test the legality of the Mueller law and the certificates to be issued under that law.

Judge Grosscup has entered the decree in the 99-year case as far as the West Side lines of the Union Traction Company are concerned. The city is benefited in the main points. An appeal will be taken by the traction company, so that no final ruling may be looked for within a year. The decree in the case of the North Side lines has not yet been entered.

Bion J. Arnold, the consulting engineer of the local transportation committee of the City Council, submitted on March 7th a report upon methods for increasing the capacity and reducing the noise on the Union Loop. This is Mr. Arnold's second report, the first being the monumental one of November, 1902, on the whole traction situation. The present report is likewise characteristic of Mr. Arnold's thoroughness and penetration. It makes a pamphlet of 54 printed pages, with eight plates and 19 smaller drawings. Part I. is devoted to a discussion of the problem of increasing the capacity of the loop. An abstract is given in this issue of the Western Electrician. Part II. is an "Analysis of the Causes of the Present Noise and Discussion of Different Methods Suggested for Reducing the Noise upon the Union Elevated Loop." A condensation of this portion of the report will be given in a future issue of this journal.

Engineer George W. Jackson's report for a proposed subway system for Chicago, which was outlined in the Western Electrician of December 17, 1904, has been referred to the City Council. The report also covers the lowering of the present surface-car tunnels under the Chicago River.

## Coal Tests at the Louisiana Purchase Exposition.

A preliminary report on the operation of the coal-testing plant at the Louisiana Purchase Exposition installed by the United States Geological Survey has been published, it being the work of Messrs. E. W. Parker, J. A. Holmes and M. R. Campbell, who were appointed by the director of the United States Geological Survey as a committee to install the plant. The report contains a brief statement of the results obtained from September 1, 1904, when the plant was put in operation, to December 24, 1904. The total sum appropriated for the work was $60,000.

The tests in the steam-boiler plant of 65 carload samples of coal from 17 states indicate that the steam-producing capacity of American coals is high and that the quality of many of these coals may be improved by washing. The producer gas tests show the most striking results, and they indicate a revolution in the economical use of coal for the production of power. The results clearly demonstrate the following points: That most of the American bituminous coals and lignites can be used successfully in the manufacture of producer gas and that this gas can be utilized in an explosive gas engine, and that this method of using fuel is much more economical than the present mode of generating steam.

## Increasing the Capacity of the Union Elevated-railway Loop in Chicago.[1]

By Bion J. Arnold.

In analyzing this subject it will probably facilitate matters to quote certain portions of my report submitted to the local transportation committee of the Chicago City Council, November, 1902, relating to the Union Elevated Loop, as follows:

"The Union Elevated Loop, which encircles the business district of Chicago, is a two-tracked railroad two miles in length, and it serves as a terminal for the traffic coming from practically seven different elevated-railroad lines. The Metropolitan West Side Elevated brings in over the four-track structure east of Marshfield Avenue the traffic from its four double-track branches. The traffic from the South Side Elevated road, as well as that from the Lake Street [name since changed to Chicago and Oak Park] and the Northwestern Elevated lines, is operated over this two-tracked structure simultaneously with the traffic coming from the Metropolitan lines.

"No less than 1,600 trains, ranging from two to five cars in length, are delivered to the Loop railroad daily. The total number of cars operated on the loop per day is 5,000. The traffic of the elevated railroads, like that of the surface lines which terminate in the business district, is principally handled during 90 minutes in the morning and 90 minutes in the evening. The period of maximum congestion on the loop tracks extends over approximately 30 minutes during the morning and 30 minutes during the evening rush hour. At these times the average headway between trains on the outer loop is 19.8 seconds and on the inner loop 19.5 seconds. The ultimate capacity of the loop tracks is fixed by the number of inbound and outbound trains which it is possible to pass through the junctions at Lake Street and Fifth Avenue, Wabash Avenue and Van Buren Street, and Van Buren and Fifth Avenue.

"It has been demonstrated that a train of five cars can be successfully and successively passed through one of the junctions from a state of rest to clearance, and the interlocking combinations be operated to open another route for the passage of incoming or outgoing trains in 45 seconds of time. If it were necessary to operate the interlocking mechanism for each inbound and outbound train, the capacity of these junctions would long ago have been exceeded. It is possible, and, in fact, is the usual practice, to simultaneously pass an inbound and an outbound train from the main line to the loop, and vice versa.

"As previously stated, the ultimate capacity of the present double-tracked loop is limited to the maximum number of trains which it is possible to pass in all directions through the junction points, and, moreover, the capacity of the junctions cannot be increased. Under existing conditions, however, it is the station platforms on the loop and not the junctions which limit the number of trains that can be operated over its tracks.

"These platforms are much too short to admit of trains being operated at intervals and speeds which will equal the capacity of the junctions. They should be lengthened sufficiently to permit two trains, of five or six cars each, to simultaneously occupy a platform. If the junctions were operated to their maximum capacity, the longest time to be consumed by a train in making one complete circuit of the loop should not exceed 15 minutes. Under the existing conditions, during the hours of maximum traffic, the average time consumed by a train in making a complete circuit of the loop is 20 minutes."

While universal through-routing can be accomplished, if demanded, the capacity of the loop would not be increased to such an extent as seems necessary; but if through routing to as great a degree as is practicable, or, in my judgment, necessary, is acceptable, the capacity of the loop and of the roads operating over it can be greatly increased and the present method of operation simplified.

Fig. 1 represents the loop as it is now constructed and operated. The trains of the South Side elevated railway and those of the Metropolitan West Side railway run upon the inner loop track, thus necessitating their crossing, both incoming and outgoing, at points (a) and (b), the outer loop track over which the Northwestern and Oak Park trains run; but it should be noted that these crossings are so designed that it is practical for trains to pass on to and off from the inner loop simultaneously in case they chance to arrive at their respective loop connecting points at the same time.

From an analysis it will be seen that the point on the loop which now limits its capacity is at (a), where the Metropolitan tracks cross the outer loop track to enter and leave the inner loop at Fifth Avenue and Van Buren Street, where, under present conditions of maximum operation, 40 inbound and 40 outbound Metropolitan trains meet 67 Oak Park and Northwestern trains in one hour.

The next most congested point is at (b), Van Buren Street and Wabash Avenue, where 31 inbound and 31 outbound trains of the South Side road meet 67 Oak Park and Northwestern trains in one hour.

Assuming that it is practicable to pass a train through these points and clear for another train in 45 seconds, the maximum number of trains that could enter the loop in one hour from either of these points would be 45, providing the interlocking plant had to be worked for each train; but since it is possible for a train to pass off from the loop at each of these points at the same time that a train is also passing on to it, the interlocking device needs to be worked but twice to allow the passage of three trains—one entering the loop, another leaving the loop, and the third crossing the tracks of the other two, and it is this feature that gives the present junction points their efficiency over any other that can be devised for the present method of loop operation, for it permits three trains to be handled through them in 1½ minutes, provided the trains chance to come, or are arranged in such manner as to utilize this advantage.

It is this fact, in connection with the fact that, under present conditions of operation, the trains of the different roads become bunched in such a manner as to allow two or more of them to pass through a junction point with but one setting of the interlocking devices, that makes it possible to operate more than 45 trains on and 45 trains off the loop per hour at these points, and gives to the present loop system its high efficiency from an interlocking standpoint, which efficiency must be somewhat sacrificed with any method I am able to devise for through routing the trains between all the different sections of the city, although, by providing for through service between the North and South Side systems and between the two West Side systems only, the congestion can be reduced, due to the through cars occupying but one-half the loop, and more cars can be operated over the loop per hour than at present. By elevating the structure at certain points, hereinafter shown, the through-routing features could be retained, the grade crossings eliminated, and the capacity of the loop would be increased 100 per cent., if only through cars were run. Owing to the difference in the number of trains operated by the different roads, the through routing of all trains is impracticable from an economic standpoint, and, therefore, provision should be made for running such a proportion of the trains of each road around the loop as might be found desirable, in which case the increased capacity of the loop would be reduced in the proportion that the loop trains bear to the through trains.

During the middle of the day and at other than the rush-hour periods, the running time around the loop is from 13 to 14 minutes, thus showing that when fewer trains are operated upon the loop the running time can be materially cut down, owing to the loading facilities then being ample. But, as pointed out in my previous report, about 25 per cent. more trains could be put around the loop during the rush-hour period, under present conditions, if additional platform facilities were provided.

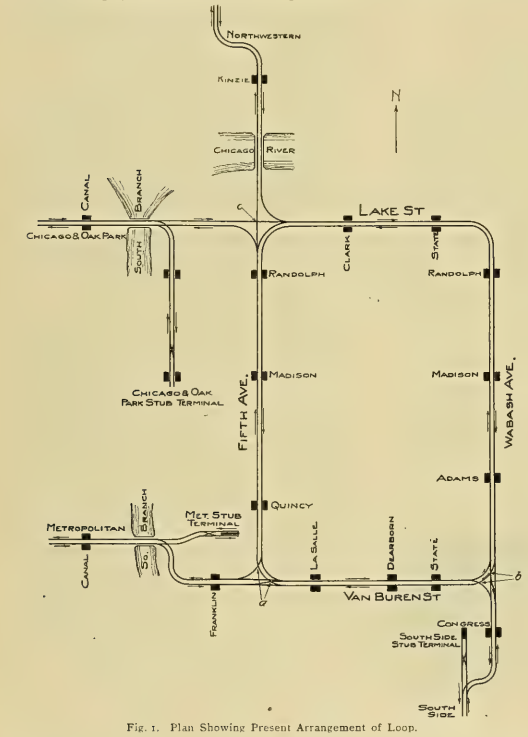



Fig. 1. Plan Showing Present Arrangement of Loop.

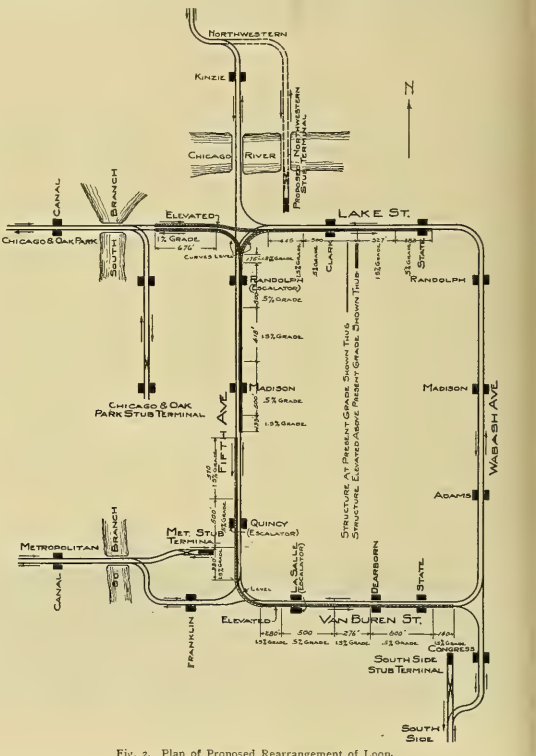



Fig. 2. Plan of Proposed Rearrangement of Loop.

INCREASING THE CAPACITY OF THE UNION ELEVATED-RAILWAY LOOP IN CHICAGO.

[1] Abstract of Part I. of a report made to the committee on local transportation of the City Council of Chicago by Mr. Arnold as consulting engineer. The report is dated March 7, 1905. It will be understood that, owing to limitations of space, not all the plans considered by Mr. Arnold are mentioned in this condensation.

The perfection during the past few years of power mechanism for operating switches and signals at junction points has been such as to warrant its adoption on the loop, and if used the capacity of the junctions could be somewhat increased, owing to the quicker action of the mechanism. When the advantages of this improvement and of the use of "the multiple-unit system" on the cars are utilized, I know of no way that the capacity of the loop, as now built, can be increased under the present method of individual-ownership operation except by extending the platforms, and when this is done, relief to the present loop district must come from the development and operation of stub-end or other terminals for each road, unless unification or some method of joint operation can be effected whereby through routing can be adopted, as hereinafter described.

It does not seem to me advisable to attempt to apply the through-routing principle to the elevated roads as thoroughly as it might be applied to the surface roads, or to the elevated roads, were there more elevated tracks laid through the business district. Consequently a plan [Plan A] has been developed, which provides for through routing to as great an extent as seems practicable or desirable with the present structure.

In this plan provision is made for routing through trains from the South Side road to the Northwestern road and back, and from the Metropolitan road over the Union loop to the Chicago and Oak Park road and back, and at the same time it makes provision for the operation of loop trains for all the roads. It places the trains of the South Side and Northwestern roads on the outside loop track, and the trains of the Metropolitan and Chicago and Oak Park roads on the inside loop track. It also reverses the running of the trains of the Northwestern road to right-hand running, and those of the Metropolitan road to left-hand running. The routing of the through trains under this system would be as follows:

A train originating on the South Side road would run north on the east track of the Wabash Avenue section of the loop, thence west on the north track of the Lake Street section of the loop, thence north on the east track of the Northwestern road. Returning it would run south on the west track of the Fifth Avenue section of the loop; thence east on the south track on Van Buren Street and south on the west track of the South Side road, thus intersecting traffic on the Metropolitan road at points (a) and the Oak Park road at points (b) and (c), as at present.

A train originating on the Metropolitan road would enter the loop on Van Buren Street from the north track of the Metropolitan road, thence north on the east track of the Fifth Avenue section of the loop, thence west on the south track of the Chicago and Oak Park road. Returning it would run east on the north track of the Chicago and Oak Park road, thence east on Lake Street on the south track of the loop, thence south on the west track of the loop on Wabash Avenue, thence west on the north track of the loop on Van Buren Street, and out to the south track of the Metropolitan.

Suitable curves are provided at Van Buren Street and Wabash Avenue and Fifth Avenue and Lake Street on the outside loop track to allow the operation of loop trains for both the South Side and Northwestern systems, while similar curves are provided at Fifth Avenue and Lake Street and Fifth Avenue and Van Buren Street on the inner loop track to allow the operation of loop trains of both the Metropolitan and Chicago and Oak Park roads.

This plan gives all the advantages of the present system of operation and all necessary advantages of through routing, and at the same time reduces the congestion on the loop or increases the capacity of the entire elevated railway systems up to the full capacity of the junction points—an increase of not less than 25 per cent. over its present capacity—and if power-operated junction-point mechanism is employed a further increase will be effected.

In order to eliminate the noise and danger due to grade crossings and to increase the capacity of the entire system of elevated roads of the city to the greatest possible extent with the present loop structure the plan shown in Fig. 2 is submitted as the best possible solution known to me of the entire problem. It is the same as the plan just described, except that the crossings are eliminated by elevating the tracks of the inner loop over those of the outer loop at Fifth Avenue and Lake Street, and the outside track of the loop over the Metropolitan tracks at Fifth Avenue and Van Buren Street. The routing of the cars would be the same, but the capacity of the systems would be limited only by the facilities for loading and unloading on the loop structure. Assuming that all trains operated were through trains, the capacity of the present loop and of the roads connected therewith would be increased 100 per cent., and by extending the platforms, thereby permitting increased facilities for loading and unloading, the capacity would be still further increased, and thus the advantages of the entire elevated and loop systems utilized to their possible maximum capacity.

If then each road should be allowed a stub-end terminal, its rush-hour capacity could be still farther increased, so that the only limit to the capacity of the elevated roads of the city would be determined by the number of [illegible] from the terminal [illegible] of the different roads that each road [illegible] so far as the main line [illegible] at least double its present number [illegible] will thus be seen that if through routing [illegible] vating should be adopted [illegible] would then be capable of handling all [illegible] present double-tracked roads could deliver to it. Since, however, it will probably be advisable to continue operating a certain proportion [illegible] of each road as loop trains the capacity of the loop for through trains would be proportionately reduced, and as some of the roads now have three or four tracks, the surplus capacity of such roads over a double tracked road would have to be taken care of outside the loop by stub-end terminals or auxiliary loops.

The plan shown in Fig. 2 provides for the through routing of cars, thus practically making a double-tracked elevated road through the entire city from north to south, thereby tending to lengthen the present business district in the same manner that the two West Side roads will tend to extend it westward.

The plan shown in Fig. 2, including elevation of structure, removing and replacing track on elevated portions, modification of stations and platforms due to elevation; new power mechanism for interlocking plants, necessary changes in special work and the installation of esculators at Clark, Randolph, Quincy and La Salle streets, but not including any alterations of present track or structure to reduce noise, would cost about $500,000.

Summarized, then, my recommendations for increasing the capacity of the loop are as follows, arranged in the order of their merits in general and in sub-classification:

First—
- (a) Reconstruct, elevate and through-route in accordance with plan shown in Fig. 2.
- (b) Extend the platforms.
- (c) Develop the stub-end or auxiliary terminals.

If it is found impracticable to elevate, then

Second—
- (a) Reconstruct and through-route in accordance with plan outlined [Plan A].
- (b) Extend the platforms.
- (c) Develop the stub-end or auxiliary terminals.

If on account of the diversified ownership of the roads, or for any other reason, it is found impracticable to secure through-routing, then

Third—
- (a) Leave the loop as it is now and install power mechanism for operating the switches and signals at the junctions.
- (b) Extend the platforms.
- (c) Develop the stub-end or auxiliary terminals.

## The Electrical Fire Hazard.

The subject of the electrical fire hazard is one of interest and one which has an important relation to electrical construction. Mr. William T. Benallack, who presented a paper on this subject before the Electrical Section of the Western Society of Engineers on March 10th, is an authority in this line, having been for a number of years state inspector with the Michigan Inspection Bureau.

In his paper Mr. Benallack first gave an interesting sketch of the development of artificial lighting from the time of the golden candlesticks of King Solomon to the present day of electrical apparatus.

An important point which the author brought out was the fact that while the electrical man is generally held responsible for all fires of electrical origin, in reality a great number of these defects are due to the property-owner himself, who insists on cheapness of construction, and will use inferior material against the advice of the electrician. Often, too, in large office buildings and apartment houses the janitor or steam engineer is expected to make all repairs to the electric-lighting system, often with dire results.

Mr. Benallack said: "During the period that I have been following up this work I have investigated about 300 electrical fires, aggregating a loss of a little over a quarter of a million dollars, and in practically every case I have found that the fire was the direct result of arcs, grounds or short-circuits developing in defective devices or improperly installed wiring." In justice to the fraternity he has always advocated electricity as the safest means of lighting, the only condition being that the equipment be installed in accordance with the National Code.

In the paper were given numerous instances of curious electrical fires, and lantern-slide pictures were shown illustrating some of these.

The National Electrical Code is somewhat technical and has grown to such an extent that it is too intricate for many to understand properly who have not sufficient time to master the contents. With this in mind Mr. Benallack compiled a few simple rules which, though not intended to cover large installations, if followed in the smaller ones, will be found to be of great advantage in the majority of equipments. These rules are here quoted:

"Service wires must, where they enter buildings, be supported on brackets and insulators and have [illegible] entire equipment, including meter, can be disconnected [illegible] for each 660 watts, i. e., the equivalent of about [illegible] on the nature of buildings and placed in approved cabinets lined with slate, marble or one-eighth-inch [illegible]

"For ordinary open work, wires should be mounted on porcelain cleats or knobs, which keep the wires at least one-half inch from the surface, wired over and 2½ inches apart. Supports to be used at least every 2½ feet.

"Suitable mechanical protection should be provided on all wires running on side walls, either by a substantial boxing, wooden moldings, or preferably metal conduit.

"Flexible cord must not be run on walls or ceilings in place of wire, and is not approved in show windows. Cord is only designed for use as a pendant and should not hang lower than a distance of five feet from floor. Flexible cord-drops of unnecessary length should be avoided as much as possible and kept clear of contact with wood pipes, etc.; where portable lights are required, cord especially designed for this use can be procured.

"In all wiring, special attention should be paid to the mechanical execution of the work. I would rather see a lot of poor material well put up than the very best approved devices installed in a careless and slipshod manner."

Speaking of theaters, the author said: "I have inspected about 60 theaters and with the exception of a few of the more recently constructed and those located in the larger cities, not over 10 per cent. would pass inspection."

Deterioration is a factor which should not be ignored, especially in places exposed to dampness, acid or other fumes which injure the wire or insulation. The extent of the deterioration depends largely on the owner.

Speaking of the relation between electrical men and the inspection departments, Mr. Banallack said: "As a rule, speaking from may own experience, the electrical fraternity feels kindly toward the inspection departments if for no other reason than that the business has increased from the great amount of repair work and remodeling that our inspection has developed, and at the same time efficient inspection makes it more difficult for the unreliable and irresponsible electrician to do business. The only consistent grievance they may have, if any, is due to the lack of uniformity of interpretation and enforcement of rules."

Among those taking part in the discussion of the paper were Harold Almert, J. R. Cravath and Mr. Boyd of Chicago.

# COMMUNICATION.

## Rock Falls Municipal Plant Not Discontinued.

To the Editor of the Western Electrician.

We notice in your issue of March 11th an article to the effect that the Rock Falls (Ill.) municipal lighting plant had been discontinued, as it was a losing venture. This we wish to state is entirely untrue and without any ground whatever. The year ended May 1, 1904, showed a neat profit for the year, and the year which will end May 1, 1905, will show a still better profit; and we further state that the plant never was in as good a financial condition as at the present time, and that arrangements are being made to do a larger and better business with the city of Rock Falls as owner.

O. M. Aarvig,
Superintendent.
J. G. Limerick,
City Collector.

Rock Falls, Ill., March 11, 1905.

[The publication in the Western Electrician last week was based on a newspaper dispatch, as therein stated. The newspaper referred to was the Chicago Daily Tribune.—Ed.]

A new company to be known as the Central Kentucky Traction Company has been incorporated by Lexington men, who propose to build several electric-railway lines. The company will also take over the Fayette Interurban Company and the Blue Grass Consolidated Traction Company. Louis des Cognets, J. W. Rhodes and D. F. Frazee are among those interested.

## Cement in Central-station Design.[1]

By Eugene B. Clark.

The Illinois Steel Company has just completed and placed in operation at its plant in South Chicago a new power house for the supply of power to its various mills at South Chicago and at Buffington, ten miles distant. This station contains, at the present time, two units, each consisting of a 2,000-kilowatt, 25-cycle, 2,200-volt, three-phase generator, direct driven by a 24 by 60 by 48-inch duplex, horizontal-vertical, cross-compound engine. The addition of two more generating units, of a capacity of 4,000 kilowatts each, is contemplated in the near future. This alternating-current station operates in conjunction with a direct-current station, which has been in operation for some considerable time. The two power houses are connected by means of rotary converters. Both stations take steam from blast-furnace boiler houses, in which the fuel is excess blast-furnace gas. The supply of this excess gas is quite variable at times, and it is desirable, under such conditions, to be able to shift load from one station to the other, as desired. Such an arrangement gives the opportunity of utilizing completely all excess blast-furnace gas at either point.

The principal points of interest with which we are concerned to-night deal entirely with the use of cement in the building of this and other power houses.

The foundations for the machinery and the building rested upon piles and were made of slag concrete, consisting of one part cement, three parts Torpedo sand, and seven parts crushed slag. The cement used for those parts of the foundations which were not exposed was of the brand known as "Puzzolan;" for those parts which were exposed, Universal Portland cement was used. The foundations were started in the coldest weather of last winter, and the concrete, which had to be mixed with warm water and warm sand to keep from freezing in the mixer, did freeze immediately after being tamped into place. Filling was used to follow up the foundations as rapidly as they were put in place, so that the concrete was not permitted to alternately freeze and thaw as the warmer weather came on. The result was to obtain a thoroughly solid foundation, the concrete setting up firmly as it gradually thawed out during the spring months. About the middle of summer we tested the foundation by drilling a hole several feet deep into that part which had originally been frozen. We found that it had set up to make an extremely solid and strong concrete.

A considerable amount of time and attention was devoted to determining the most desirable method of floor construction. The power-house apparatus is controlled by electrically operated switching devices. The electrically operated switches, together with the bus bars, control pedestals, instrument posts and feeder panels, required the construction of galleries at one end of the engine room for their accommodation. Two of these galleries were built, and the engine-room floor was used as another gallery. On the engine-room floor were located the generator switches; on the first gallery were located the bus bars, the instrument posts, generator control pedestals, feeder panels, etc.; on the third gallery were located the feeder switches and the lightning arresters. A transmission line, carrying a pressure of 20,000 volts, was necessary to transmit the required amount of power to Buffington, located ten miles south of South Chicago. At least 4,500 kilowatts of transformers had to be located in the power house. It was decided to place these on the engine-room floor, under the first gallery, constructing an isolated transformer room for that purpose. The transformer room was isolated from the rest of the apparatus on the engine-room floor by means of a wall about three inches thick and 17 feet high, built up of reinforced concrete, in accordance with the method to be described later. This wall proved, after erection, to be thoroughly solid and substantial—as rigid, in fact, as would have been a masonry wall 12 inches or 14 inches thick. It then became necessary to take wires carrying a pressure of 20,000 volts through the operator's position on the first gallery. In order to harmonize these various requirements it soon became evident that much additional space would be required if it should prove necessary to have the usual steel beams in the gallery floors, inasmuch as the beams would be in the way of the many wires which it would be necessary to take through these floors. These conditions pointed to the advisability of using a floor construction of concrete slabs or of fireproof tile. Careful consideration of the subject proved that, even with the comparatively long spans for such heavy loads, the concrete construction would be far preferable, both from the standpoint of cost and from the standpoint of fireproofing. Experience at the Baltimore fire had shown that properly constructed concrete floors had withstood the test of fire and water better than any other kind of floors.

To make certain of the safety and conservatism of the proposed design, a section of the floor, as proposed, was built and tested prior to the final decision as to the construction of the floor for the building and galleries. After being allowed to set 21 days this section of floor was tested by piling pig iron upon it to the extent of 500 pounds per square foot. The test slab was seven inches thick and 15-foot span, made of concrete, consisting of one part Universal cement, two parts Torpedo sand, and four parts one-half to one inch crushed limestone, reinforced with one-half-inch steel rods, spaced five inches apart and laid on top of No. 10 gauge expanded metal placed one inch from the bottom of the slab. Upon test, the slab collapsed under a load of 550 pounds per square foot. An even distribution of the load over the surface was obtained by covering the top of the slab with about four inches of sand, upon which was piled the pig iron. Deflections were measured as the load increased. The deflection at the center had risen to about 1½ inches by the time the slab failed. It was determined that the expanded metal was comparatively valueless for purposes of reinforcement when used in conjunction with the ½-inch round rods, as all the tension was taken by the rods. These rods were bent at the ends for a distance of about 10 or 12 inches through an angle of 180 degrees, thereby insuring that they would not pull out at these points. We found that it was important that the rod should be bent through 180 degrees, and not through 90 degrees, for those which were bent 90 degrees only showed a very decided tendency to crack the concrete at the corners and then to pull out. Round rods were used in preference to twisted or notched, or any other form of rods designed to prevent slipping or pulling out of the concrete, for two reasons. In the first place, the round rods are far cheaper; and, in the second place, it was decided that nothing was gained by preventing the rods from pulling out of the concrete, provided they were properly fastened at each end. The mixture used in all the floor construction was one part Universal Portland cement, two parts Torpedo sand, and four parts crushed limestone, one-half to one-inch mesh. The shoring under all floors was permitted to remain 28 days before removal. In the engine-room floor, for the very long spans, some floor beams were used, but in all cases they were entirely covered with concrete, to give thorough fireproofing.

Wherever generator pits or flywheel pits were to be covered, such covers were made of cement castings, reinforced with expanded metal, rather than of cast iron. These cover plates were made to exact fit for each place as the work progressed, no drawings being necessary. The carpenter made a small mold of the correct size, in which the cement worker cast his floor plate and finished it exactly as the rest of the floor. The gallery floors were completed and the shoring removed before any work was done on the installation of the electrical control apparatus or the supports therefor. Each gallery was treated as independent of the one under it, so far as support was concerned, though, in building up the switch cells, the bus-bar construction, and the barriers for same, the practical result was to give additional support to each floor from the one under it. The switch structure was also constructed in such a way as practically to be a beam in itself. Round iron rods were cast into the lower part of the structure and allowed to extend through from the first switch in the row to the last. The result was to provide a construction of the switch cells which, being in itself a beam, would distribute the load to those points at which the load might best be taken. In addition to this fact, the barrier which rose from the switch cell to the ceiling above, taken in conjunction with the lateral barriers, all of which were built monolithically with the wall rising from the switch structure, formed a column of very considerable strength. It would probably not be poor engineering to depend upon the strength of this column, in a measure, to support the floor above it, but in the case which is being described, this was not done. Even though no attempt was made to utilize the switch structure as a column, still, the fact was taken into consideration that there would be a natural tendency, by reason of the presence of the switch structure, to transmit load from one floor to the one under it, and therefore, to impose a greater load upon the lower floor than would be accounted for by the weight actually upon that floor. This effect was compensated for by giving the lowest floor additional supporting columns, which were placed between the basement and the engine-room floor. These columns were covered with expanded metal and a cement plaster to insure against failure, in case a fire should occur, due to the storing of inflammable materials. It has not been contemplated that such materials should be stored in the basement, but it was thought wise to provide against this contingency.

The roof of the engine house was constructed of concrete laid in place as is usual for side-walks. In each bay a removable wooden frame was secured to the structural roof chords in such a way as to permit of ready removal by knocking out wedges after the roof was in place. A thin layer of cement mortar, consisting of cement and sand, was placed on the top of this woodwork support. The function of this thin layer was to give a smooth coat for the finished interior of the roof. The expanded metal reinforcement was laid immediately on top of this preliminary coat and was covered with about two inches of concrete of about the same mixture as was used for the floors. On top of this was placed a thin layer of rich mixture, which was given a sidewalk finish on the side exposed to the weather. After 28 days the wooden supports were removed from the inside, by knocking out wedges, and were lowered to the engine-room floor. The roof, made in this way, developed cracks after drying out. These cracks were filled by pouring into them a thin grout consisting of cement and sand. The result was to stop all leaks and secure a roof which was cheap and thoroughly fireproof. It has the disadvantage of being heavy, however, and requires rather heavier roof trusses than does a tile or slate roof. It is very strong, however, and is not damaged by men walking upon it, or by pieces of stone or other materials falling upon it. The latter consideration was an important one, in the case described, because the station is located near blast furnaces, which, unfortunately, have the habit of throwing stone and ore out of the top at times.

The advantage of using expanded metal on such a place as a roof rested entirely in the economy of labor in handling the material. The writer believes the disposition of material in expanded metal to be uneconomical and, at times, disadvantageous. All of that material which lies transversely to the strain is wasted, and, furthermore, it is the writer's belief that there is a tendency on the part of expanded metal, when subjected to strain, to elongate the diamond-shaped meshes and to shear off the concrete between the meshes. The tendency to shear the concrete would be trifling and unimportant, if, in addition to this, there were not a tendency to break the concrete which is always placed below the expanded metal for fireproofing purposes. This lower section of concrete is generally about one inch thick, and, being in tension, is apt to crack when the floor is heavily loaded. After the lower section of concrete cracks, there is a tendency for the expanded metal to shift in position, and therefore become ineffective. This belief on the part of the writer arises from observations of heavy beams reinforced with concrete and tested to the breaking point. He does not mean to convey the impression that for light beams, loaded comparatively lightly, expanded metal is not a desirable reinforcing material.

The electrically operated oil switches, which are usually mounted in a brickwork cell structure, were mounted in a cell structure built up of concrete. A collapsable wooden mold was made, which was set up in the proper position for the switch, and was filled with concrete from the top. This mold was built similarly to a hinged flask standing on end, and was built large enough to allow of casting two switches at one setting. The mold was properly lined up, leveled and braced to prevent moving while tamping the concrete. The bolts for holding the switches in place were set in the concrete of the cell structure by means of a template on top of the mold, just as foundation posts for engines are set. The concrete mixture was one part Universal cement, two parts Torpedo sand and three parts screened limestone, which would go through a three-eighths-inch mesh. After the mold was constructed the only skilled labor required was that of the carpenter, who lined up the mold each time it was moved into a new position. After the concrete had set for approximately 48 hours, the mold was stripped and again set up for the next two switches. After all the switches of a row had been cast, and the molds removed, the cement worker went over them to point up any voids which might have occurred in the corners, and to give the whole structure a finished appearance. The result was a pleasing one. It was decided that the mold, which, in this case, was built of dressed lumber, in the attempt to give a smooth and finished appearance to the concrete work, might better have been of rough lumber, in which case it could have been built for about $50. In case a large number of switches were to be built, however, the writer would recommend the construction of a metal mold, which perhaps would cost $100. A mold constructed of metal would be free from liability to warp, which always exists in the case of a wooden mold.

The wires leading from the oil switches are separated from each other by means of barriers built up of thin slabs of concrete. The method of construction of these barriers was simple and effective. Pipes, or one-half-inch rods, were set up and tied together with wire in the form of the proposed compartment construction. A light metal lath, such as is used for plaster partitions in building construction, was then wired to the light framework. A cement mortar was then applied, in the same way as the plaster. The cement worker became so expert in doing this class of work that he could build these compartments more rapidly than a draftsman could make the drawings for them. The bus-bar structure was built up in the same way as was the cell structure for the oil switches. Where lines leave the building, or where they were run in any horizontal position, barriers were suspended from the ceiling by allowing a piece of metal lath to project down at the time the floors were put in. The barrier was plastered to this piece of lath in the same way as just described. Where conductor wires were taken through the floor, which, of course, was frequently necessary, the insulators were set into the concrete as the floor construction progressed; therefore, when the floor and switch construction was completed the wire men had the insulators through which the wires were to be run properly located. One great advantage of this form of construction rests in the economy of space which it makes possible. Any brick wall must necessarily be four inches thick, whereas a concrete wall may

1. A paper read before the Chicago branch of the American Institute of Electrical Engineers on February 28, 1905.

be put up only two inches thick, provided it is reinforced. In case brick construction is employed, where thin partitions are desired, they must be built of soapstone or marble. The concrete is just as effective in most cases, and is much cheaper.

In constructing the switch cells and bus bar structures, an attempt was made to secure a perfectly smooth finish by dressing the mold smooth and coating it with shellac, as is customary for patterns. This was found to be a mistake, as the bubbles of excess water contained in the wet mixture tended to gather on the smooth surface and make a rough finish to the work. It was found preferable to leave the mold rough and to finish the work with a final float coat.

The generator leads were brought from the machines in three-inch bituminized fiber conduits, laid in the cement floor of the basement. Under the generator switches, they were brought from the basement floor to the engine-room floor in a solid concrete wall. The lead sheathing was removed from the cables, and additional coating, consisting of paper and shellac, was provided. After allowing a few days for this to dry, the cables were built into a wall of concrete. Inasmuch as the wall was only a few inches thick, little difficulty would be encountered in cutting the cables out, if necessary; in fact, three cables were cut out, under the mistaken impression that they were improperly connected. Little difficulty and slight expense were involved in the operation, and they were found to be in perfect condition. In the basement no important wire or cable was permitted to be exposed. The result is that if a fire should start in any material which might be stored there, it could not affect the connections to the generators or instruments, nor could it cause the collapse of the structure, due to the failure of exposed steel columns. The instrument leads and the control wires for the switches are buried in cement. It was originally intended to use for this purpose lead-covered cable run in iron-armored conduit, the latter being embedded in the floors. It was decided later, however, to do without the iron-armored conduit, and to lay the cables directly in the cement floor. For this purpose a top coat of 2½ inches of cement on the floor was allowed, in addition to the original cement floor, which was designed to support the full loads. Of this top dressing, two inches consisted of a mixture of cement, sand and sawdust, in the proportions of one of cement, one of sand and two of sawdust. The method of installation consisted of laying the conductor cables on the top of the original supporting floor. When all the instrument wiring was completed and tested the cables were covered and embedded in this mixture of sawdust-cement, and on top of all was laid a one-half-inch finishing coat for the floor. The mixture of sawdust-cement is soft enough to permit of chopping a cable out at any time without damage to the cable or to surrounding cables. The repair of the floor is very simple. Still, the floor is perfectly solid, and, to all intents and purposes, the same as if constructed wholly of concrete. The necessity for chopping out cables is very remote, because, once properly installed, there is no chance for movement or damaging of the cables. The item of labor saved by making it unnecessary to draw into the conduit the very great number of cables which are required for the installation of electrically controlled switching apparatus is very considerable.

The 20,000-volt wires which were led from the transformer room on the first floor to the lightning arresters, and building outlets on the top gallery, were provided with thorough protection where they passed through the operator's gallery. For each wire a chimney was built of 10-inch bituminized fiber conduit. The three chimneys carrying the three wires of a circuit were placed close together and were surrounded with a construction of expanded-metal lath, covered with cement plaster. The result was, to outward appearance, a rectangular column. In effect, there was a thoroughly insulated duct provided for the conveyance of each high-tension wire, which acted to entirely prevent the possibility of an operator coming into contact with these wires in any way.

After the installation of all apparatus and connections thereto, the cement work was given a final finishing wash of whiting, glue and a slight amount of dark coloring matter, the result being to produce a uniform natural cement color over the whole job. It is impossible to produce this without some such wash, since all cement work will discolor more or less as it dries out.

The final result is a most pleasing one, not only from engineering considerations, but from an artistic viewpoint, as well. Not much effort was taken at the start to lay out the work with a view to securing good architectural lines, but, even though this was not looked to as it might have been, it was possible, by adding a touch here and a touch there, to secure some very satisfactory effects from the point of view of appearance. Of recent years most large power houses are designed with a view to securing good architectural lines on the exterior, whereas the interior is generally designed from an engineering viewpoint only. The possibilities of cement construction along the lines of securing artistic and decorative interior effects, with very slight increased cost, and without sacrificing engineering requirements, have so far received too little consideration in many power houses.

## Foreign Trade Opportunities.

The British and South African [illegible] states that the following [illegible] South Africa contemplate the [illegible] plants: Heidelberg, for lighting [illegible]; Bloemfontein, tramways; borough of [illegible] town, lighting; Greytown, near Durban, lighting; Klerksdorp, lighting; [illegible].

Benjamin Hampson and W. W. [illegible], Natal Colony, will apply to Parliament for a concession to build an electric railway from [illegible] to [illegible] and to supply that region [illegible] Durban) with electric power and light.

The Metropolitan and Cairo-Helonan Railway Company has received a concession for erecting an electric plant to furnish light for the town of Helonan, Egypt. The Mansura Electric Supply Company has been awarded the contract for the electric lighting of the town of Mansura.

The city of Turin, Italy, is to negotiate for a loan of $4,800,000 for the purpose of erecting electric works.

Professor Sultanow, chairman of the technical committee for the construction of tramway lines, examines and passes on all applications and plans for projected street railways in Russia. In cases where such enterprises are projected the professor, who is attached to the ministry of interior at St. Petersburg, may be able to give information to parties desiring to furnish tramway construction supplies, rolling stock, etc.

The municipality of Arenas de San Pedro, Spain, intends to install electric lighting.

The Swiss government has granted a concession for the building of an electric narrow-gauge railroad from Meiringen to Gletsch.

The Chilean Congress has passed an act granting $12,850,000 for new harbor works at Valparaiso (bids are to be handed in within the next twelve months) and $4,465,000 is to be expended on new harbor works in the port of Talcahuano. The Ministerio de Marina at Santiago is able to furnish particulars.

## International Railway Congress.

The International Railway Congress will hold its seventh session at Washington, D. C., next May. Delegates from all parts of the world will be present. These congresses are held at intervals of five years, in the interim the affairs of the congress being conducted by a permanent international commission of 48 members, the president of which is Mr. Arthur Dubois, honorary director of the Belgian State Railways, and the secretary, Mr. Louis Weissenbruch, manager of the Belgian State Railways.

The meeting place of the congress will be the New Willard Hotel and the sessions will last from May 3d to 13th. The congress will be divided into five sections and numerous papers relating to all phases of railway construction and operation will be read. Those on electrical subjects will be "Electric Traction," by W. D. Young, electrical engineer of the Baltimore and Ohio railroad; Paul Dubois, engineer of bridges and highways, Orleans railway, France; Ernest Gerard of the Belgian Ministry of Railways; Victor Tremontani, engineer electrical section, Mediterranean Railway of Italy, Milan. "Lighting, Heating and Ventilation of Trains," by Mr. C. B. Dudley, chemist, Pennsylvania railroad, and Mr. Cajetan Banovits, ministerial councillor and superintendent of rolling stock and motive power, Hungarian State Railways. "Traffic Conveyed by Automobiles," by Mr. Lechelle, superintendent of transportation, Northern Railway of France; Mr. Eugene Sartiaux, electrical superintendent, Northern Railway of France, and Mr. Keromnes, principal engineer of machine shops of La Chapelle and Hellemnes, Northern Railway of France, and "Automatic Block System," by Mr. C. H. Platt, late general superintendent, Western District, New York, New Haven and Hartford railroad, and Mr. Margot, engineer, assistant to the management, Paris, Lyons and Mediterranean railway.

## Coal Production in 1903.

The world's coal production in 1903 reached the enormous total of 864,000,000 long tons, of which the United States produced 319,000,000 tons, as against 230,000,000 produced by Great Britain, 160,000,000 by Germany, 39,000,000 by Austria-Hungary, and 35,000,000 by France. In 1902 the total production was 789,000,000 tons and of this amount the United States supplied 269,000,000.

The world's growth in coal production is coincident with its growth in commerce, indicating the close connection between coal supply and industry and transportation. Coal production has, in the last half century, increased tenfold, and commerce more than fourfold, the former increasing from 81,000,000 tons in 1850 to 864,000,000 tons in 1903; the latter from $4,000,000,000 in 1850 to $22,000,000,000 in 1903.

Of the output of 319,000,000 tons by the United States in 1903, practically the entire amount is consumed in the domestic market, as the exports of coal have averaged but about 5,500,000 tons per annum during the last five years. The United Kingdom is the world's greatest exporter of coal, her annual exports having ranged between 35,000,000 and [illegible]

## Census Report on Street and Electric Railways.

[illegible] E. Dana Durand of the Bureau of Corporations. [illegible] which are of especial interest:

[illegible] single-track mileage for street and electric railways increased from 8,123 to 22,577. This increase was due partly to the establishment of new railways, but principally to the extension of the lines already existing. The mileage of the electric lines increased from 1,262 to 21,907, while there was a decrease for the lines operated by other motive power, the decrease being from 488 to 241 miles for cable lines, from 711 to 170 miles for steam lines, and from 5,662 to 259 miles for lines using animals for their motive power. The average length of track per operating company increased from 10.56 miles to 27.63 miles during the same period.

In proportion to its area Massachusetts has much more electric-railway mileage than any other state.

There were 66,784 cars of all classes in the United States in 1902. Of this number 60,290 were passenger cars and 6,494 were cars used for express and other purposes. Of the passenger cars 32,658 were closed, 24,259 were open, and 3,134 were combination closed and open cars, while 239 were combination passenger and express cars. There were 1,114 cars devoted solely to express, freight and mail business. The largest number of cars of all classes for any state was reported for New York, the number being 14,040.

About half of all the cars in the United States were equipped with heating apparatus, 19,021 being heated by electricity and 11,138 by stoves, hot water, or other contrivances. Many railways, however, have two sets of cars—one for use in summer and the other in winter—so that in winter the proportion of the cars in operation equipped with heating apparatus is larger than these statistics would at first glance indicate.

The report shows also that 62,369 cars, or 93.4 per cent. of the total number, were lighted, 55,703 being furnished with electric light.

The total number of passengers carried was 5,836,615,296, of which 1,062,403,392, or 18.2 per cent., were transfer passengers. The average number of rides per inhabitant advanced from 32 in 1890 to 63 in 1902 for the country as a whole, while the advance for the urban population was from 98 to 168. The proportion of rides to the total population is greatest in the District of Columbia, where the whole population is urban, and is next greatest in Massachusetts, while New York ranks third. California has the highest proportion of rides to the urban population, largely as a result of the hilly streets in San Francisco, which compel general resort to this method of travel.

The average number of salaried officials and clerks employed by the street-railway companies of the United States in 1902 was 7,128 and the average number of wage-earners was 133,641. The salaries paid amounted to $7,439,716 and the wages to $80,770,449. The wages alone formed 56.8 per cent. of the total operating expenses of the street-railway companies.

One passenger was killed for every 18,015,894 fare passengers carried, and one was injured for every 178,876 passengers. The rate of accident for the wage-earners was one killed out of 1,095 and one injured out of 36. This rate is very much lower than the rate for steam railroads, for which one employe out of every 401 was killed and one out of every 24 was injured.

The report gives some interesting illustrations of the extent to which the outer areas of cities have increased through the development of the street railway. For instance, the population in Manhattan Borough of New York city increased from 1,441,216 in 1890 to 1,850,093 in 1900, or 408,877. Of this increase 231,556, or considerably more than one-half, took place in that part of the island lying north of Eighty-sixth Street, the population in this section having practically doubled during the decade. This district is situated about seven miles from the southern extremity of the city, and the great majority of its breadwinners do business downtown and make daily use of the street railways.

The Public Service Corporation is promoting a bill in the New Jersey state Legislature, which, if approved, will authorize a rapid-transit line to be built between New York and Newark, N. J., part of the line to be a subway in the bed of the Morris Canal, near Newark, if certain rights can be acquired. High-speed trains will be used on this line.

## Why the Farmer Should Have a Telephone.

In the rural districts of the United States the telephone is fast becoming a necessity to the farmer and the farmer's wife. In a little pamphlet entitled "A Little More Light," issued by the Ewing-Merkle Electric Company of St. Louis, among other things there are given a number of reasons why the farmer should be in possession of a telephone. The reasons are here given and they serve to show the many ways in which the telephone may become a real source of pleasure and profit to people in the country.

1. It saves time, "horseflesh" and money, making many trips to the village unnecessary.

2. It gives the farmer all the advantages of his village neighbor by placing him in communication and easy access of all.

3. It calls the doctor night or day, saving the time that may often mean life or death.

4. It orders supplies from his hardware or implement dealer sent out by parties coming in his direction, and in urgent cases by special messenger, saving the time which to the farmer in seedtime and harvest means many dollars.

5. It gives him the daily weather reports whenever he cares to inquire, enabling him to avoid loss of crops by storm and the opportunity of planning his work accordingly.

6. It enables him to take every advantage of the market in the sale of his grain, and his grain buyer is ever ready to keep him informed. In this alone he can save more than the cost of his telephone every year.

7. It enables him to call up his grocer and sell his butter, eggs and vegetables before they leave the farm, receiving therefor an average price far in excess of what he would receive were he compelled to accept what is offered in a congested market.

8. It places him in direct contact with the post-office in the event of important mail, forming an important adjunct to his rural-delivery privileges.

9. It sells his stock to the local shipper for more than the market price "in order to fill up the car," and enables him to deliver it in prime condition, with the least possible shrinkage.

10. It enables him to plan his work during harvest and threshing when "exchange work" is necessary, and many delays from breakdowns in securing supplies are prevented.

11. It places him in direct communication with his town and county officials, whose representative capacity enables them to more fully serve his ineests.

12. It gives him the important daily news and keeps his local newspaper fully informed of the social happenings in his neighborhood.

13. It oversteps storms and snowdrifts and brings to him assistance in time of need.

14. It renders fire protection and is the best thief catcher in the world.

15. It is protection to wife and daughters against the importunities of tramps and vagabonds and gives a security nothing else can.

16. It finds the strayed cattle, returns the lambkin to the fold and becomes the shepherd of the neighborhood.

17. It gives his family church and social privileges they cannot enjoy without it, while his rural neighbors are always within "talking distance" though many miles apart.

18. It affords his family, and especially his young people, the social converse so essential to their happiness, making home more attractive and therefore more enjoyable.

19. Over it he discusses business, politics and religion, debates "ways and means" with his neighbors, arranges picnics and club outings, school meetings and roadwork—in fact the thousand and one advantages where distance is annihilated. It makes rural life the most ideal of all life, brings the whole country within the confines of a neighborhood and bestows upon the farmer many, if not all, the privileges of his city kinsmen. It is the most valuable investment he can make, pays for itself many times every year and when once installed will make itself so indispensable as to remain a fixed adjunct to rural life.

## NEW COMPANIES.

C. C. Luttrell, J. W. West and F. E. Bundy have incorporated as the Bruce (Ill.) Mutual Telephone Company.

G. R. Couch, J. F. Posey and F. M. Morton have incorporated as the Haskell Telephone Company of Haskell, Texas. The capital of the company is $10,000.

The Waterville (N. Y.) Telephone Company, to serve Oneida County, has been incorporated with a capital of $25,000. The local directors are I. D. Brainerd, M. W. Terry and S. W. Goodwin.

Among the companies which have recently been incorporated in the state of Kansas are the following-named telephone companies: Limestone Farmers' Telephone Company, Iona, $5,000; Pleasant Plain Telephone Company, Brownell, $50,000; Preston Mutual Telephone Company, Preston, $5,000; Farmers' Union Telephone Company, Inka, $8,000; Rural Telephone Association, Minneapolis, $6,000.

## Ohio Telephone Notes.

The Ohio Bell Telephone Company of Mt. Vernon has been incorporated with a capital stock of $20,000. This is said to be one of 75 Bell companies to be organized in Ohio. The small companies are to be pledged to use the Bell instruments and connect with the Bell Long-distance lines, but otherwise the companies are largely owned by local people. In this way they expect to stand upon the same ground the Independents occupy, and thus attempt to make their foothold a little firmer than it has been. The officers of the company are as follows: President, L. V. French; vice-president, F. F. Dowds; secretary and treasurer, F. H. Hutsberger. Mr. French is manager of the Bell exchange at Delaware, Ohio. The new company will build lines in the northern part of Knox County and in surrounding territory.

The Cincinnati and Suburban Bell Telephone Company is negotiating with the Zumstein Livery and Cab Company of Cincinnati for the 125 private telephones which have been maintained for some time for private business purposes.

The Pioneer Telephone Company of Union Furnace has been incorporated with a capital stock of $2,000. A. F. Woodward and others are interested.

Reorganization plans for the Citizens' Telephone Company of Batavia have been perfected. The old common stock will be retired by the issue of $75,000 of six per cent, preferred and an equal amount of common stock. Afterward $25,000 of the preferred stock will be put upon the market. The remaining $25,000 stock will be held as treasury stock. The company operates lines in Hamilton and Clermont counties, with W. T. Fee as manager.

The meeting of the third district of the Ohio Independent Telephone Association was held at Zanesville on March 1st, with 65 persons present. The following papers were read and discussed: "The Best Method of Advertising," by A. C. Davis, manager Marietta and Parkersburg Telephone Company; "Shall We Standardize the Directory, and How Often Should It Be Published?" by H. Doudna, manager the Belmont Telephone Company; "Farm Line Development: How Can It Best Be Accomplished?" by S. G. Kissner, manager Coshocton Citizens' Telephone Company. In the 12 counties of this district there are 45 Independent companies, with 4,571 stockholders, operating 19,017 telephones, in comparison with 7,173 Bell telephones. J. B. Rhodes was re-elected vice-president of the district and was also made delegate to the National convention. Delegates to the state convention were chosen.

An increase from $10,000 to $25,000 in the capital stock of the Crooksville Telephone Company of Crooksville was made at the annual meeting, held a few days ago. Following are the officers elected at the same time: President J. B. Rhodes; vice-president, H. A. Skidmore; secretary, William Harris; treasurer, J. L. Bennett.

The Supreme Court has refused to grant a rehearing in the case of the city of Toledo against the Toledo Home Telephone Company, in which the question of the authority of the Probate Court to fix rates was decided in favor of the company.

The Eastwood Telephone Company of Elmore has been incorporated with a capital stock of $50,000 by J. E. Steinkamo and others.

The Unity Township Telephone Company of East Palestine has been incorporated with a capital stock of $8,000 by J. F. Johnston, M. W. Beyer and others.

Material began to arrive in Columbus last week for the new automatic switchboard of the Citizens' Telephone Company, and workmen went to work at once setting it up. It is expected the new plant will be in operation by June 1st. C.

## Indiana Telephone Items.

The Northwestern Telephone Company has been incorporated with a capital of $10,000 and proposes building an exchange in Chesterton and telephone lines throughout Lake County. A. G. Taylor, Charles Thompson and H. E. Vinnege are among the incorporators.

The Liberty Center Telephone Company has increased its capital stock from $2,500 to $25,000 for the purpose of extending its lines, installing modern equipments and improving the entire system. James P. Morrisey is president and E. M. Collier secretary.

The Eckerty, Cannelton and Branchville Telephone Company has applied for a franchise to enter Tell City.

The Central Union Telephone Company has petitioned for permission to construct conduits for its wires in the business section of Richmond. The plan is arousing considerable opposition. The council takes the ground that conduits when constructed should be controlled by the city and be used jointly by all the wire companies. The Home Telephone Company is opposed to the plan at present, but assures the council that in a year or so it will join in the construction of a joint conduit system. The petition is not likely to receive favorable action at present.

The Mutual Telephone Company of Shelbyville is considering an extensive improvement. An electrical engineer is at work preparing plans and specifications for an entire new plant, which will be an underground automatic system.

The Cities and Towns law recently enacted by the Legislature puts no limitation on the length of franchises that boards of works or city councils may grant to telephone and telegraph companies. As the bill was originally drawn it limited franchises to 25 years. This law and a law giving telephone or hydraulic companies power to condemn land for their poles are all the Legislature enacted that in any way affects telephone companies. S.

## Telephone News from the Northwest.

The Clearwater (Minn.) Telephone Company has completed a system and has made connections with the Northwestern toll lines.

The Northeastern South Dakota Telephone Association met at Brookings, S. D., March 1st. It consists of the owners of eight exchanges of cities of that neighborhood, and a rural line at Brookings. Officers elected were: President, P. R. Crothers of Hetland; vice-president, C. E. Pope of Estelline; secretary and treasurer, L. F. Lundy of Castlewood.

The West Wisconsin Telephone Company of Glenwood, Wis., will build a toll line to connect with the Hammond lines, giving connection with the Independent lines of St. Croix and Pierce counties; also with the Independent lines to St. Paul, Minneapolis and Duluth.

The Fulton Rural Telephone Company of Fulton, S. D., has been formed to build rural lines.

H. P. McConnell of Benson, Minn., is promoting the construction of farmers' telephone lines into Benson.

Milford, Iowa, will vote on March 27th on granting a 25-year franchise to the Midland Telephone Company.

The Torah (Minn.) Telephone and Improvement Company has been incorporated to install a local telephone and electric-light system and a waterworks system.

The Wisconsin Telephone Company will make improvements to its exchange in Oshkosh, Wis., to cost $12,000.

It is understood that the Twin City Telephone Company will build a local exchange at Excelsior, Minn., and other points on Lake Minnetonka, in competition with the Northwestern Telephone Exchange Company.

The Bronson (Iowa) Telephone Company has filed articles of incorporation, with a capital stock of $5,000. M. G. Smith heads the list of stockholders.

The Mid-western Electric Company has purchased the Davis County telephone system, with the main exchange at Bloomfield, Iowa. The price paid was $37,000. R.

## Telephone Extensions in Mexico.

The government of the state of Sinaloa will construct a telephone line between Culiacan and the port of Mazatlan. It has also decided to extend the state system of telephone lines to a number of towns in the northern part of the state.

Juan Woessner of Saltillo, who owns a concession which he obtained from the Mexican government for the construction of an extensive system of long-distance telephone lines in Northern Mexico, says that the line between Torreon and San Pedro and Durango will soon be finished. He is now installing an exchange at San Pedro and will soon install one at Durango. The line between Torreon and San Pedro is already completed. The distance between Torreon and Durango is about 175 miles. Mr. Woessner says that he will extend the line from San Pedro to Monterey, a distance of about 160 miles. He now has about 400 telephones in use in Torreon, Gomez Balacio, Lardo and upon the ranches of that section, and proposes to extend to many other towns in the states of Coahuila, Nuevo Leon and Durango.

T. F. Maguire, general manager of the Mexican Telephone Company, recently made a trip of inspection of the company's exchanges at Monterey, Tampico, Progreso, Merida and other towns. He says that many improvements will be made in all these places. A new switchboard is being installed at Monterey. The Monterey exchange now has about 900 subscribers. About 30,000 feet of new cable is also to be installed at Monterey.

Esteban Arreola will install a telephone system at Zapotlan. H.

## EXTENSIONS AND IMPROVEMENTS.

I. D. Clarke of the Independent Telephone Company, Columbus, Neb., says that long-distance connections will soon be made with Lincoln and Omaha.

Long-distance lines of the Fort Worth Telephone Company, Fort Worth, Texas, have recently been extended to Adell, Advance, Agnes, Anthen, Azle, Boyd, Carter, Cundiff, Gibtown, Groveland, Hartford, Jacksboro, Joplin, Knob, Mineral Wells, Opal, Peaster, Poolville, Roberts, Reno, Sebro, Veal Station, Weatherford and Whitt.

The York Telephone Company is making extensive improvements between York, Pa., and Red Lion. Another cable of 40 wires has been strung for the benefit of the business men of the latter place. The York company is popular in the territory it serves and its business outlook for the future is encouraging.

## GENERAL TELEPHONE NEWS.

I. H. Schwalin has opened a new telephone exchange at Osage City, Kan.

The Republican Valley Telephone Company has been incorporated, with headquarters at Bostwick, Neb.

The Independent Telephone Company has applied for a franchise to operate its system at American Fork, Utah.

Arthur Hawkinson has purchased the business of the Westmoreland Telephone Company at Westmoreland, Kan.

The county commissioners at Spokane, Wash., have granted a franchise to the Mica Creek Telephone Company.

The Dover and Kiel Rural Telephone Company of Kingfisher, Okla., has been incorporated with a capital stock of $5,000.

Citizens of Macleay, Ore., have organized for the purpose of installing a telephone system in that town. John Craig is president of the organization.

The Elk Mountain Mutual Telephone Company of Steamboat Springs, Colo., has been incorporated with a capital of $37,500 by Archie Wither and others.

The Home Telephone Company of Rockford, Ill., is considering the installation of an automatic system of telephones. E. W. Brown was recently elected president of the company.

Property on Light Street, Baltimore, Md., has been purchased by the Chesapeake and Potomac Telephone Company (Bell), on which will be erected a telephone exchange and office building.

The Bethel Telephone Company of Eugene, Ore., intends to construct a telephone line from Eugene to Bethel and will extend lines to other points as desired. Mark T. Fleming, Charles K. Compp and M. A. Bitgood are members of the company.

The Mexico American Mining and Development Company of Torreon, Mex., intends to construct a telephone line to connect the smelter and different mines at Velardena. Phil Head, a prominent electrical engineer of Torreon, has secured the contract.

Considerable trouble has been caused the Michigan State Telephone Company by the presence of an illuminating gas in its conduits. Recently three manhole covers were blown off by the explosion of this gas, the effects of which were felt for several blocks.

The organization of the Cumberland River Telephone Company has been completed, the company proposing to construct a telephone line from Barbourville, Ky., to Keely, Tenn. John Woodward is president and general manager and T. R. Benjamin, secretary and treasurer.

Dr. W. T. Crawford, J. R. Kennedy and others of Fresno, Cal., are interested in a project to construct an Independent telephone line in Fresno County. It is proposed to run a line to Lone Star, Oleander and eventually to Easton and five miles south of the Wild Flower road.

The Mount Burney Rural Telephone Company of Burney Valley, Cal., has filed articles of incorporation at Redding, Cal. There are 40 members of the corporation, all residents of Burney Valley and Fall River Valley. The object of the company is to maintain a telephone line from Montgomery Creek to Pittville, with branches through Hat Creek and Grass Valley, Cal.

## MANUFACTURERS AND DEALERS.

The Stromberg-Carlson Telephone Manufacturing Company has closed contracts for switchboards, to be placed at Ames, Iowa; Liberty, Ill.; Daykins, Neb.; Higginsville, Mo.; Ashton, Ill.; Sheffield, Ill.; Walnut, Ill.; Lamoille, Ill., and Buffalogap, S. D.

At the annual meeting of the Strowger Automatic Telephone Company two changes were made in the board of directors. F. Siegel succeeded his brother J. Siegel and C. C. Wheeler succeeded A. G. Wheeler, Jr., the latter having moved to New York. The directors, after the stockholders' meeting, elected officers as follows: President, J. L. Kesner; vice-president, C. C. Wheeler; treasurer, F. Siegel; assistant treasurer, Sanford F. Harris; secretary, M. Sello.

The American Electric Telephone Company has just shipped an additional increase of capacity consisting of one section of multiple switchboard for the Independent exchange at Springfield, Mo. This is the second increase made since the original installation. The Springfield company reports a brisk demand for telephones, and it became necessary to increase the capacity of the switchboard a full section. The Independent Telephone Company of Topeka, Kan., has also recently ordered an additional equipment of private branch-exchange switchboards from the American Electric Telephone Company, the Topeka company having secured the contracts for equipping most of the hotels in that city with this class of service.

## Recovering Tin Scrap and Slag.

By George E. Walsh.

The recovery of tin scrap and slag by the electrolytic method is rapidly developing into an industry that represents investments of considerable amounts, and works for treating both scrap and slag erected in this country and Europe indicate profitable exploitation of this comparatively new field. The demand for the raw material has steadily increased in this country, and tin scrap is frequently reported in New York at $5 a ton. Considerable supplies of tin cuttings and scrap are purchased in that city for export for the recovery plants of France and Germany, and, owing to this competition of foreign buyers, prices are much higher than formerly.

The future of the tin-scrap-recovery industry by the electrolytic process depends upon a number of considerations, the chief of which is the relative cost of electric current and the market for by-products. In the treatment of tin scrap it has been found that the average of only 3.5 per cent. of tin is recovered and 96.5 per cent. of iron. The result is that much more ferrous sulphate is produced than metallic tin. At present the market for ferrous sulphate is not extensive. In the ordinary recovery process it takes nearly 30 tons of scrap to produce one ton of metallic tin, while some 70 tons of crystalline ferrous sulphate are produced. With a good market for the latter, the tin-scrap-recovery factories would instantly prove of great commercial value.

The amount of tin scrap wasted each year in our large cities is enormous, but improved methods of collecting the tin cans and other tin scrap are gradually eliminating this waste. With better systems of collection and distribution of scrap cuttings, the cost of the raw material will be reduced, so that profits will be enhanced. The tin waste of a large city like New York is generally sufficient to keep a plant in operation the year round, and the cost of carting direct to the factory within the limited territory should make first cost of raw material small.

The different electrolytic recovery processes for treating tin-scrap cuttings and slag are covered by patents in the different countries, but many of them differ so slightly that descriptions of details are often unnecessary. One of the early tin-scrap-recovery factories was started in the suburbs of London in 1898, and was operated under the Claus process until the concern failed. The electrolytic bath in this process was composed of sulpho-stannate of sodium, and the tin scrap was used as the anode. There was a fatal defect in this method, which probably accounted for its non-success. Such impurities as arsenic and antimony, when they occurred in the tin, had to be removed by a second process. As a good portion of tin scrap contains these impurities, it was really necessary to pass the tin through another bath of hydrochloric acid and hyposulphite of soda to precipitate the arsenic and antimony in the form of sulphides. The factory operating under this process had sufficient available supply of tin scrap gathered from the city of London, but it could not satisfactorily demonstrate its value.

At Essen, Germany, one of the largest and most successful tin-scrap factories has been in successful operation for a number of years. This plant is known as the Goldschmidt Tin Recovery Works, and is operated under the Goldschmidt patents obtained in Germany, England and America. The total capacity of the works today is over 15,000 tons of scrap a year, or nearly 50 tons a day. The supply of tin scrap is collected systematically all over Germany for this factory and delivered directly to the plant by railroad cars. The generating plant for operating the works is of modern type and well equipped for producing current at low cost. In the Essen tin-recovery plant the alkaline process of treating the scrap is employed. There are several alkaline electrolytic processes used in different factories, and most of them have some secret methods which are not given to the public. This is the case with the Germany plant at Essen. What little is known of the process is that sodium hydrate is used for the electrolyte, and the tin scrap forms the anode in the usual manner. The tin scrap is placed in a huge receptacle or basket, and current of varying power is turned on to dissolve the tin and iron.

When tin scrap is used as the anode in a bath of sodium hydrate, the usual amount of current employed is 10 amperes at 1½ volts to deposit 11.12 grammes of tin per hour. In this process the electrolyte can be used continuously for a considerable time without renewal. The accumulation of impurities in the sodium-hydrate solution is very slow,

[illegible] melting must be performed in a vacuum or in a chamber filled with some inert gas. So difficult is this process of refining and working into marketable shape that some of the tin, in the form of oxide, is lost. Sometimes this loss of oxide is 10 per cent. of the amount.

In the different acid processes of recovering tin scrap, the amount of current used is not necessarily much larger, but the electrolyte must be renewed after each process. The acid is used up in dissolving the iron, and chloride or solution of ferrous sulphate is obtained. So long as this product is not in general demand for commercial or industrial purposes, the acid process of tin recovery must prove of less value than the alkaline. According to the average estimate of a number of plants employing the sodium-stannate solution for the electrolyte, it takes about 2,500 kilowatt-hours to yield one metric ton of pure tin. If the cost of the current is low, the expense of producing a ton of pure tin from scrap should represent from 10 to 15 per cent. of the market value of the metal.

Several of the tin-recovery plants in Austria and Germany use the alkaline process, but various solutions are employed for the electrolyte. In some of them hot caustic-soda solution is employed for the electrolyte, the solution usually being from 10 to 20 per cent. strong and heated at a temperature of 60 to 70 degrees Centigrade. With a current of 800 amperes at eight volts, from 10 to 12 tons of scrap could be treated in a week. The scrap and tin cuttings are used as anodes after being placed in flat iron boxes, with thin iron plates for the cathodes. The tin obtained in this way is generally in powdery form, which later must be pressed into flat cakes, and used in a second vat, in which chloride or sulphate stannate is used for the electrolyte. The tin deposits are then in a more dense and solid state, which can be finally melted and cast into ingots. The first process merely dissolves the tin and does not attack the iron.

In the Garcia process of tin recovery no electric current is employed, but there is no account of this ever having proved commercially profitable. The tin is dissolved by using a pure solution of ferric chloride. By immersing the scrap in hot ferric-chloride solution for three minutes, the tin is dissolved; but after that the solution has to be filtered and carbolic acid and sulphuric acid added. Then, by the electrolytic process, with carbon and lead anodes and cathodes, the pure tin deposits are obtained. These are then washed with water and petroleum, and finally cast into ingots. The process appears somewhat clumsy and intricate, and a London company formed to operate under the Garcia patents failed several years ago, without commercially proving the value of the process.

In utilizing any of the electrolytic processes for the recovery of tin slag a good deal of trouble has been experienced, and a number of failures recorded. A number of small recovery plants have been in operation in Germany and Austria, and, apparently, they are profitable. One of the first attempts to use sulphuric acid for recovering tin was made in France a number of years ago. Several German patents cover this and similar processes. The scrap tin was packed in wooden baskets or crates, and then immersed in the electrolyte of dilute sulphuric acid and tin sulphate. The proportion of these two is about one in 10. Tinned copper sheets were used as cathodes, while the tin scrap formed the anode. With an electromotive force of 1.9 volts and nine amperes of current the iron and tin were dissolved in the electrolyte. The electrolyte could be used for nearly two months before it became so saturated with ferrous sulphate that its renewal was necessary.

In treating tin slag as raw material a similar electrolytic process is employed with dilute sulphuric acid. After being dissolved the tin is recovered from the solution by electrolytic deposition. But by this process the loss in tin is still quite pronounced. The silicious slag residue carries a certain amount of tin with it, but by a process of using this for the hearths of the smelting furnaces the tin enters the process again at another stage. The treatment of the granulated tin slag can be carried on with success where the silicious slag residues can be employed over again in this way.

Although it is doubtful if permanent success can be attained by using any of the acids of mixtures

of acids as electrolytes until ferrous sulphate or chloride can be commercially sold on a large scale, it is interesting to note some of the other processes experimented with acid electrolytes. One of these processes is known as the Gelstharpe method, and it was employed in England for a time with fair success. As in the former case, where sulphuric acid was employed, the scrap and cuttings were packed in wooden crates and immersed in an electrolyte bath of 1.25 per cent. solution of hydrochloric acid. To this was further added an infinitesimal amount of sulphuric acid to increase the electrolytic process. The cathode was composed of tinned sheets. The tin was deposited and then washed for melting and casting in ingots. Special furnace designs were made to save time and money in this process of melting. In the Manchester (England) recovery plant using this process a direct-current dynamo of 1,500 amperes at five volts was employed. This dynamo, however, supplied current not only for the electrolytic process, but for four stripping tanks and the depositing plant. As in all the other acid processes, the iron remaining after the tin was recovered, had to be worked up into crystalline ferrous sulphate, which, with a very small valuation as a by-product, barely paid for the extra work of preparing it for market.

With the alkaline electrolytic process for recovering tin from scrap and slag steadily developing, it is likely to add a good deal to the valuation of waste tin and slag. Several new plants have been established in this country, Germany and England for recovering tin from waste by some of the alkaline processes. The process is cheap and not intricate, and as an adjunct to tinning plants and mines a recovery factory should prove profitable. The amount of current used is comparatively small and the number of workmen needed limited to only a few. The chief trouble is to secure the supplies of raw material at little cost. Where the local supply is sufficient to keep the plant going continuously the question of profits is easily answered. At present tin scrap is collected at some of our seaport cities and shipped to Germany for use in the recovery plants, and apparently this can be done successfully so as to leave a margin for profits. Until there was a home demand for such tin scrap the cost of the raw material was only a little more than that paid for shipping and for labor in collecting the material. Competition, however, has sent the price of tin scrap up to such figures that both Germany and England are finding it more difficult to secure raw supplies from abroad at reasonable cost. Several plants that formerly depended upon supplies of scrap gathered from the Atlantic seaboard have shut down in recent years because of their inability to secure tin scrap in satisfactory quantities and cost.

No country in the world uses more canned goods than our own, and the waste tin scrap obtained from this source, if it could be systematically and profitably collected, would be sufficient to keep a score of tin-recovery plants in active operation all the year round. The more general collection and separation of tin articles from the waste and sweepings of our large cities are gradually making the difficulties of obtaining regular supplies of tin scrap by factories less apparent. The purchase of such scrap direct from city street-cleaning departments should prove of advantage to the cities and the tin-recovery plants. The cost of transporting the tin scrap any great distance by rail or boat practically precludes any but local recovery plants utilizing the waste.

## Extensive Plans in Baltimore.

Financial writers report that the filing of the mortgage of $47,500,000 by the Baltimore Electric Power Company discloses the financial plan and other details in connection with the building of the new electric light and power plant under the franchise given to the Maryland Telephone and Telegraph Company. The mortgage is made to the Northern Trust Company of Philadelphia, and covers an issue of 34-year five per cent. gold bonds. The proceeds of the bonds will be used to build the new plant, to retire first-mortgage bonds, to retire general mortgage bonds of the Maryland company, to retire ground rents, and for the extension of electric power and telephone plants. The mortgage is a first lien on the new electric-light and power plant and a lien after the other bonds of the Maryland Telephone Company. These latter bonds will be retired. The Baltimore Electric Power Company absorbs the Maryland Telephone and Telegraph Company, as 85 per cent. of the $1,000,000 of capital stoock of that company goes under the new mortgage. The Baltimore Electric Power Company has a capital stock of $2,500,000, making in all a capitalization of $10,000,000, covering both the electric power and telephone properties.

## Telegraphs and Telephones in Spain.

At the beginning of the year 1904 telegraph lines in Spain had reached the extent of 18,176 miles of overhead wires, 65 miles of cables and 2,044 miles of submarine cables. There were 850 government stations, 572 pertaining to railroad companies but maintained for public service, 167 municipal stations, 17 private, and, strangely enough, 12 semaphores. The personnel of the service consisted of 133 superiors, 2,019 subordinates and 908 assistants. During the year 1904 the number of domestic messages of all kinds reached a total of 3,549,978, and the foreign messages, received and transmitted, numbered 1,293,911.

Public telephones installed by private companies numbered 15,003 at the beginning of 1904, of which 52 were central, 27 branch and 14,924 subscribers instruments. The public telephone lines directed by the government were ten in number, comprising 676 stations, distributed in the towns of Córdoba, Murcia, Oviedo, Gijón, Mieres, Pola de Siero, Sama, Trubia and León. There were 13 long-distance lines, with stations at Madrid, Segovia, San Ildefonso, Alcalá de Henares, Guadalajara, Escorial, Jetafe, Toledo, Oviedo, Mieres, Pola de Siero, Sama and Trubia. Official telephone lines, seven in number, were also established at Avila, Bilbao, Madrid, San Sebastian, Segovia, Tortosa and Vich and comprise, besides centrals, 187 installations. There were 1,096 private lines with 2,138 stations. The total number of telephone installations operating in Spain at the close of 1903 was 17,349.

Receipts derived from both domestic and foreign telegraph services were $759,991 and $316,648, respectively, while the receipts from the telephone service were $125,373, making the total proceeds to the treasury from these two sources $1,202,012.

## BOOK TABLE.

Study of Electricity for Beginners. (In four numbers). By Norman H. Schneider. New York: Spon & Chamberlain. 1905. Pp (4¾ by 7¼ inches), 88, 59, 72 and 63, with 54, 30, 217 and 59 illustrations, respectively. Price, 25 cents each.

Electricity applied to everyday practical work is dealt with in these four little books, and for those who desire to spend their spare moments in the construction of simple electrical devices the books will be found useful. "The Study of Electricity for Beginners" (No. 1) gives a short review of the primary laws of electricity in terms understandable by the layman. Mathematics are avoided as far as possible and examples are given, worked out in simple arithmetic. Number 2 describes the dry battery, its construction and the various uses to which it may be put, such as bell work, Christmas-tree lighting and the like. Number 3 is devoted entirely to wiring diagrams of circuits met with in common applications of electricity from the wiring of telephones, automobiles and motors in general to that of space-telegraph apparatus. The last book, No. 4, tells how to connect electric bells, annunciators and alarms and is intended for the use of those who desire to install their own apparatus of this sort and to be able to locate and remedy any trouble affecting it. No apparatus is described which is not readily procurable. Altogether the series contains a large amount of data prepared in a manner to make it useful in work of a practical nature.

## Gigantic Frequency-changer at Shawinigan Falls in Operation.

A brief description was given in the Western Electrician last week of the gigantic frequency-changer installed at the plant of the Shawinigan Water and Power Company. The big machine has since been put in operation and some additional facts concerning it are here given: The total length is 30 feet, and the motor and the generator are each 15 feet high. The total weight is 500,000 pounds or 250 tons. The middle pedestal alone weighs 34,000 pounds. The motor has 10 poles, each weighing 2,200 pounds, and the generator 20 poles, each weighing 1,300 pounds. These poles, aggregating 48,000 pounds, revolve at 300 revolutions a minute. The motor rotor weighs 72,560 pounds and the generator rotor 76,700 pounds. The section of the shaft between the two weighs 12,000 pounds. The bottom half of the motor stator weighs 54,000 pounds and the bottom half of the generator stator 42,000 pounds. Nine railway cars were required to transfer the material. The set is composed of a 7,500-horsepower motor, driving a 5,300-kilowatt generator, and approximates 14,600 horsepower.

Writing of commercial and industrial conditions in Germany, Consul H. W. Harris at Mannheim, Germany says: "In face of extensive improvements in the steam-railway lines of this district during the last year there is a singular backwardness in electric-railway building, especially in suburban and interurban lines. State-railway ownership and the difficulty in securing charters for private railways have in part caused this backwardness in electric-railway construction. The city lines now in operation are well built and are reported to be yielding fair incomes. The future will doubtless see a new impulse given to electric-railway building in the thickly settled portions of this part of Germany."

# CORRESPONDENCE.

## New York.

New York, March 11.—The lighting question was advanced a step on Tuesday, when the Board of Aldermen passed a resolution appropriating $600,000 to buy a site for a generating station. At the same sitting it was stated that the lighting companies had made a proposition to the city that if the city would drop its municipal-lighting scheme they would supply underground-feed 2,000-candle-power arc lamps for $120 a year, as compared with the old rate of $146, but the companies also want outstanding bills settled at the old rate. Both the action of the aldermen and the offer of the companies are being criticized.

At four o'clock on Tuesday morning about 7,000 employes of the Interborough Rapid Transit Company went out on strike, with the result that throughout the whole of the day the traffic on the New York subway and elevated was practically at a standstill, no pretense being made to run the ordinary trains on several of the lines. The main dispute concerned the wages and hours of the motormen. With respect to the wages, which are $3.50 a day for motormen, very little has been said, but on the point of a demand for less than a 10-hour day some little public sympathy was at first expressed for the men, as being an important factor in the safe working of the traffic, especially on the subway. When, however, it was alleged that the men had broken a previous contract with the company, and the public found how highly inconvenient it was to travel without the usual means of transit, popular sympathy went away entirely from the strikers. The Interborough company, under General Manager Hedley, took prompt measures to meet the situation. James Farley and his "strike breakers" were soon on hand, and hundreds of extra men, including not a few college students, were pressed into the service, and by Wednesday evening traffic on both the subway and elevated systems was fairly regular, though far from frequent. Conditions were improved from hour to hour thereafter, and at the time of writing the ordinary schedules are in operation on nearly every line. In consequence of the difficulties attendant upon the employment of so many hundreds of new men, not a few mishaps have occurred. President August Belmont has been in Florida during the period of the strike, but today he telegraphed to New York an instruction that two weeks' pay should be given to all men who had remained faithful to the company during the last few days. The strike in no way affected any other lines in the city.

The comprehensive subway plans recently published by the rapid-transit commissioners have been advanced a step this week, and five specified routes are now indicated as those most favored by the official critics. Two of these are alternative routes affecting Lexington Avenue; another will connect the Williamsburgh Bridge and East New York; the fourth is planned from East Fourteenth Street, Manhattan, under the East River, to Broadway, Brooklyn, and the fifth is from the Manhattan end of Williamsburgh Bridge, downtown, and under the East River, to Fulton Street, Brooklyn. The main lines of all these proposed subways will have four tracks above Fourteenth Street, and double tracks below.

Formal notice has been served upon the New York City railway, the Manhattan Elevated railroad, the New York Central railroad, the Western Union Telegraph Company, and some other corporations for the payment of the outstanding franchise taxes for the last three years. These taxes are leviable under the Ford franchise-tax law, but since the tax was instituted none of the corporations concerned has paid. The matter has been fought from court to court, and is now awaiting action by the United States Supreme Court, it being alleged that the tax is unconstitutional, although it is not contrary to the state constitution. The total amount due to the city, and collectable, exceeds $13,000,000, and if nothing intercepts the pending processes it will have to be paid before June 9th next, or the city will proceed to sell the franchises at public auction.

The official and legal obstacles in the way of the plans for the enlargement of the Grand Central Station on Forty-second Street have been removed, the question of encroachments on city property having been amicably arranged. It will require at least three years to carry out the work, which is in connection with the pending electrical equipment of the New York Central railroad.

The Merchants' Association, a body which of late has indulged in many speculative plans, is now considering, under the generalship of Architect Charles R. Lamb, a scheme for a freight subway, to encircle the lower part of Manhattan, giving connections with the ferries and terminals of various railroads.

The attacks at Albany upon the New York Telephone Company, in the matter of lower local rates, is likely, according to some gossip in the New York Tribune, to induce the company to lower its rates all around by 20 per cent. If this is really the case, the bill now up at Albany will probably be dropped.

D. W. W.

## Dominion of Canada.

Winnipeg, Man., March 11. The city of St. Thomas and the Southwestern Traction Company have come to agreement by which the city accepts the company's offer for the use of the St. Thomas street railway through the streets. The company has received a 50-year franchise and makes an agreement for 25 years to pay the city $1,500 per year per mile for the first five years and increasing to $1,750 for the last five years. The company will collect no fares in the city, pay the cost of the power, and pay one-half of the cost of maintaining the tracks.

The Winnipeg Electric Street Railway Company is to be assessed as its part of the cost of the bridges to be built over the Red River at the north end and center of the city according to the amount of space taken up by the tracks on the bridges. The building of these bridges, which will cost about $100,000 each, will have a marked effect on the extensions of this electric railway, as it will take in a large suburban district not otherwise served, and as all the municipalities are in accord in the matter of extension, a lot of work may be looked forward to in the coming spring and summer.

The city engineer of Toronto has reported to the Board of Control that the estimated cost of installing a municipal electric plant, with alternating current sufficient to keep up 1,500 arc lights, would be $648,000, which includes buildings, but not land. If the power were obtained from Niagara, the cost of lighting would be $475,000.

The West Kootenay Power and Light Company of Rossland, B. C., has commenced an elaborate scheme of development of the upper falls of the Kootenay River at Bonnington, by which it is intended to harness the waterpower at that point to an extent never before contemplated in Canada.

The North Bay (Ont.) Light, Heat and Power Company, with a capital of $50,000, has been organized to generate and distribute electricity and gas, for light and power, with incidental and subsidiary powers. The provisional directors are T. Wallace, J. T. Lovell, W. Martin, Sr., A. F. Leggatt and W. Martin, Jr.

The council of Carberry, Man., favors the establishment of an electric plant in Carberry, and negotiations to that end are being carried on with Mr. Bois of Portage la Prairie, Man.

The street-railway company of Kingston, Ont., has passed into the hands of a receiver, appointed by the bondholders, who hold a mortgage for over $150,000; Hugh Nickle, the present superintendent, will assume the management. Since the railway lost the light and power plant the line has not paid. The street railway has had a profitless winter, owing to the heavy snowstorms. Now the bondholders have taken over the railway and ordered the trustees not to continue running the cars if they are run at a loss. Such is now the case, and therefore, unless the city gives power at less than cost for at least six months more, the people will have to walk and the road will be sold. If it is to be run as a going concern, a less stringent agreement must be drawn. The whole question is now in the hands of a civic committee of the City Council, which will make a special report to the council. H.

## New England.

Boston, March 11.—Contracts have been let thus far for the construction of four of the sections of the Washington Street subway and tunnel in this city. Excavating work is under way and is being carried on beneath plank coverings that are so propped up that surface traffic is unimpeded. This is the same method that was so successfully adopted in the construction of much of the work under business thoroughfares while the former subways were in process. In some places excavation work goes 10 to 15 feet below the level of building foundations along the route, and a big item of cost is the necessary work of propping and insuring the safety of big mercantile structures.

The Boston Elevated Street Railway Company officials and the mayor of the city of Cambridge have reached a tentative agreement for a subway instead of an elevated structure in Cambridge on that portion of the authorized route which approaches Harvard Square and the university site. The college authorities were particularly solicitous lest the streets adjacent to the university property should be disfigured by an overhead structure, and the element of noise also gave much concern. If the new plan is adopted there will be general satisfaction, it is believed.

An important matter is pending in the Legislature in the shape of a bill to authorize steam railroads to acquire street-railway properties. The example of the New York, New Haven and Hartford Railroad Corporation in acquiring so many railways which parallel its lines in Connecticut is contagious. The road has its eye also on some of the Massachusetts railway systems which compete with its lines in this state, and the Boston and Maine railroad is also eyeing some of its street-railway competitors with an acquisitive glance. It is believed that the bill stands a good chance of success, in view of the fact that it has been drawn so as to eliminate stock-watering and jobbing evils.

The Boston Elevated Street Railway Company asks authority from the Railroad Commission to [illegible] the $7,500,000 [illegible] per cent [illegible] for elevated [illegible] debt.

In its different damage [illegible] against the Boston Elevated Street Railway Company verdicts favorable to the plaintiffs were rendered in the courts last Saturday. The aggregate awards were $7,700.

The Georgetown, Rowley and Ipswich and the Haverhill, Georgetown and Danvers street-railway companies want to consolidate, and the matter is pending before the Railroad Commission, a hearing having been given this week on the project. The total capitalization of the consolidated company will be $240,000, and the length of the system operated will be 26 miles.

The Lorain Steel Company of Lorain, Ohio, was awarded the sum of $21,800, as the result of its suit against the Norfolk and Bristol Street Railway Company, by the full bench of the Supreme Court last Saturday. The bill of the Ohio company was for rails and other equipment.

The car barns of the Manchester (N. H.) Traction Company were burned on March 4th. The buildings, rolling stock and other equipment were all consumed, and the loss will reach about $150,000. H.

## Michigan.

Detroit, March 11.—The town of Deerfield endeavored to raise $10,000 to secure the Toledo and Ann Arbor electric railway and also the power house and car shops. It was found, however, that the town cannot be legally bonded for the amount necessary. Committees have been formed and $9,000 has been raised by subscription.

The Detroit Omnibus Company, it is reported, has decided to discontinue the use of horses and install automobile delivery wagons to handle its business of delivering baggage. A trial demonstrated that an automobile delivery wagon could handle in 50 minutes what had formerly taken two hours for the horse wagons.

Morton B. Wheeler and others of the White River Power Company have purchased the franchise granted to the Thornapple Electric Company for the construction of an electric plant and the furnishing of light. It is understood that the latter company will begin active operations.

The Manistee, Filer City and East Lake electric railroad has been sold by the master in chancery to Walter H. Trumbull of Salem, Mass., who represents the bondholders. His bid was $51,000, just enough to comply with the order of the court, and was the only bid made. It is probable that a new company will be organized to manage the road. It is also stated that possibly the Sands electric-lighting plant will be acquired and operated with it. This property has been under the receivership of the Michigan Trust Company of Grand Rapids for the last 15 months, during which time the property has been much improved.

The Grand Rapids, Holland and Lake Michigan interurban railway has recently placed an order with a St. Louis firm for a number of open cars to be used in the summer months. These cars are similar in construction to the cars now operated by the Grand Rapids street-car system.

A bill has been passed in the Michigan Legislature giving the right to street railways, gas and electric-lighting companies to consolidate in Marquette, Muskegon, Newaygo, Allegan, Jackson, Kalamazoo, Calhoun and Houghton counties. It provides that the minority stockholders who object to consolidation may be forced to submit by taking the matter to court and receiving payment for their stock at an appraiser's price. Governor Warner has not signed this bill and considerable influence is being brought to bear upon him not to do so. The Kalamazoo Valley Electric Company, which owns many concerns, is said by some to be benefited by the bill.

The Detroit, Monroe and Toledo will soon install another innovation in its car service in the way of chair cars, for which an additional charge will be made. The cars will run between the Russell House in Detroit to the Boody House in Toledo within two hours. This company is also preparing to run these cars in trains under multiple-unit control.

The city of Albion has just turned down a 30-year electric-light franchise proposed by the Jackson-Battle Creek Traction Company. Fault is also found with the present service from the gas plant which is owned by Grand Rapids persons and operated under a 30-year franchise granted in 1895.

It is proposed to put through a bill in the Legislature prohibiting the purchase of one electric railway by a competing line and also preventing any steam road from buying an electric line and operating it under the provision of the new law. At present there is no law providing for the organization and operation of interurban and suburban electric lines in the state of Michigan, and most of these companies now organize under the steam-railroad act and some under the tramway or street-railway law. It is now proposed to enact legislation covering the existing new class of transportation concerns.

The capital stock of electric railways in this state is now given as $34,000,000, and the actual value of the roads $45,000,000. The statistics of the labor commissioner show that the electric lines received [illegible] outside of the cities.

## Ohio.

[illegible] in that location. It is surmised that the company will build a freight and express depot on the land, with entrances from at least three streets, but the officers have not confirmed this as yet. Whether the supposed plans include a passenger station is not known.

It is said that the Columbus Railway and Light Company is negotiating for a lease on the property of the Columbus Gas Light and Heating Company, now that John G. Deshler has retired as the head of the latter, and that the trade will shortly be closed. It is further said that the railway and light company is after a lease on the property of the Public Service Company, but officials of the latter deny this. The older company is making an endeavor to secure all the public-service plants in the city, if possible.

W. H. MacAllister, treasurer of the Cincinnati Traction Company, has been made comptroller of the company, a new position. A. L. Kasemeier has been made treasurer. Mr. MacAllister will have complete charge of the auditing and treasury department.

The people of Arcanum have voted to bond the corporation for electric lights and waterworks.

The Cleveland Electric Railway Company, the Cleveland Electric Illuminating Company, Cleveland Gas Light and Coke Company and the People's Gas Company have filed an answer in the case brought against them by the county treasurer to collect increased taxes, claiming that the county auditor has no right to make the additions or alter the figures made by the Board of Review.

The Public Service Company of Maumee has been incorporated with a capital stock of $40,000. George McGovern, James H. Ragan, Thomas H. Harper, Nelson Shugars and C. W. McCutchan are the incorporators. A plant supplying heat, light and power will be furnished by the company.

Ties and other material have been purchased for the extension of the Toledo, Fostoria and Findlay road to Pemberville, a distance of 17 miles. The company has increased the fare between Findlay and Fostoria from 25 to 30 cents.

M. J. Randel has been appointed receiver for the electrical firm of Wingate & Brooks, whose store is located on the Public Square in Cleveland.

Plans are now being drawn for the power house of the Toledo, Port Clinton and Lakeside road, although the location has not yet been decided upon. The building will be 100 by 90 feet, and the machinery to be installed will cost about $120,000.

Suit has been brought against the county treasurer to enjoin the collection of taxes for the purpose of paying bonds issued for an electric-light plant at Cridersville. It is alleged that the issue was authorized by a special act of the Legislature, that the act was not general in its nature, and is therefore unconstitutional.

It is said that the steam roads in the northern part of the state will make a fight against the traction lines for the short-haul business. It is reported that the Lake Shore has already reduced its fare to several points reached by the traction roads.

The Muskingum, Coshocton and Tuscarawas Electric Railway Company of Zanesville has been incorporated with a capital stock of $10,000 by W. F. Koontz and others.

It is the general impression that the Cleveland Electric Railway Company is willing to construct a subway at a cost of $2,000,000, bringing the cars through the business district of the city to the Public Square, then retire the bonds and turn the improvement over to the city. It is said that William Barclay Parsons of New York has been asked by John J. Stanley of the Cleveland company to prepare plans for such a subway. O. M. C.

## Indiana.

Indianapolis, March 11.—The first step in a project to build an air-line traction railway between Indianapolis and Chicago was taken this week in the filing of articles of incorporation by the Indianapolis and Chicago Air Line Traction Company. The company is capitalized at $1,000,000. The promoters say that the line will be shorter than any now in operation between the two terminal cities. Among those interested are G. B. King, W. S. Taylor, H. S. Leonard, J. A. Shafer and John Ferger of Indianapolis; C. J. Raub, Chalmers; C. F. Knowlton, Pennville; J. J. Gibson, Alexandria; A. J. Behymer, Elwood, and J. W. Alderman of Chicago.

The annual meeting of the Indiana Union Traction Company, the Union Traction Company of Indiana and the Indianapolis Northern Traction Company was held in the general offices of the allied companies in Anderson on March 7th. The comptroller made a report showing that the receipts from

all sources for the year 1904 were $1,341,236; operating expenses, $731,328; net income, $609,907; fixed charges, including dividends upon annexed property, stock dividends and rentals, $591,453; surplus for the year, $18,454. According to the report the increase in earnings over that of 1903 was about $325,000, during which time the line of the Indianapolis Northern Traction Company was completed. The matter of building a car shop in Anderson was considered, but the final arrangements deferred until the meeting to be held in Philadelphia next week.

The Board of Commissioners of Grant County has granted a franchise to the Marion and Eastern Traction Company to construct an interurban electric railway from Marion to Warren. The company filed a bond to have the road completed and in operation within one year.

Within the last five weeks 11 township subsidy elections have been held in different parts of the state, and at least seven or eight more are to be held during this month and next. In addition to the lively contest in Wabash County subsidy elections will be held in two townships of Spencer County, one in Tippecanoe County, and one in Clinton County in a short time to vote a tax in aid of interurban roads.

Word comes from Paris, Ill., that the ties and rails are being distributed along the line of the Terre Haute and Paris line and that the builders expect to have the line in operation by June 15th.

A delegation of traction men of Toledo, Cleveland, Dayton and Akron, Ohio, headed by H. A. Everett of Cleveland, the head of a big syndicate, visited Indianapolis on March 10th to inspect the terminal station, the local street-railway lines and the lines of the numerous interurban companies centering in Indianapolis. The Everett syndicate is planning to construct new terminal stations in Toledo and Detroit, and they say there is nothing to equal the Indianapolis station in the country. Those in the visiting party were H. A. Everett of Cleveland, J. C. Hutchins of Detroit, Charles W. Wasson of Cleveland, Charles Curie of Akron, L. E. Beilstein of Toledo, Warren Becknell of Cleveland, Valentine Winters of Dayton and J. S. Ross of Cleveland.

George B. Markle of Hazelton, Pa., has purchased the General Gas, Electric Light and Power plant at Connersville. Mr. Markle announces that he will spend a large sum of money in improvements and betterments.

Walter Ramsey has formed the American Arc Lamp Company, which succeeds to the business of the Lea Electric Manufacturing Company of Elwood. There is a possibility of removing the factory to Kalamazoo, Mich.

The F. H. Cheyne Electric Company of Indianapolis has been incorporated with a capital stock of $20,000. The company will do a general electrical manufacturing business. F. H. Cheyne, R. R. Ferry and G. A. Fischer are the directors. S. S.

## Texas.

Austin, Tex., March 11.—The Houston-Galveston Electric Railway Company, which was organized a few days ago with a capital stock of $1,350,000 for the purpose of building and operating an interurban electric railway between Houston and Galveston, has no connection whatever with the Houston-Galveston Interurban Railway Company, which was organized some time ago for the same purpose. The members of the board of directors of the new company are Frank P. Read, William Johnston, George L. Horton and A. D. Trotter, all of Houston. These men are all connected with the contracting firm of Johnston & Read of St. Elmo, Ill., which is doing the construction work in Texas for the Frisco railroad system. David M. Duller is chief engineer. The work of making the survey for the road has been commenced. The proposed road will be about 54 miles long. Application will be made to the cities of Houston and Galveston for franchises for the use of streets.

Edward Merrick and A. J. Morgan have taken the necessary preliminary steps looking to the construction and operation of an electric street-railway system in San Angelo.

The Hamilton Light and Ice Company has been organized at Hamilton with a capital stock of $20,000 for the purpose of establishing an electric-light and ice plant. C. Schuwirth of Dallas is interested. The company has a capital stock of $20,000.

The project of building an interurban electric railway between Austin and Fredericksburg is being considered by local capitalists. The distance is about 75 miles.

The telephone, electric-light and street-railway companies operating in Texas are much disturbed over the taxation legislation now pending in the Texas Legislature. One bill, of which A. M. Kennedy of Mart, McLennan County, is the author, places a tax of one per cent. on the gross receipts of all street-railway companies; 1½ per cent. on the gross receipts of all telephone companies, and one-half of one per cent. on the gross receipts of all electric-light companies. An intangible-assets tax, which applies to street-railway and electric-light companies, is also pending. Both of these measures have passed the House and are now before the Senate committee on internal improvements. It is asserted by the interests to be affected that the enactment of these measures into law would cause great financial hardship to these concerns. H.

## Mexico.

City of Mexico, March 9.—The San Lorenzo water fall, situated near Parral, has been purchased by James Roberts of the city of Durango. It is the intention of Mr. Roberts to establish a large electric power-transmission plant at the falls and to furnish power for mines and other industries. He paid $400,000 for the water fall.

Pablo Gunter of Camargo and Joaquin Cortazar of Parral have made application to the Mexican government for a concession to use the water of the Conchos River for the purpose of generating electric power. They propose to invest not less than $1,000,000 in the enterprise, and have had plans prepared for a large masonry dam across the river about four miles from the village of San Francisco Conchos.

A company of Mexican capitalists has been organized for the purpose of establishing an electric power plant on the Quebrada River in the state of Durango.

The Mexican government has granted a concession to Arnauld Salles for the use of the water of the Vado River, in the state of Mexico, for power purpose.

The Acino Mine of Mexico, which operates the mine at Avino, state of Durango, will install a 300-horsepower electric plant.

It is announced that the steam-power electric lighting plant of the city of Zapotlan, which now furnishes 1,500 electric lights and is capitalized at $96,000, has been acquired by a company composed of Rafael Arias, D. Villanueva and Ugarte & Fuentes, electrical engineers of the city of Guadalajara. The new owners will install a large plant to generate electrical energy by means of water power. The plant will be located at the Piedras Negras falls of the Covianas River, 16 miles from Zapotlan.

The Guanajuato Power and Electric Company, whose large plant is situated at Zamora, state of Michoacan, is rapidly extending its transmission lines to La Barca, where it will furnish power for the city and a number of industrial concerns. This company recently completed its transmission lines to the city of Leon, which has a population of about 80,000 people. It is now furnishing light and power for the city as well as to a large number of manufacturing concerns there. It is also supplying the cities of Guanajuato and Irapuato with light and power. H. H. Filley is chief engineer for the company.

The street-railway company at Zacatecas has been reorganized. The following officers were elected: President, Flavio Macias; vice-president, Rodolfo Villalpando; treasurer, Luis G. del Valle. It is stated that the company will make extensive improvement to its system.

The Mexican government has rescinded the concession which it had granted to Carlos F. de Landero for the establishment of an electric power plant on the Rio Grande de Santiago in the state of Jalisco.

Arthur E. Banks of Monterey will install an electric-light and power plant at Lampazos. The plant will start with about 1,000 incandescent lights and a number of arc lights.

Col. Joseph A. Robertson of Monterey has obtained a concession for the construction and operation of a system of electric street railways in Monterey. In obtaining the concession he was acting as the representative of a syndicate of American capitalists.

Kunhardt Brothers, owners of a mule-car street-railway system in Guadalajara, have applied to the state government for a concession to convert their lines into electric traction and to extend the system, which comprises about eight miles of track. The Bermejillo syndicate, which owns and operates the principal street-railway system in Guadalajara, recently agreed to pay the municipal government $400,000 for a concession to convert its lines into electric traction and to extend its system. It is expected that Kunhardt Brothers will be required to pay a sum in proportion to the mileage of its system based on that which the Bermejillo syndicate was required to pay.

The Agencia Commercial y Maritima will install an electric-light plant at Abol Grande, adjacent to Tampico.

Francisco Segura & Bro. will install an electric-light and power plant at Temascaltepec.

The Mexican Cable Company's steamer Mexican is making a survey for a new cable to be laid between Coatzacoalcos and Galveston. W. D. H.

## Northwestern States.

Minneapolis, March 11.—The Twin City Rapid Transit Company will build a sub-station between Hopkins and Excelsior, to furnish power for the new suburban line, which is to be built from Minneapolis to Excelsior, Minn.

Robert McKechnie has resigned as manager of the electric-light plant at Medford, Wis., and will be succeeded by William Johnson.

An ordinance has been passed at Centerville, Iowa, granting a franchise to the Mutual Electric Company. It must be submitted to the voters this spring before becoming binding. A plant costing about $15,000 is proposed.

A contract calling for the expenditure of $20,000 has been let at Duluth, Minn., for the reconstruction of 6½ miles of the Park Point electric railway.

Figures and profiles have been completed by the Twin City Rapid Transit Company for prospective contractors on the line to Lake Minnetonka, and bids will be received at once. The company engineers have data and estimates ready for the use of bidders.

The Interurban Railway Company of Des Moines, Iowa, has decided to build its proposed line to Granger and Woodward without delay.

E. G. Porter, manager of the Owatonna (Minn.) Gas, Electric and Heating Company, was badly burned recently by an explosion of gasoline, and his recovery is doubtful.

The question of having electric lights at Sibley, Iowa, is being agitated by the Commercial Club. A. Huntington of Sioux Falls, S. D., has made a proposition regarding the matter, which is being considered.

Onalaska, Wis., is again considering the matter of electric lights. L. Steenson of West Salem has applied for a franchise, and, if granted, will build a plant on the LaCrosse River. The Wisconsin Light and Power Company of LaCrosse has also made application for a franchise.

The Eastern Wisconsin Railway and Light Company has been granted an extension until August 1, 1906, in which to complete its own street-railway tracks into the city of Oshkosh, Wis. R.

## Rocky Mountain States.

Salt Lake City, March 10.—Simon Bamberger, president of the Salt Lake and Ogden railway, has applied to the council at Ogden, Utah, for a franchise to enter that city. The construction work between Lagoon and Ogden will be completed within two months. The road as at present intended will enter Ogden from the southwest and will take in Kaysville and several other towns en route. The entire line will be equipped with electricity.

At a special election held at Payson, Utah, recently it was decided to issue bonds in the sum of $12,000 for the purpose of improving and extending the electric-light plant. It is now proposed to put in an engine and steam plant as an auxiliary to the waterpower; a new dynamo will also be installed and the system extended.

E. T. Wolverton, manager of the Utah Fuel and Iron Company's mines in Grand County, Utah, has made application for a large appropriation of water from Green River in Emery County, Utah. It is proposed to establish an electric power plant at The Narrows, Bow Knot Bend, which may be transmitted to Utah, Colorado and Nevada. A.

## Pacific Slope.

San Francisco, March 10.—The A. J. Coffee Company, representing the Gamewell Fire Alarm Telegraph Company, has been awarded a contract for furnishing the city of Pomona, Cal., with a fire-alarm telegraph system. This company has also furnished the city of Riverside, Cal., with additional fire-alarm boxes and storage-battery outfit. The company is to install a Gamewell fire-alarm system at the Lewis and Clarke Exposition in Portland.

The Atlas Contract and Supply Company, with offices in the Rialto Building, this city, has about completed a branch electric power line from Ione to Martel, Cal., a distance of about 12 miles.

An effort is being made by the Kalama Light and Power Company to secure a 25-year franchise to light the town of Kelso, Wash. The Kelso Water and Light Company will also ask for a franchise.

Seymour H. Bell and Charles H. Chance of Sumpter, Ore., have secured a franchise for constructing and operating an electric-light plant at Ontario, Ore., the works to be in operation within eight months. The outlay involved will be about $25,000.

It is reported in San Francisco that E. H. Harriman has taken a half interest in the H. E. Huntington Electric Railway Company, which was recently formed with an authorized capital of $5,000,000 for the purpose of building some 200 miles of electric road out from Fresno, Cal., including the Yosemite line, about 90 miles in length, between Fresno and Wawona.

Work is being rushed on the 500-horsepower motor generator for the electric plant at Elmhurst, Cal. It will be necessary to put a wire from the Southern Pacific tracks to the power house, as the line from the Amador country source is not yet complete. A switch-house must also be erected. The Standard Electric Company is to have control of the power and will sell it to the Oakland Traction Consolidated Company. The old plant will be shut down, but is to be held in readiness for emergencies. There will also be a connection made with the De Sabla power house, near Chico, Cal., belonging to the Bay Counties company, which will furnish electricity if needed. Waterpower will be used in each of the primary power houses to generate alternating current at 50,000 volts. This will be transmitted to the Elmhurst plant, where direct current is also generated for the cars on the

Haywards line of the Oakland Traction Consolidated Company.

President Cleveland of the Spokane Power and Transportation Company, Spokane, Wash., states that the company is making surveys for the proposed electric road to Davenport, Wash., and has nearly reached Reardan. Contracts for part of the grading will be let by the first of May.

The Northern California Power Company is planning to construct an electric road north from Redding to Kennett, with a spur striking west to the Southern Pacific railroad at Keswick station. A.

## PERSONAL.

James A. Pearce of St. Louis, Mo., has been appointed superintendent of the Mexican Tramways Company's system in the City of Mexico and has assumed his new position.

C. A. Alderman of Springfield, Ohio, has resigned his position with the Dayton, Springfield and Urbana Electric Railway Company, to accept a position with the Elkins-Widener syndicate of Philadelphia.

Emmitt C. Gibson, vice-president and principal owner of the Pittsburg, McKeesport and Greensburg Electric Railway Company, died in Florida on March 6th. He had lived in Philadelphia for five years and was 60 years of age.

Dudley B. Wick, chief engineer of the North Electric Company of Cleveland, died on March 1st in that city. He was a young man—not yet 29—and had studied electrical engineering at the Case School of Applied Science and at Cornell. He had the reputation of great thoroughness and his death, which is greatly regretted, is believed to be due, indirectly, to overwork.

Louis A. Ferguson, second vice-president of the Chicago Edison Company, returned to Chicago last Saturday, after several weeks' sojourn in Florida and other southern points. Mr. Ferguson went away after an attack of the grip and returned greatly benefited. On arriving at his desk on Monday he found a bank of roses—the kindly remembrance of the office force—that reminded him of the semi-tropical clime he had left, but more of the warmth of the greeting to be found even in a Chicago March.

Henry Norcross Munn died at his home in New York city on March 9th from locomotor ataxia. Mr. Munn was at one time on the editorial staff of the Scientific American. Sixteen years ago he was forced by ill health to give up his work and since that time had been an invalid. Mr. Munn was a son of Orson D. Munn, founder of the Scientific American, who survives him at an advanced age. A brother, C. A. Munn, general manager of the publishing company, a widow and two children also survive him.

Walter H. Whiteside has been promoted from the position of general manager of sales of the Allis-Chalmers Company to be a vice-president and general manager of the company in charge of the operations in Chicago. This change was made to permit President Warren to devote more of his time to the business at the New York office. Newspaper reports to the effect that William J. Chalmers has resigned are unfounded. Mr. Chalmers will continue in his position as vice-president and treasurer of the company.

Roy Robinson, the young electrician so badly burned by a short-circuit under switchboard No. 1, power house No. 1, of the Niagara Falls Power Company, on the morning of February 23d, died in a hospital at Niagara Falls on March 8th, making the second victim of the accident, the previous death having been that of Frank Frommert, as previously related in the Western Electrician. According to testimony presented before the coroner the mistakes in the connections that led to the short-circuit were made by Mr. Robinson. John Frommert, the third man burned by the accident, is expected to recover.

## ELECTRIC LIGHTING.

F. N. Holmes contemplates the construction of an electric-light plant in St. Augustine, Fla., it is said.

A special election will be held at Willard, Utah, March 20th, to vote on the proposition of installing an electric-light plant.

The City Council of Covington, Ga., contemplates re-establishing the city electric-light plant, which was destroyed by an explosion.

At an election in Houston, Miss., the voters approved the proposed bond issue of $13,500 for establishing an electric-light plant and waterworks.

Edward Durham of Philadelphia, Pa., and W. B. Cutler of Buffalo, N. Y., have secured a franchise from the city of Bristol, Tenn., to construct and operate an electric-light plant.

A correspondent of the Philadelphia Record at Seaford, Del., under date of March 6th says: "After a bitter fight the ticket opposed to Seaford owning its own electric-light plant won this afternoon. Two tickets appeared in the field, one favoring and one opposing electric light. Supporters of both tickets have been actively at work for 10 days."

The West End (Birmingham, Ala.) City Council has granted an electric light franchise to the Birmingham Railway, Light and Power Company.

C. W. Moore and associates of Gainesville, Ark., have incorporated as the Gainesville Gas and Electric Company, capital stock $[illegible]. The company will operate a gas and electric-light plant.

An electric-light plant was recently installed by the Big Brushy Mountain Coal and Coke Company of Petros, Tenn. The company is now planning to extend the plant so as to light the town of Petros.

Property owners of Elgin, Ill., who objected to the recent action of the City Council in transferring the municipal electric-light plant to the Elgin, Aurora and Southern Traction Company, have secured an order from Judge Bishop of the Circuit Court of Kane County temporarily staying the transaction. Irregularities are charged in the bill of complaint. C. H. Potter, A. E. Price, former mayor of Elgin, and E. L. Wilson head the objecting citizens.

The Denver Republican editorially commends the suggestion that property-owners keep their porch electric lights burning and points out the benefits to follow from this exhibition of public spirit. The Denver Gas and Electric Company reproduced the editorial for advertising purposes and in printing it on mailing cards has inserted at opportune places the following: [Makes the street attractive.] [A silent policeman.] [A cent or two per night.] [Helps the neighborhood.] [A modern watchdog.]

Bids are invited for the electric lighting of the city of Shreveport, La., for periods of five and 10 years, the number of lights to be not less than 150 and subject to increase. Arc lights to be not less than 2,000 candlepower. Bids are to specify the charge for arc lights, and also for incandescent lights, and specify the maximum charge to be made to private consumers of arc and incandescent lights. Arc lights for street lighting shall burn every night. All bids to be in the hands of the city comptroller by six p. m., on April 11th.

The Edison Electric Illuminating Company of Brooklyn says that by the reduction in the retail rates for electric lighting which became operative on January 1st last, an electric sign, with 24 incandescent lamps, may be illuminated for as low as five cents an hour. The use of electric signs by progressive merchants in all parts of Brooklyn has increased very rapidly during the last two years. The Brooklyn Edison company will supply an electric sign, designed and lettered to suit any business and install it, including wiring, free of charge. The company retains title to the sign.

## ELECTRIC RAILWAYS.

Following the abandonment of the proposed electric line from Elmira (N. Y.) to Corning, the tracks of the Corning and Painted Post railway will be extended to Elmira.

A franchise has been granted to the Freeport-Dixon Electric Railway Company by the council of Dixon, Ill. The company now has franchises to enter both Freeport and Dixon over its own lines.

It is said that a proposition is on foot to build a new power house for the Chicago and Oak Park Elevated Railroad Company. A committee appointed from the board of directors some time ago is expected soon to report on the matter.

It is announced that the electric street railway building in the city of Manila, P. I., will be in operation about the 1st of April. The plant, besides furnishing power for the street railway, will supply current for lighting the city and for commercial consumers.

Total gross receipts of the Elgin, Aurora and Southern Traction Company for the month of January were $33,906 compared with $34,694 for January, 1904. The operating expenses were $22,296 compared with $22,308, and the net income $2,276 as against $3,129 in January last year.

The New England Engineering Company of Waterbury, Conn., has secured the contract for the electrical work for a trolley line from Jeannette to West Newton, Pa., which is to be built by the Jeannette, West Newton and Monongahela Valley Street Railway Company. The road will be about 13 miles long and it will pass through the towns of Edna, Arona and New Madison. The construction work will begin about April 1st. Approximately $325,000 is involved in the contract.

The formal opening of the new interurban electric railway between Alton and Granite City, Ill., took place a few days ago, President J. F. Porter, and F. E. Allen and L. C. Haynes of the executive committee being in charge. The occasion also marks the formal opening of the new North Market Street ferry at St. Louis, which will connect with the electric-railway tracks at Venice, and by which passengers to and from St. Louis will be transported across the river. A short line from Granite City to East St. Louis and thence to St. Louis via the Eads Bridge will probably be finished within six months.

[illegible] route or the Granite City-East St. Louis electric [illegible]

[illegible] Oklahoma City, O. T., which is building a street- [illegible] nect Oklahoma City with Guthrie.

[illegible] special commission is the purpose of a bill which was drafted at a recent meeting of the passenger committee of the Trades League of Philadelphia. The bill [illegible] which shall have authority to supervise the operation of all street railways in the state of Pennsylvania and to enforce remedies in their operating methods when complaints shall be brought before the commission at a public hearing. The proposed commission is modeled on the system of supervision now prevailing in Massachusetts.

It is announced that all the city and suburban traction lines, electric-light, water and bridge properties of the city of Wheeling, W. Va., have been merged, the deal involving properties valued at $7,000,000. The plan is to put all the properties into one new corporation. The companies that have been bought outright and will be taken over by the merger are the Wheeling Traction Company, the Wheeling and Elm Grove Traction Company, the city railway, Wheeling; the Suburban Water and Light Company, Wheeling; the Steubenville, Mingo and Ohio Traction Company, the Wheeling Bridge Company, the Wheeling and Western Traction Company and the Wheeling and Western Park Association.

The New York, Westchester and Boston Railway Company will commence breaking ground for its new electric line as soon as weather permits. This company has entered into an arrangement with the Interborough Rapid Transit Company of New York city for traffic connections with the subway in the vicinity of One-hundred-and-fiftieth Street. The road is expected to be ready for operation in about two years and will have two local and two express tracks. The construction is to be under the direct supervision of Vice-president Samuel Hunt. The engineering corps will include William A. Pratt, formerly engineer of the Staten Island Rapid Transit Company, as chief engineer, and William Barclay Parsons and John Bogart as consultants.

The Toledo Interurban Construction Company has recently contracted for the complete equipment of the new power house of the Toledo, Port Clinton and Lake Side railway at Port Clinton, Ohio, including two 1,280-horsepower engines, two 800-kilowatt alternating-current generators, two 50-kilowatt direct-current generators, one 400-kilowatt alternating-current rotary converter, two Tomlinson barometric condensers and boilers, pumps, heaters, etc. Arrangements have been made to have the new extension of the railway completed as far as Marblehead and cars put in operation to that place from Toledo by July 1st. It is planned to run cars the entire length of the line—from Toledo to Lakeside—in two hours. The power-house equipment is to be furnished by the Allis-Chalmers Company.

In a recent report United States Vice-consul W. T. Gracey at Nankin, China, recommends that the matter of building an electric railway in that city be laid before American manufacturers. All steamers coming to Nankin must anchor at Hsiakuan, a small village on the river bank, about five or more miles from the crowded business portion of the city. Within the last few years a well-made macadamized road has been completed, nine or more miles in length, but the only means of transportation is by donkeys, horses, jinrickshas, or very poor and expensive carriages. The viceroy does not believe that an electric line could be made to pay, but he seemed impressed with the idea of tram cars drawn by Chinese ponies, which can be purchased very cheaply. The population of Nankin is about 300,000, and Mr. Gracey thinks that an electric railway owned and operated by Americans would pay.

## POWER TRANSMISSION.

The Kauai Electric Company has been incorporated at Honolulu, Hawaii, by D. P. R. Isenberg, William A. Kinney, Francis M. Swanzy and others. The capital stock is $300,000. The object of the company is to furnish electric power for various uses.

The Tallapoosa Waterpower and Electric Company of Sturdevant, Ala., incorporated several months ago by Messrs. Aufeld and Chapman of Montgomery, is about to begin the erection of a $500,000 plant for developing the waterpower of the Tallapoosa River, to furnish electric power for manufacturing purposes.

The expected Niagara, Lockport and Ontario bill has been introduced at Albany. This bill is an amplification of last year's defeated measure and is even more comprehensive. If passed the company may take the water from the Niagara River and generate and supply current at any place in the state and may also act without the consent of local au-

thorities and acquire other power plants anywhere in the state.

D. W. Bolich is making surveys for a proposed $1,000,000 waterpower electric plant, to be built on the Grand River, near Fort Gibson, I. T.

The Republican River Hydraulic Power Company is preparing to dam the river at Junction City, Kan., where it will develop 1,200 horsepower by turbine water wheels.

The incorporation of the Wisconsin River Traction and Power Company and the Mathie Brothers Lumber Company of Madison, Wis., is the beginning, it is said, of a large interurban-railway, waterpower and paper-mill system. The former corporation, headed by Neal Brown, is capitalized at $30,000 and the latter at $90,000. Trappe City waterpower will be developed.

Col. W. C. Greene, the copper magnate of New York and Cananea, Mexico, is pushing forward his plans for building a large electric power plant on the Aros River, near the new town of Dedrick, which he is establishing. The line will be about 150 miles long, it is said. It is estimated that 30,000 horsepower can be developed by the water of the river at the point where the generating plant is to be located.

## PUBLICATIONS.

The production of beautiful lighting effects in large buildings and stores is something in which the Holophane Glass Company excels, and it has devoted one of the handsome little booklets for which it is noted to this subject. Numerous finely executed illustrations throughout the booklet speak more than words for the effects which can be secured by the use of Holophane globes.

"Telephone Development" is the title of a good-sized pamphlet compiled by Vinton A. Sears of Boston in the interest of Independent telephony. It contains statistics, articles and letters obtained from well-informed and reliable authorities, collected by the author, and showing the growth of the industry, with the object of encouraging its further growth. There is also an excellent map of Pennsylvania, New York and New Jersey, indicating the extent of the present Independent toll lines.

An educational chart showing in isometric perspective the mechanisms belonging to the modern boiler room, drawn by George L. Fowler, has just been published by the Norman W. Henley Publishing Company of New York city. The various parts of the appliances are shown, broken or removed, so that the internal construction is fully illustrated. It is educational in that, with it, the student will be able to learn of the construction and arrangement of the best type of boiler plant, and examine into the relations of the various parts, while a glossary gives the name of each piece and part that is shown and numbered on the chart, 235 names in all. The chart is sold for a small sum.

The first number of the new Engineering Supplement of the London Times was issued on March 1st. It consists of 12 pages, 12 by 18 inches, with no illustrations. Articles by Sir Charles McLaren, Bart., on "British Engineering," by Sir William H. White, K. C. B., on "Submarines," and by C. W. G. Little on "The Motor Omnibus" are included in the initial issue. There are other articles dealing with light railways, British electrical industries, electrification of railroads and internal-combustion engines. The Supplement gives the impression that it is to be much like the paper itself—ponderous, reliable, highly respectable and (possibly only to American taste) somewhat dull and stodgy.

The Ewing-Merkle Electric Company of St. Louis, when it issued the little pamphlet entitled "A Little More Light," not only hit upon a very good method of advertising its products, but at the same time it published something which is of real interest and value to those interested in the development of rural telephone lines. The pamphlet tells how to organize a farmers' mutual telephone company, and presents a model constitution and by-laws, gives forms for petitioning the mayor of a town for permission to erect lines, the board of supervisors for right-of-way on highways, the superintendent of a railroad for the privilege to cross right-of-way, etc. This is not all, for there is also helpful information relating to the construction of lines, their operation and repair, etc.

The twenty-sixth year-book of the American Society of Mechanical Engineers contains much useful information in relation to that important society and its members, such as lists of the names of officers and members, portraits of the officers, constitution, by-laws, rules, calendar of meetings and the like. The total membership of the society in all grades is 2,780. John R. Freeman of Providence, R. I., is president. Among the vice-presidents is H. H. Westinghouse of Pittsburg, while John W. Lieb, Jr., of New York, Asa M. Mattice of Milwaukee, George M. Brill of Chicago and Richard H. Rice of Lynn, Mass., are on the board of managers. Prof. F. R. Hutton of 12 West Thirty-first Street, New York city, is the secretary, and to him credit is due for the value and completeness of the year-book.

## SOCIETIES AND SCHOOLS.

The excellent paper prepared by Mr. Charles A. S. Howlett of the Western Electric Company upon the "Commercial Aspect of Engineering," and read by him before the Electrical Section of the Western Society of Engineers on January 13, 1905, has been reprinted in pamphlet form from the proceedings of the society.

According to a "well-known British engineer" in the London Times, "The best school in this country for electrical engineering is the engineering school in Trinity College, Dublin, where a man gets not only the best of teaching, but also something to show for it in the way of an engineering degree to append to his name. Next to it probably comes King's College, London, and the Finsbury Technical Institute."

Prof. W. M. Goss, dean of the engineering school at Purdue University, has announced a schedule of lectures, which will be given by Purdue professors as follows: "Railway Signaling Illustrated," by F. B. Ernst, March 20th; "Possibilities of Electric Traction," by Prof. H. T. Plum, April 3d; "Appliances in the Economical Handling of Power Plants," by Prof. J. D. Huffman, April 10th; "Brake Equipments for Railway Trains," by Prof. L. V. Ludy, April 17th.

Arrangements are taking shape for the fifth annual convention of the National Electrical Contractors' Association, which will be held in Boston, Mass., in July. The exhibition committee has secured Mechanics' Hall Building for holding the exhibition. Mr. A. T. Sampson, who has been appointed to fill the vacancy on the executive committee caused by the resignation of Mr. Leonard, will act as secretary of both the executive and exhibition committees.

The "Proceedings" of the tenth annual meeting of the Ohio Electric Light Association, held at Sandusky, Ohio, August 16 to 18, 1904, have been issued in book form containing besides the doings at the convention lists of the active and associate member companies of the organization. Of the former there are now 54 and of the latter 34. The present officers are: President, M. E. Turner, Cleveland; vice-president, F. E. Valentine, Piqua; secretary-treasurer, D. L. Gaskill, Greenville.

The next meeting of the American Institute of Electrical Engineers will be held at the Chapter Room, Carnegie Hall, 154 West Fifty-seventh Street, New York city, on March 24th. The following papers will be presented and discussed: "Line Construction for High-pressure Electric Railroads," by George A. Damon of Chicago; "High-pressure Line Construction for Alternating-current Railways," by Theodore Varney, and "Application of High Pressure to Electric Railroads," by Ernest Gonzenbach of Sheboygan, Wis.

The Michigan College of Mines will hold its second annual class-day exercises in Houghton and Hancock on May 5th. The principal feature of the event will be the public address by William G. Mather of Cleveland, Ohio, president of the Cleveland-Cliffs Iron Company. This will be delivered in the Kerredge Theater at Hancock in the evening. A banquet will also probably be given by the class. The exercises are held at this early period so that all the students may be present, as in previous years it has been found that nearly half have left for their vacations when the class-day exercises were held at the close of the college year.

The annual meeting of the British Association for the Advancement of Science is to open in Cape Town, S. A., August 15th. The sectional meetings will be held there and in other cities which will be visited by the delegates. The president for the meeting is Prof. G. H. Darwin. Prof. A. R. Forsyth will preside over the deliberations of the Mathematical and Physical Science Section, and Col. Sir Colin Scott-Moncrieff will be chairman of the Engineering Section. Among the lectures, for which arrangements have been made, will be one on "Physics," by Mr. C. V. Boys, at Cape Town; one by Mr. F. Soddy on "Radio-activity" at Durban; one by Professor Ayrton, delivered at Johannesburg, on "Distribution of Power," and at Kimberley Sir William Crookes will discourse on "Diamonds."

## TELEGRAPH.

Reports from Caracas, Venezuela, announce that President Castro has ordered the Venezuelan court to render judgment annulling the contract and authorizing the seizure of the French Cable company's property. The government, it is said, has cut the coast cable east and west of La Guayra to prevent communication with the revolutionists, who are active at Trinidad. The Europeans at Caracas are excited.

The quarterly report of the Western Union Telegraph Company shows net earnings for the quarter ended December 31, 1904, amounting to $1,872,965.91. A dividend paid on January 15, 1905, amounted to $1,217,021.25 and interest on the bonded debt required $297,550, which left a total surplus on January 1, 1905, of $15,793,257.46. The net revenues for the quarter ending March 31st, based upon nearly completed returns for January, partial returns for February, and estimating the business for March, will be about $1,600,000.

Fire in the Stock Exchange Building did considerable damage to the operating quarters of the Postal Telegraph-cable Company in Chicago on the night of March 14th. All the wires were put out of service for two or three hours—fortunately at a time when they were least needed. At an early hour in the morning the circuits in all directions were in good working order again. One daily paper reported that Mr. E. J. Nally, the widely known general superintendent of the company, escaped by climbing down a fire-escape, but inasmuch as Mr. Nally was in Florida at the time of the fire, this report is obviously much exaggerated.

## MISCELLANEOUS.

By a ruling of the Dominion Board of Customs of Canada the duty on automobiles and rubber tires therefor has been increased to 35 per cent. It was formerly 25 per cent.

A committee of the City Council of Seattle, Wash., has tabled an ordinance providing for the appointment of a city electrician whose duty would be to inspect all wiring and electrical installations. It was argued that the underwriters inspected all such work and the passage of the ordinance would work a double fee, which was considered unjust.

At the fourth annual banquet of the apprentices of the Westinghouse Electric and Manufacturing Company, held in Pittsburg recently, 75 colleges and universities were represented among the apprentices present. Charles F. Scott was toastmaster and the speeches made were by Frank H. Taylor, Dr. Orren Hales, W. M. McFarland and P. E. Lohman.

The Denver Gas and Electric Company is giving a series of instructive and interesting cooking lessons at its office. From week to week attractive announcement cards are sent out. This week, appropriately enough, the programme foreshadows a practical demonstration on the preparation of Irish dishes. This company keeps its products constantly before the public through the medium of well-designed literature.

## TRADE NEWS.

The General Incandescent Arc Light Company has removed its Chicago office from the Marquette Building to 1543-6 Monadnock Building.

Sealed bids will be received by the city clerk of Des Moines, Iowa, until March 31st for electrical supplies, etc. N. B. Vertrees is the city clerk.

F. R. Perrot will in the future represent the Allis-Chalmers Company in West Australia, with headquarters at Perth. John Chambers & Son will represent the company in New Zealand, their headquarters being at Auckland.

The Wisconsin Timber and Land Company of Mattoon, Wis., dealer in poles, reports a change of management since the beginning of the year. E. E. Hemingway has taken the office of treasurer-manager, formerly held by O. E. Karste.

The Stanley Electric Manufacturing Company, which for so long had its Chicago office on the fourth floor of the Monadnock Building, now makes 1543-6 Monadnock Building its new headquarters. The company's new telephone numbers are Harrison 5244 and 5245.

The statement that the Flint-Lomax Electric and Manufacturing Company of Denver, Colo., has sustained a considerable fire loss needs modification. Only slight damage from water was caused by a fire in the foundry, which was discovered before it had gained much headway.

The partnership between George W. Conover and Edward W. Hammer, doing business under the name of George W. Conover & Co. at 1112 Merchants' Loan and Trust Building, Chicago, was dissolved on January 31, 1905. Mr. Hammer has transferred all his interest in the partnership to Mr. Conover. The business will be continued under the same name, and at the same location as before.

A press dispatch, dated at Berlin, March 5th, and printed in the Pittsburg Gazette, is as follows: "A new American stock company, which will compete with the famous concern of Siemens & Halske, was incorporated here yesterday under the name of the 'German-American Edison Accumulator Company.' The paid-up capital of the new company is 3,000,000 marks, and Thomas A. Edison is one of the directors."

The Standard Underground Cable Company announces that, on account of the general growth of its business on the Pacific Coast, it has decided to discontinue all agency arrangements for the sale of its products, and on April 1st will open its new offices in the Rialto Building, San Francisco, with Mr. A. B. Saurman as manager for the Pacific Coast territory, which includes Washington, Oregon, Idaho, California, Nevada, Arizona, British Columbia, Alaska and the Hawaiian Islands. Mr. Saurman has in turn been connected with the Standard Underground Cable Company, in both construction and sales departments, at Philadelphia and New

York, and was later for several years manager of the Boston office, while for the last two years his position has been that of manager of the Pacific Coast sales department. The company expects to make early announcements of location and personnel of sub sales offices at Los Angeles and Portland. It also reports that its factory at Oakland, Cal. (the only factory west of the Mississippi equipped with lead presses for cable work), has been unusually busy during the last six months, and that the future on the coast points to its continued activity.

## BUSINESS.

W. L. Arnold, manager of the Wittenberg Cedar Company of Wittenberg, Wis., reports an unusually good demand for poles this spring.

The Electric Appliance Company of Chicago says that the Packard lamp lives a useful life up to 600 or 800 hours. At the end of that time, if the lamp has not died a natural death, the company advocates the use of chloroform—removal from the circuit.

The S.-E. Missouri Cypress Company of Campbell, Mo., makes a specialty of cypress poles for telephone, telegraph, electric-light and street-railway companies. It is also a producer of ties and has supplied many users, particularly in the Southwest.

The Oshkosh Logging Tool Company of Oshkosh, Wis., has recently moved its office and factory to larger quarters in the same town, where every facility is on hand to meet the increasing demand that its line of linemen's and construction tools has created.

F. E. Pfanmueller & Co., 733 Rookery Building, Chicago, make a specialty of handling the better grades of second-hand steam power equipment, consisting of engines, boilers, heaters, pumps, air compressors, etc., and have a stock on hand ready for immediate delivery, which they guarantee to be practically as good as new.

Pass & Seymour of Solvay, N. Y., manufacture a complete line of weatherproof socket which they recommend as of standard excellence, and they are also calling particular attention to a line of porcelain pendant sockets for reinforced cord, adapted for 250 volts.

The S. H. Couch Company of Boston is marketing an ingenious lampguard consisting of a spiral of wire approximately the shape of an incandescent lamp globe. One end fits over the tip of the lamp and the other over the base, the wires being readily pulled apart and the lamp slipped through, after which it is screwed into the socket.

The Williams Electric Machine Company of Akron, Ohio, reports a large number of sales during the last month of its magnetic clutches, among its customers being a state university, brass rolling mill, an engraving company and a large clay manufacturing company, which shows the diversified application of these clutches.

George L. Lindsley, president of Lindsley Bros. Company of Chicago, states that the outlook for the coming season in the cedar-pole line is very encouraging here as well as in the western states, where the Lindsley Bros. Company also has yards. The company has a large stock of choice poles and expects to do a large business. Mr. Lindsley asserts that there is a great demand for short poles and that 35 and 40-foot poles are easier to sell than to produce. Consequently Mr. Lindsley predicts that the price of poles of these lengths is liable to be raised. It may be added that Mr. Lindsley will [illegible] hereafter.

[illegible] plant. The Wheeling and Lake Erie Railroad Company has ordered from the Allis-Chalmers Company's electrical department equipment for its new machine and car-repair shops at Canton, Ohio, consisting of two engine-type 250-volt generators, one of which is [illegible] motors with capacities aggregating 300 horsepower.

The Edison Electric Illuminating Company of Boston, which began in 1898 to experiment with the Wright demand system of charging manufactured in this country by the General Incandescent Arc Light Company, and which has steadily since that time extended its use, is now said to be making, as rapidly as possible, a final extension of the system to all its customers, both for light and power, so that it will be used to measure the demand of all contract customers having five or more lights. To make these mentioned extensions over 4,000 Wright demand indicators will be required, orders for which have been placed. With the extension of the Wright demand system, the Boston Edison Company will put into effect a scale of rates which it is expected will completely do away with the inconvenience and expense of figuring out what rate a customer is entitled to. This new scale of rates is designed automatically to give to each customer the proper rate; that is, a rate having as nearly as possible a definite ratio to the cost of supplying him.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued (United States Patent Office) March 7, 1905.*

784,019. Electrically Operated Station Indicator. Ernest K. Adams, New York, N. Y., Edward Dean Adams, executor of said Ernest K. Adams. Application filed March 10, 1904.

An indicator carrier carried on the car is adapted to be driven by a motor. Means are provided for making and breaking the circuit to control the motor and thereby the movement of the carrier. A safety device comprises means independent of the make-and-break means for automatically breaking the circuit when the carrier has reached the end of its travel.

784,022. Electric Switch. Charles B. Askew, Chicago, Ill. Application filed May 11, 1904.

Means for oscillating the switch arm includes electromagnetic devices arranged to move the arm in opposite directions. A timing switch device for the electromagnetic circuit is operatively associated with the electromagnetic devices for actuation, the timing-switch device being arranged to effect the circuit of one of the electromagnetic devices to energize it when actuated by the other electromagnetic device and timed to operate subsequently to the operation of the oscillating switch arm.

784,024. Dynamo-electric Massage Instrument. Albert Barrett and William Condon, Kansas City, Mo. Application filed July 5, 1904.

A handle to the instrument forms an electrode and carries a permanent magnet. An armature is rotatively mounted on the handle in the field of the magnet and provided with a suitable insulated winding one end of which is electrically connected to the electrode, and a rotary electrode is connected to the other end of the winding and carried by but insulated from the armature.

784,032. Laminated Core for Dynamo-electric Machines. James Burke, New York, N. Y., assignor to the Burke Electric Company. Application filed March 9, 1904.

Combined with a laminated core and support, the support having a grooved portion, is a collar or closed ring adapted to be forced into the grooved portion for retaining the laminæ in place.

784,034. Electroplating Device. George W. Clough, Cleveland, Ohio. Application filed January 30, 1904.

Electroplating apparatus comprises a bath provided with walls, a shaft mounted on the walls and a cylinder of insulated material mounted on the shaft. A flanged metal carrier is spirally and continuously wound about the inner surface of the cylinder, and forms the cathode. Anodes are suspended from the shaft.

784,037. Switch for Overhead Trolley Tracks. Robert N. Cundall, Hopedale, Mass., assignor to the Draper Company, Hopedale, Mass. Application filed January 4, 1905.

A Fixedly mounted support having transverse guides is adapted to be interposed between fixed main and branch track sections. A switch plate is slidably mounted on the guides and has depending track sections to bridge the gaps in the fixed track sections. Manually controlled means shift the switch plate and positively lock it in position when shifted.

784,038. Automatic Self-dropping Trolley Pole. John Delane, Terre Haute, Ind. Application filed September 5, 1903.

A trolley arm is mounted so as to be free to fall of its own weight. An arrangement of cords and pulleys is adapted to raise the trolley pole into the normal position.

784,052. Electromagnetic Device. William Kaisling, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed October 17, 1901.

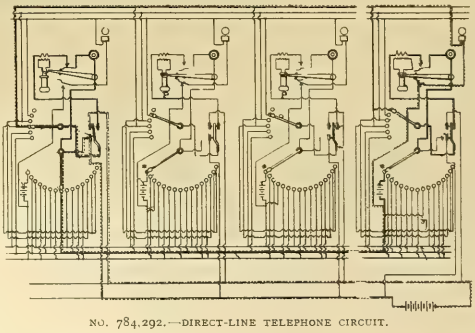
A form of relay is described, the armature therefor having two arms extending at an angle to each other. A support having a knife-edge is adapted to fit into the apex of the angle and to form a support for the armature upon which as a fulcrum it may rock. One of the arms of the armature serves to complete the magnetic circuit of the magnet.

784,056. Electric Motor. Waldo A. Layman, St. Louis, Mo. Application filed December 28, 1903. Renewed August 25, 1904.

Combined with one of the members of an alternating-current motor are a conductor connected at a number of points to the member to form a short-circuit, a second conductor connected to the member, means for determining the position of the poles of the member and means for short-circuiting the second conductor.

784,064. Electrically Operated Locking Mechanism. John Nordenberg, Canon City, Colo., assignor of one-half to Olof J. Rundahl, Canon City, Colo. Application filed September 16, 1904.

Electromagnets operate a series of locks and an electric circuit is common to the several magnets. A circuit closer in the circuit, circuit-controlling devices in each lock, whereby the locks will be successively operated upon successive closures of the circuit, and manually actuated means in each lock for rendering them inoperative without affecting the other locks of the series are the other features.



NO. 784,292.—DIRECT-LINE TELEPHONE CIRCUIT.

784,071. Electric-lighting Apparatus for Railway Cars. Willard F. Richards, Buffalo, and William A. Turbayne, Lancaster, N. Y., assignors to the Gould Coupler Company, New York, N. Y. Application filed April 9, 1904.

An electric dynamo and a motor have parallel field magnets, and rotary armatures mounted on a common shaft. The field magnets are carried on a base, bearing standards being placed at the opposite ends of the base in which the ends of the armature shaft are journaled.

784,088. Telephone System. William D. Watkins, San Jose, Cal., assignor to the Watkins Manufacturing Company, San Jose, Cal. Application filed March 11, 1902.

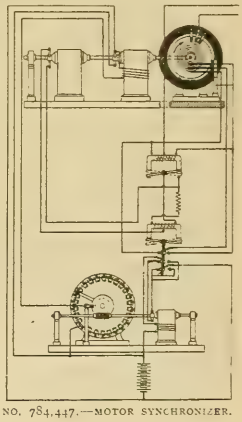
An electromagnetically actuated selecting device is arranged in the signaling circuit and a call bell is controlled by the selecting device and includes a movable member. A switch is controlled by the movable member for placing the local talking circuit in communication with the main line.

784,102. Brushholder for Dynamo-electric Machines. James Burke, New York, N. Y., assignor to the Burke Electric Company. Application filed May 3, 1904.

A U-shaped sheet-metal support is mounted to turn on a threaded stud and a brush is held by the support. Means force the brush against the commutator, the means being adjustable along the length of the support.

784,103. Dynamo-electric Machine. James Burke, New York, N. Y., assignor to the Burke Electric Company. Application filed July 18, 1904.

The frame for the machine has a central opening through its bottom portion, the opening communicating directly with the space between the field poles and affording free access to the poles and the coils, the field poles projecting radially inward.



NO. 784,447.—MOTOR SYNCHRONIZER.

784,125. Galvanic Battery Cell. Albert T. Sanden, New York, N. Y. Application filed December 15, 1904.

A battery comprises a folded outer element, an intermediate porous fabric portion in contact with the inner side of the outer element and a grooved inner element providing on both of its faces lines of contact with the fabric portion and having capillary spaces between.

784,139. Electrical Annunciator for Trolley Cars. Ira J. Bradshaw, Waukegan, Ill., assignor of one-half to Jacob J. Dietmeyer, Waukegan, Ill. Application filed June 29, 1904.

Arranged on a bracket carrying the trolley wire is a switch actuated by the passage of the trolley wheel. The switch controls the annunciator circuit.

784,175. Automatic Telephone Repeater. Emory Parsons, Chicago, Ill. Application filed February 16, 1903.

A telephone repeater comprises a transmitter having a number of diaphragms. A medium is interposed between the diaphragms, exposed to their vibrations, and a local circuit comprises the medium and the primary wire of an induction-coil. A like number of telephone receivers have their diaphragms facing the transmitter diaphragms respectively and an incoming line circuit is branched to include in parallel the electromagnet coils of the several receivers, the secondary wire of the induction coil being in the outgoing line circuit.

784,186. Thermostat. John F. Shepherd, Chicago, Ill. Application filed April 25, 1904.

Separated parts adapted to be included in two electric circuits have a circuit-controlling means associated therewith, comprising a movable member, means for independently completing circuits through the circuit parts when the movable member is in normal position, and to break both circuits when the movable member is moved. Other means are arranged to close the circuit subsequent to the breaking by the first named means when the movable member is moved.

784,188. Stop-motion Detector for Looms. Merrill O. Steere, Pawtucket, R. I. Application filed September 3, 1902.

In case a thread breaks anywhere in the work two contacts normally held apart by the thread are allowed to come together, closing an alarm circuit.

784,226. Electrical Fuse-primer. Francis M. Quinn, Silverking, Idaho. Application filed September 17, 1903.

An electrical fuse primer consists of a wrapper containing a combustible material, the upper portion of the wrapper being split and the combustible material divided to form a passage. The electrical conductor comprises a wire having a portion of high resistance, the portion being disposed in the passage and the split ends of the wrapper being brought together over the wire.

784,227. Searchlight for Revolvers or Other Firearms. Byron C. Riblet, Spokane, Wash. Application filed August 1, 1904.

A small battery is contained in the handle of the revolver and is connected with a search light on the forward part of the gun beneath the barrel. A push button on the handle closes the circuit to the battery.

784,237. Electrical Rail-guard. Lewis B. Stillwell, Lakewood, N. J., and Frederick R. Slater, Yonkers, N. Y. Application filed September 16, 1904.

Combined with an electric conductor are a series of insulating supports to which the conductor is attached, a bracket clamped to the conductor between the supports, an upright part and a horizontal extension of the part, to which a longitudinal guard is attached.

784,238. Electrical Rail-guard. Lewis B. Stillwell, Lakewood, N. J., and Frederick R. Slater, Yonkers, N. Y. Application filed September 16, 1904.

A guard parallel with the electric conductor is insulated and an insulator is provided for the conductor. The bases for the guard and insulator are formed of a single casting and an insulating post and a bracket with a horizontal extension are attached to the post by which bracket a guard is supported.

784,292. Direct-line Circuit and Switching Mechanism for Telephone Systems. Albert K. Andriano, San Francisco, Cal., and Hermann Herbstritt, New York, N. Y., assignors to the Direct Line General Telephone Company, San Francisco, Cal. Application filed November 21, 1903. Renewed July 11, 1904.

The stations are arranged in groups and return wires common to each group of stations extend to a contact at each station. Line-wires corresponding in number to the stations in a group and terminate at each station in separate contacts. Signal devices are placed at each station, each connected on one side with the return wire of the group to which it belongs, and on the other side connected with the line wire of its particular station. Means for connecting any station with the line of any desired station of the system comprise independent switches arranged to engage respectively with the contacts of the line wires and of the return wires. Means at each station close a signal circuit through the signal of the selected station when the switches at the calling station are properly set. (See cut on preceding page.)

784,303. Third-rail Electric-railway System. Thomas J. Casey and Fred H. Pickles, New York, N. Y. Application filed August 11, 1904.

The third rail is composed of main independent insulating sections between each of which is a short independent section. A main feed wire is connected with each of the main independent sections by supplemental feed wires having switches. A guard or cover is hinged to a support at the outer side of the third rail and is composed of separate sections having insulating blocks which rest on the third rail.

784,308. Electric Motor. George Dengler and Ida W. Schmidt, Detroit, Mich. Application filed September 12, 1904.

The motor consists essentially of a series of solenoids operating plungers which are connected to cranks on a driving shaft.

784,328. System of Electrical Distribution. Frank Hoffman, Chicago, Ill., assignor of one-half to Elmer E. Hanna, Chicago, Ill. Application filed May 21, 1903.

A method of obtaining a change of speed of electric motors consists in maintaining three or more electric circuits of substantially equal potential and connecting a number of motors with them so that all circuits which are simultaneously in operation carry substantially equal loads.

784,346. Method of Cultivating Plants by Electricity. Eugène Pilsoudsky and Eugène Ragozine, St. Petersburg, Russia. Application filed December 12, 1903.

A process of electroculture consists in subjecting adjacent parallel sections of the earth to be treated to the action of galvanic currents flowing in opposite directions between buried plates of dissimilar metals connected by overhead conductors, and simultaneously setting up in the circuits formed by the conductors, plates and earth sections, currents induced by atmospheric electricity passing through parallel overhead conductors adapted to collect such electricity.

784,357. Circuit Controller for Electric Railway Signals. Harry B. Snell, Jackson, Mich. Application filed April 15, 1904.

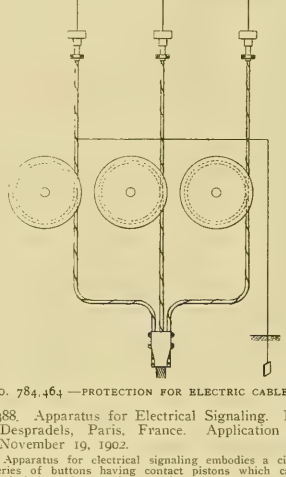
A pair of trolley contacts insulated from direct connection with each other and from the trolley wire are associated with a magnetically operated controller. Two line circuits lead from the controller to a suitable signal device, and connections are made whereby a trolley wheel passing beneath the trolley contacts in one direction will close the current from the trolley wire through one of the line circuits and when passing in the opposite direction through the other line circuit.

784,358. Electric Time-switch. Stanislaus Stemski, Brooklyn, N. Y. Application filed April 12, 1904.

Clockwork mechanism is arranged over the switch case which at predetermined intervals depresses plungers so as to allow of the motion of a drum which in turn controls the switch.

784,387. Electric Motor. Frederick Darlington, Great Barrington, Mass. Application filed October 13, 1904.

In an electric meter are a dynamometer having a stationary coil and an oscillating coil and a drag for retarding the movement of the oscillating coil in one direction only. A pawl and ratchet cooperating with means for integrating an amount proportional to the number of swings of the coil are the other features.



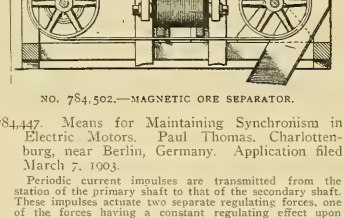
NO. 784,464.—PROTECTION FOR ELECTRIC CABLES.

784,388. Apparatus for Electrical Signaling. Louis Despradels, Paris, France. Application filed November 19, 1902.

Apparatus for electrical signaling embodies a circular series of buttons having contact pistons which can be pushed inward, a spring pushing each button outward. These buttons control electromagnetic devices operating various shutters which correspond to the order number of the stations along the line.

784,393. Commutator. Gustav Grabosch, Berlin, Germany. Application filed July 30, 1904.

The commutator has a transmitter having parallel rows of contacts, the first of the rows containing as many contacts as there are signals to be given. The second row contains half as many contacts as the first row, the third row half the number of the second row and so on, each contact of a subsequent row being double the length of contact in the preceding row.



NO. 784,502.—MAGNETIC ORE SEPARATOR.

784,447. Means for Maintaining Synchronism in Electric Motors. Paul Thomas, Charlottenburg, near Berlin, Germany. Application filed March 7, 1903.

Periodic current impulses are transmitted from the station of the primary shaft to that of the secondary shaft. These impulses actuate two separate regulating forces, one of the forces having a constant regulating effect upon the speed of the secondary shaft lasting for the time during which the shaft deviates from synchronism and ceasing as soon as synchronism is re-established. The other regulating force has a variable regulating effect upon the speed of the secondary shaft beginning with the beginning of the deviation from synchronism and increasing until synchronism is re-established and then remaining constant at the value obtained at the moment of the re-establishment of synchronism until a new deviation takes place. (See cut on preceding page.)

784,448. Trolley. John H. Thompson, Charleston, W. Va., assignor of one-half to Daniel Rogan, Birmingham, Ala. Application filed August 4, 1904.

Patentable features of the invention consist of a spring and an interposed rocking lever having a number of fulcrums and links connecting the pole and lever on opposite sides of their fulcrums adapted to yieldingly uphold the trolley and permit it to be automatically lowered and to raise it after lowering.

784,454. Electric Heater for Oil or Gas Wells. Fred B. Waring, Lima, Ohio, assignor of one-half to Ira R. Longsworth, Lima, Ohio. Application filed April 22, 1904.

An electric heater for oil wells embodies a pair of supports having openings and tubes with their ends extending in the openings and hermetically connected to the supports. Heating devices extend through the tubes and out of contact therewith. Binding posts carried by one of the supports furnish connection for the leading-in wires.

784,456. Electromagnet and Armature. Joseph Weber, Brooklyn, N. Y. Application filed May 1, 1900. Renewed August 31, 1904.

A disconnected armature is loosely mounted upon the core of a magnet, to oscillate about an axis parallel to the longitudinal axis of the armature; a projection on one part and a co-operating member being operatively arranged with relation to the projection for pivotally engaging the armature and core at their points of connection.

784,457. Electrical Attachment for Musical Instruments. Joseph Weber, Brooklyn, N. Y. Application filed August 19, 1904.

Combined with a musical instrument provided with keys are a series of electromagnets, one for each key and an upright on each of the keys, the electromagnets when electrically connected operating on the uprights to actuate the keys.

784,464. Means for Protecting Electric Cables Against Excess Pressure. Georg Zapf, Cologne-Nippes, Germany. Application filed March 24, 1904.

A coil for protecting an electrical cable against excess pressures, comprise a weakly insulated cable introduced into the circuit of the cable to be protected and provided with a lead casing and an earthed conductor formed of a wire wrapped around the casing. (See cut.)

784,498. Automatic Telephone-exchange System. John K. Norstrom and Henry M. Graif, Chicago, Ill., assignors to the Automatic Telephone Company, Chicago, Ill. Application filed May 18, 1903. Renewed July 5, 1904.

Lines of the subscribers are connected with a central group of line-selecting switches adapted and arranged to be instrumental in connecting for communication the lines of any two subscribers. Switch-actuating means are operatively associated with each switch, including a series of devices each adapted and arranged to control the corresponding switch. One of the devices in each series is operatively associated with each subscriber's line for control by the subscriber.

784,502. Magnetic Ore Separator. Lewis G. Rowand, Camden, N. J., assignor to the Wetherill Separating Company. Application filed February 28, 1898.

A conveyor-belt is adapted to convey the material to be treated and magnets are placed above and below the belt. The pole-pieces of opposite magnets are in proximity to the conveyor belt, the upper magnet having the stronger magnetic field. A discharging belt passes over and beyond and at an angle with the conveyor belt, the discharging belt being interposed between the conveyor belt and the upper magnet. (See cut.)

784,508. Electrically Actuated Piano. Joseph Weber, Brooklyn, N. Y. Application filed August 19, 1904.

Magnets for each key operate the latter, each magnet having a diameter greater than the width of one key but less than the width of two keys. The magnets are arranged so as to present a staggered effect. An operating armature is provided for each series of magnets, the armature having a lateral extension formed at one end and a connection between the end of the extension and the key.

784,521. Commutator for Electric Machines and Process of Making Same. Fritz A. Feldkamp, Newark, N. J. Application filed April 16, 1901.

Electrolytically deposited commutator sections are mounted on a core. Each commutator section comprises a main body portion extending laterally across the cylindrical face of the core, and downwardly extending end portions form integral parts with the main body portion, the end portions extending down the sides of the end faces of the core. Means on the end faces embedded directly in the end portions of the commutator sections prevent centrifugal displacement of the sections.

784,523. System of Electrical Distribution. Frank Hoffman, Chicago, Ill., assignor of one-half to Elmer E. Hanna, Chicago, Ill. Original application filed May 21, 1903. Divided and this application filed August 13, 1903.

A number of conductors are arranged to form three or more electric circuits of equal potential. An electric motor, and switch mechanism for connecting the electric motor between different pairs of the conductor complete the apparatus.

## EXPIRING PATENTS.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on March 13, 1905:

379,221. Coupling for Joining Electric Wires. C. Hering, Philadelphia, Pa.

379,284. Dynamo-electric Machine. L. C. Rice, Denver, Colo.

379,339. Fire-alarm Signal Box. G. M. Stevens, Cambridge, Mass.

379,368. Telegraphic Pen. H. P. Copeland, East Orange, N. J.

379,372. Non-polarizing Constant-current Battery. F. J. Crouch, Eugene City, Ore.

379,396. Electric Gas Lighter and Extinguisher. G. L. Hogan, Olmstead, Ky.

379,404. Device for Returning Signals in District-telegraph Systems. W. V. Lockwood, Waterbury, Conn.

379,406. Automatic Electric Spacing Mechanism for Typewriters. J. F. McLaughlin, Philadelphia, Pa.

379,451. Working Metals by Electricity. N. De Benardos, St. Petersburg, Russia.

379,465. Apparatus for Electric Bleaching. E. Hermite and C. F. Cooper, Dalston, County of Middlesex, England.

379,466. Regulation of Electric Motors. D. Higham, Philadelphia, Pa.

379,467. Regulation of Electric Motors. D. Higham, Philadelphia, Pa.

379,501. Switch for Electric Light and Motor Circuits. F. W. Braun and G. J. Kinney, San Francisco, Cal.

379,509. Electric Surface Railway. J. A. Enos, Boston, Mass.

379,532. Test Circuit and Apparatus for Electrical Cables. J. H. Farnham, Malden, Mass.

379,535. Telegraph Wire. W. Hewitt, Chambersburg, N. J.

379,551. Primary Electric Battery. H. Woodward, Detroit, Mich.

379,552. Primary Electric Battery. H. Woodward, Detroit, Mich.

# WESTERN ELECTRICIAN

**EVERY SATURDAY**

Vol. XXXVI. CHICAGO, MARCH 25, 1905

## Bloomington, Pontiac and Joliet Single-phase Railway.

Much interest has been manifested among engineers in the single-phase electric railway designed ultimately to connect the cities of Bloomington, Pontiac and Joliet, Ill. The distance between Bloomington and Joliet, which will be the two extremes of the completed line, is 90 miles, and forms one of the important links in the interconnecting system of electric railways which it is hoped will, before long, give direct service between Chicago and St. Louis. Already one can ride on electric cars from Chicago to Joliet. With the completion of the line now under consideration, Bloomington will be reached, making nearly one-half of the distance to St. Louis. A line already connects the city of Decature with Carlinville, and electric service can also be had from Edwardsville to St. Louis. The only two links remaining, then, would be from Bloomington to Decatur and from Carlinville to Edwardsville, and these are now under contemplation.

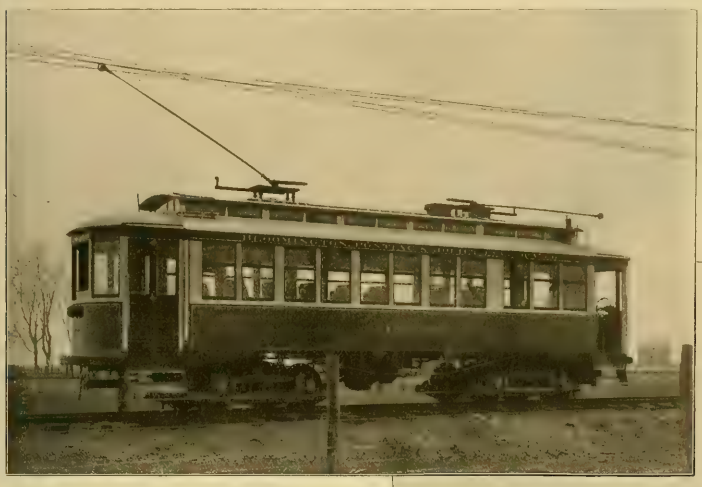


Fig. 1. View of Exterior of Car.

Aside from its relation, however, to what will eventually be one of the most important electric-railway systems of the state of Illinois, the system of the Bloomington, Pontiac and Joliet Electric Railway Company possesses many features of technical interest, it being the first single-phase road in the state and the third single-phase road of any kind to be put in operation anywhere in the United States. Thus far about 10 miles of the line has been put in operation, or that portion between Pontiac and Odell, to the northeast; from Odell to Dwight, still farther northeast, the construction work is now proceeding. The present article will treat of the completed section from Pontiac to Odell, which was opened to the general public for the first time on March 15th. One car only is as yet operated, which makes eight trips each way daily. Another car is under construction at the present time, and the two together will take care of the service until further extensions of the system are completed.

The General Electric Company's single-phase system of electric-railway operation has been employed, and the general characteristics are similar to those of the Ballston single-phase railway in New York state, which was described in the Western Electrician of August 27, 1904. In the present case, however, there is not the problem of direct-current city operation to be considered.

### Roadbed and Overhead Construction

Observing Fig. 2 of the accompanying illustrations, a straight-away view of a portion of the line a short distance from Pontiac is obtained. All work on the roadbed has as yet not been completed, but when the ballasting and leveling have been finished the road will compare favorably with steam-railroad practice. The maximum grade is one per cent., which occurs at but one point. The rails weigh 70 pounds to the yard and are American Society of Civil Engineers standard cross-section. They are bonded with General Electric ribbon bonds, corresponding in cross-section to a No. 0000 copper wire. The rails are also cross-bonded every 1,500 feet.

The trolley wire is supported by a catenary construction, as shown in Fig. 2, the supporting steel wires acting also as conductors. The line is in duplicate, to avoid complication at switching points and also to avoid delay in case of breakage of one of the wires, the other wire being always available. The steel supporting wires are three-eighths inch in diameter and are carried by poles placed 100 feet apart. The insulators for the two parallel lines are placed seven inches apart, center to center, on the bracket arms. Suspended from the steel catenary wire is a No. 00 copper trolley wire. As shown in the picture, this is suspended from the steel wire at one point only, midway between each two poles. As soon, however, as the weather has become warmer, and the wires have expanded as much as they are likely to, suspension wires from the catenary to the trolley wire will be put in.

Fig. 2. Catenary Construction of Trolley Line.
BLOOMINGTON, PONTIAC AND JOLIET SINGLE-PHASE RAILWAY.

The construction of pull-overs used on curves is shown in Fig. 3. Here is also shown the typical bracket construction for carrying the insulators.

The total cost of construction of the line was $16,000 a mile, which included everything connected with the overhead work and the track. The cost of the pole line, including poles, wires, insulators and labor, was $2,550 a mile.

### [illegible]

[illegible] full length of the car body, with the trolley boards suitably fitted on the top. There is a brake shaft mounted on each platform provided with a vertical ratchet brake wheel for emergency use.

Inside, the car is finished in cherry. The seats have high backs and are done in green leather, 16 being in the main compartment, and the smoking compartment being provided with longitudinal seats. A hot-water heater is installed.

The car, which was made by the American Car Company of St. Louis, is mounted on Brill trucks with 34-inch wheels, the wheel base of each truck being six feet. All up-to-date features have been supplied to the car, such as air brakes, trolley retrievers, enclosed arc headlight, etc.

Most interesting from an electrical viewpoint, of course, is the motor equipment. Four 50-horse-power single-phase motors furnish the necessary power for the car. These are connected two in series permanently, and are fed by the secondary of an 80-kilowatt self-cooled step-down transformer. The motors are each wound for 200 volts and are fed from five taps on the transformer secondary. A difference of potential of 400 volts is obtained on the last tap of the series, intermediate voltages of 350, 300, 250 and 200 volts being obtainable. During the transition of the controller point from one tap to the next there is no serious arcing, as coils of very high resistance are placed intermediate to the taps and the ground, effectually damping the arcing effect, which would otherwise be serious. With this arrangement the motors run at practically the same efficiency on any speed, which is one of the important points of advantage which the single-phase equipment has over direct-current operation, effecting a large saving of current over that which the ordinary motorman will use with direct-current motors.

The weight of the motors is approximately 4,200 pounds each. On the roof of the car are located the high-tension fuses and the copper ribbon fuse which protects the transformer. A 2,000-volt lightning arrester protects the car, and the trolley base is supported by the necessary insulators to give protection from the high pressure of 3,300 volts

which is used on the line. The trolley poles are two in number, 12 feet long and equipped with high-speed wheels.

Between the trolley and the ground there is mounted on the car a no-voltage-trip oil switch, the tripping solenoid of which is wound oppositely to

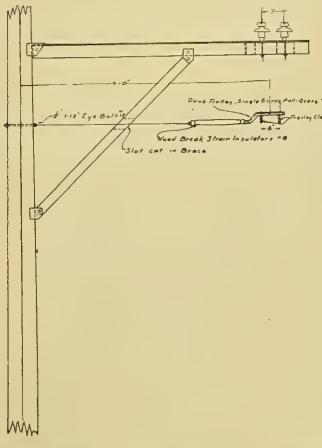



FIG. 3. BRACKET CONSTRUCTION AND PULL-OVER USED ON PONTIAC-ODELL SINGLE-PHASE LINE.

that of the ordinary circuit breaker which is intended to open the circuit at a certain overload. The no-voltage switch is so arranged that the solenoid plunger is held away from the tripping device by the normal action of the current. If the pressure fails or falls below a certain point, however, the coil lets go and the plunger, through the action of a spring, trips the switch.

The diagram in Fig. 4 shows the connections of the motor wiring, and by tracing the circuits a more correct idea can probably be obtained of the general arrangement of the apparatus than can be had from the description given above. The diagram represents the latest development in the system, which is as yet in the transitory stage.

Figs. 5 and 6 are the connections for the 25-cycle alternating enclosed-arc headlight, showing, respectively, the lamp-resistance circuit and the car connections. The resistance lamps shown in Fig. 5, which also serve for lighting the interior of the car, are of 24-candlepower, 115 volts, and are connected in groups of three in series. Current from the trolley passes through the primary to ground on the frame. Current from one terminal of the secondary is conducted through the arc of the headlight and back through the lamp resistance to the other terminal, the scheme being shown more clearly in Fig. 6.

### Power Plant.

Power for the road is procured from a temporary installation located in the power plant of the Pontiac Light and Water Company, located near the heart of the city on the bank of the Vermilion River. Fig. 7 is a view in the interior of this plant, showing the railway generator.

The generator is of the General Electric make, and is a 25-cycle machine delivering 53 amperes at 3,300 volts, with a speed of 500 revolutions a minute. It is a three-phaser and was installed instead of a single-phase machine for various reasons. Exciting current is obtained from a 12½-kilowatt direct-current dynamo, belted to the shaft of the main generator, as shown in the picture, and runs at a speed of 1,360 revolutions a minute.

The main generator is driven by a 25-inch triple belt from a Westinghouse 18-inch automatic compound non-condensing engine, the diameter of the high-pressure cylinder being 18 inches and that of the low-pressure cylinder 24 inches, both developing about 500 horsepower. Steam for the engine is taken from the boilers of the light and water company. They are three in number, Stirling water-tube, of 250 horsepower each.

At the side of the generator and partially shown in the picture is the temporary switchboard, supplied with a Thomson voltmeter and ammeter, field rheostat, etc. On the back of the board is located a 300-ampere electrically equipped oil switch with the necessary pressure transformers for the electrical tripping device of the switch.

There is nothing of especial interest about this part of the plant, the apparatus not being put in with a view of permanent operation. As soon as the system has been extended sufficiently to warrant the outlay, a new and fully equipped power house will be erected for the exclusive operation of the road.

### Organization and Personnel.

The Bloomington, Pontiac and Joliet Electric Railway Company was organized January 1, 1905, with a capital of $300,000. The officials of the company are as follows: President, J. A. Carothers; vice-president, D. S. Myers; secretary, A. C. Folsom;

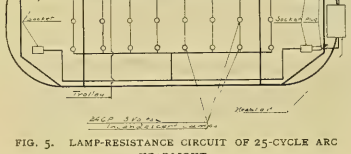



FIG. 5. LAMP-RESISTANCE CIRCUIT OF 25-CYCLE ARC HEADLIGHT.

treasurer, W. F. Van Buskirk; general manager, Fred L. Lucas; directors, J. A. Carothers, B. F. Harber, John McWilliams, Jr., John S. Murphy, D. S. Myers, E. M. Johnson, A. M. Legg, C. E. Legg and Dr. J. E. Covey.

In the few days that the road has been in operation evidence of a bright future, financially, has been manifested. The road parallels throughout its length two steam roads, the Chicago and Alton and the Wabash. The former is the one indicated by the line of telegraph poles at the left in Fig. 2. The fare from Pontiac to Odell on the new electric line is 20 cents, considerably less than that on the steam roads, and in consequence of this and for other reasons some jealousy has been manifested on the part of the steam lines toward the competitor, and one of them has succeeded up to the present in preventing the electric road from crossing its tracks to reach the center of Pontiac. Everything is in readiness, however, to run cars clear in as soon as the legal proceedings have been concluded, and the track is all ready with the exception of a few rods across the steam road's right-of-way.

In the mean time, however, the electric company is obliged to run free buses from the courthouse square out to beyond the steam-railroad tracks, a distance of about a mile, which is naturally a detriment to the traffic. In spite of this, however, the car in operation is running with good loads at every trip and the traffic has increased to about 250 fares a day.

All the engineering and construction work on the

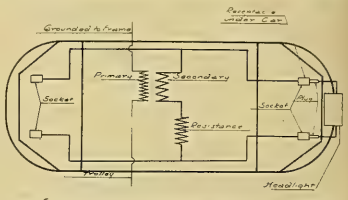



FIG. 6. CAR CIRCUIT OF 25-CYCLE ARC HEADLIGHT.

power and line equipment was done by The Arnold Company of Chicago.

The General Electric Company has taken a great interest in this particular piece of work, as it embodies so much that is new and of the utmost interest to builders and operators of electric railways. Mr. J. S. Pevear and Mr. G. H. Hill, two prominent engineers of the company, came from Schenectady to witness the opening of the line. Since the new car was brought from the factory the company has also had a capable man (Mr. R. Stearns) out from the factory, to stay with it till everything has been thoroughly tested and to observe carefully its action under operating conditions.

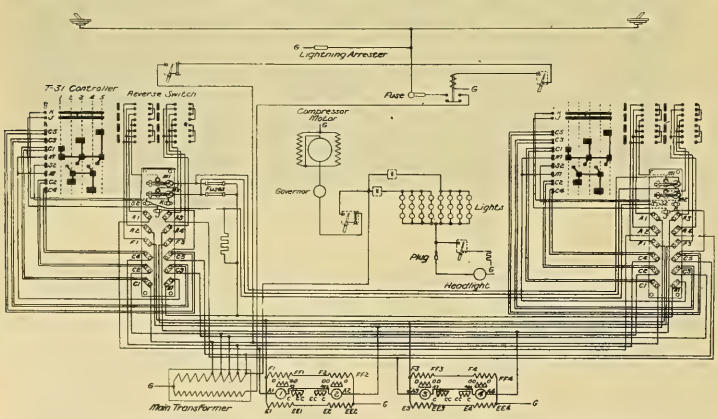



FIG. 4. DIAGRAM OF WIRING OF SINGLE-PHASE CAR OF BLOOMINGTON, PONTIAC AND JOLIET RAILWAY.

## Recording Ammeters on Arc Circuits.

The use of recording instruments has long been held in favor in general power-plant practice where the conditions require the preservation of an automatic exhibit of voltage, current or power fluctuations. Thus, recording voltmeters are often installed in central stations so that the manager or other supervising official can see at a glance how well the pressure on the bus bars or distributing circuits is held up to normal, and, similarly, ammeters are frequently placed in series with storage batteries during charge or discharge, so that a record of the current input or output may be had.

For use on arc-lighting circuits, however, the advantage of a recording ammeter is not so generally appreciated. At first sight the "constant-current" characteristics of such circuits naturally lead one to ask the need of recording apparatus of any sort. A little consideration will soon bring out the fact that a great deal of time and trouble can be saved through the recording ammeter. The installation of such an instrument saves a large amount of "plugging in" on the part of the switchboard attendant, with its ever-present danger of high-potential shock if carelessly done, to determine just what current is flowing in the lamp circuit. Considerable time is also saved, as the attendant consulting the disk record can tell at a single glance, and without touching a switch or plug, just what the current has been doing in the way of fluctuations since his last look at the instrument, as well as what its value is at any given moment. And, finally, it is a good thing for a central station to have such records of the behavior of its arc circuits when the representatives of the municipality appear with outage claims in their hands. It is, of course, unfortunate that the station instruments cannot record the performance of individual arc lamps, but even if this is out of the question, the moral effect of a clean diagram approaching the circle as the limit of perfection, is not to be despised. In case wires are cut or current shut off during a fire the usefulness of such records is apparent. In using these instruments at its Springfield (Mass.) power station, the local lighting company is often able to detect slight irregularities in the operation of the Brush arc machines in its waterpower plant, some eight miles away, with the result that the attendants are apprised by telephone of the condition of affairs perhaps before it naturally comes to their attention. Of course, such instruments can doubtless be dispensed with in many installations where such refinements of operation are impracticable, but their use is certainly worth thinking about in plants which attempt to operate close to the best standards of regulation and reliability.

H. S. K.

## QUESTIONS AND ANSWERS.

A Chicago reader of the Western Electrician asks the question, in relation to the proposed 60,000 volt direct-current transmission system in France, mentioned in the issue of March 11th, how the current can be utilized at the receiving end of the line. This will no doubt be done, as in the case of previous high-pressure direct-current systems, by the use of groups of motor-generators, with the motor ends in series, the generators supplying whatever character of current is desired, alternating or direct, and at the required pressure.

A central-station company in a southern state writes: "We are in controversy with one of the towns lighted by our system over the construction of the words 'Standard Moonlight Schedule' contained in our arc-lighting contract, and we would thank you very much to give us your construction of these words as applied to a contract for city lighting."

Answer.—A "Standard Moonlight Schedule" is not known. Probably the oldest and best-known moonlight schedule is the "Philadelphia Moonlight Schedule," and in the absence of any further specifications the latter is undoubtedly meant. Compare the preface to the "Lamp-lighting Schedule" of the Western Electrician for 1905 and also the article therein on "Moonlight Schedules for Arc Lighting," by Mr. F. B. Badt.

A reader of the Western Electrician in Missouri wishes to know what is meant by the terms single-phase, two-phase and three-phase.

Answer.—To obtain a clear conception of the action of an alternating current requires the exercise of some little imagination, especially when dealing with polyphase currents. Taking first the single-phase current: This is the simplest form of alternating current and is produced by the rotation of a single coil in a magnetic field. As the coil revolves the pressure begins, say, at the zero value, increases in the positive direction to the maximum, falls back to zero, increases in the negative direction to a maximum and again falls back to zero, making a complete cycle.

If, now, two coils are revolved in the same magnetic field, but placed at an angle of 90 degrees with each other, two alternating-current waves will be sent out over the circuit, but their electromotive forces differing in phase from each other by 90 degrees. That is, when the pressure generated by coil No. 1 is at the maximum the pressure generated by No. 2 is zero. When the pressure of No. 1 is zero that of No. 2 is a maximum—a two-phase current resulting. Finally, if three coils are used at

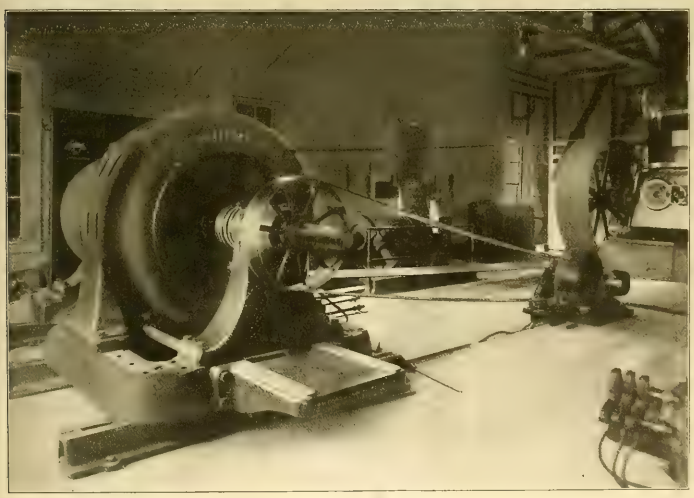


FIG. 7. THREE-PHASE ALTERNATOR OF BLOOMINGTON, PONTIAC AND JOLIET SINGLE-PHASE RAILWAY.

angles of 120 degrees apart, three waves of electromotive force will be superimposed upon one another 120 degrees apart, generating a three-phase current, the phases of the current differing from each other by one-third of a period.

In the transmission of two-phase current two wires are used, the current going by one line and returning by the other, the phase in the return line being opposite to that in the outgoing wire at any instant. In three-phase transmission there are three wires used, the currents in the three [illegible] from each other in phase by one [illegible] and at a certain instant one of the wires [illegible] positive current equal to the sum of the two [illegible] currents in the other two wires.

## The Electrical Equipment of the S. S. Caronia.

There are several interesting features in the electrical equipment of the new Cunard steamship Caronia, which left New York on her first voyage eastward last Saturday. The chief engineer, John Currie, when seen on board by a representative of the Western Electrician, was very proud of the equipment, but confessed that the multiplicity of its details was more than he could master in a single trip.

"The electrical equipment," he said, "constitutes a separate department. The four dynamos, which are in a room by themselves, are each of 100 horsepower, working at 450 revolutions per minute and giving 750 amperes at 100 volts. When the full load is upon the dynamos the speed is reduced to 400 revolutions. Generally speaking, one dynamo is always kept in reserve, for three of the dynamos are sufficient for the highest peak on the darkest winter day. The dynamos are driven by four Belliss patented quick-revolution self-lubricating engines, rated at 110 brake horsepower, and usually taking steam at 150 pounds pressure from the ship's main boilers. The cylinders are nine by 15 by seven inches and exhaust to the atmosphere.

"We have altogether about 3,000 incandescent lamps on board. The lamps in the main saloons are of eight candlepower and are wired along the length of the saloons so that they can be switched on over the tables as required. The lamps in the staterooms are of 16 candlepower. In certain parts of the ship, especially in the storerooms, where much light is needed, lamps of 36 candlepower are used. Electric light is used in every part of the ship, even for the masthead and for the port and starboard lights, which are wired in clusters of 50 candlepower lamps. A special automatic indicator on the bridge informs the bridge officer at all times whether the lamps are burning properly. In certain rooms, according to requirements, portable incandescent lamps are supplied, with movable screens, to throw the light at any angle. In the almost impossible event of the electric current failing, oil lamps are held in reserve in every part of the vessel and are kept ready trimmed, for the Cunard line is somewhat conservative."

[illegible] available and a boat can be lowered more quickly than the ship can be stopped. I believe that these are the only electric winches used for such a purpose on any Atlantic steamship."

The [illegible] reproduced herewith, was specially taken for the Western Electrician, are each operated by a motor working at 91 amperes and 100 volts. They revolve at 590 revolutions per minute and can lift a weight of three tons at the rate of 30 feet a minute. Two controllers, port and starboard, are fitted to each winch, and the whole mechanism is fully protected from the weather and the lead-sheathed cables are also protected with iron armor along the deck.

ELECTRIC WINCH ON S. S. CARONIA SHOWING ENCASED MOTOR.

Speaking of the ventilation of the vessel, Mr. Currie continued: "We have what are called thermo tanks. In these tanks, in cold weather, fresh air is passed over steam coils and raised to a temperature of 70 or 80 degrees, or in warm weather cool air is brought from the highest deck. There are 14 tanks, each driven by a motor of about 1½ horsepower, and the air is distributed to the third-class accommodations and thoroughly ventilates the dining and sleeping-rooms, renewing the entire atmosphere without drafts in about five minutes. A similar but not so extensive ventilating plant is used on board some of the other Cunard boats, and I have myself in hot weather gone down into the third-class quarters and found them cooler than the first and second cabins. This ventilating system will, I believe, in time be also applied to other parts of the Caronia. Exhaust fans, motor-driven, also remove foul air from all portions of the ship, and if the air is too dry a humidifier moistens the atmosphere. Ventilating fans, driven by small motors, are also installed in the engine room and the stokehole, which makes it very comfortable for the firemen."

Intercommunicating telephones are placed in all the rooms of the heads of departments and in the engineer's quarters. All wires are specially protected in metal pipes, but are readily accessible.

D. W. W.

## American Railway Engineering and Maintenance of Way Association.

The sixteenth annual convention of the American Railway Engineering and Maintenance of Way Association was opened at the Auditorium Hotel, Chicago, on Tuesday morning, March 21st, for a three-day session. About 100 engineers and men active in the operation and maintenance of railroads were present when President Hunter McDonald of Nashville, Tenn., called the first session to order. Other members were gradually coming in, and the indications were for a very successful meeting.

The long programme consisted mainly of committee reports on the many topics which come under the head of railway engineering and maintenance of way.

There was a good showing of exhibitors at the hotel from among the railway supply men.

The present officers of the association are: President, Hunter McDonald, Nashville, Tenn.; first vice-president, H. G. Kelley, Minneapolis, Minn.; second vice-president, James Dunn, Chicago; treasurer, W. S. Dawley, Chicago; secretary, L. C. Fritch, Chicago.

## Pyro-electrolytic Lamp.

Albert G. Davis of Schenectady, N. Y., has recently made and patented some improvements to that class of electric incandescent lamp in which it is proposed to use pyro-electrolytic substances as the source of light. Certain substances known as "pyro-electrolytes" act as conductors of electricity at high temperatures, but are insulating at low temperatures, or, speaking more broadly, tend to have their resistance reduced as their temperature rises. It has been proposed to utilize such substances as light-giving bodies in electric lamps. It is necessary in such devices to in some way heat the light-giving material to a high temperature before it will take current, and various arrangements have been proposed for doing this. A difficulty which has arisen

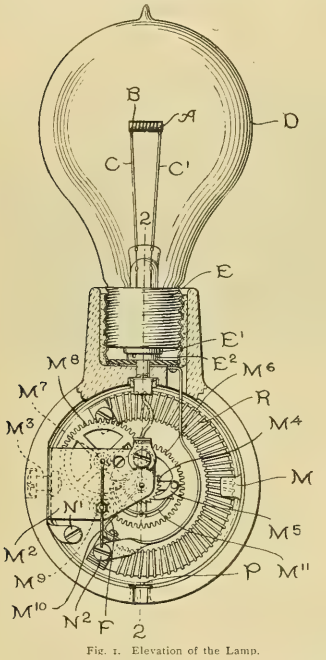



Fig. 1. Elevation of the Lamp.

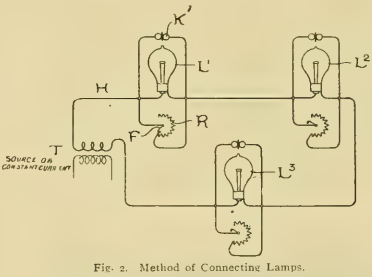



Fig. 2. Method of Connecting Lamps.

PYRO-ELECTROLYTIC LAMP.

resistance of the lamps when cold is so high it is impossible to insert them directly in the system in the manner in which arc lamps are ordinarily inserted. Mr. Davis avoids this difficulty by placing in multiple with each lamp a resistance which is capable of being gradually short-circuited. This resistance may obviously be highly inductive, if desired. Also on each lamp, in multiple with the light-giving body, is placed a starting coil or resistance.

Fig. 1 is an elevation of the lamp, partly in section, with the cover removed. Fig. 2 is a diagrammatic illustration of a system provided with three lamps in series.

The light-giving body (A) may be composed, for example, of magnesia, marble, porcelain or other substance possessing the qualities above set forth. A spiral (B) of high-resistance wire is wrapped around or embedded in the body. Conductors are connected to the terminals of the body and the resistance wire, respectively, and which further serve as mechanical supports for the light-giving body.

If preferred the light-giving body may be incased in a bulb similar to that used in ordinary incandescent lamps; but this is not essential. The shell (E) forms one terminal of the lamp, and (E') is the plug which forms the other terminal. A resistance (R) is arranged in multiple with the lamp and can be gradually short-circuited by a lever (F).

Referring now more particularly to Fig. 2, (T) is a source of constant current, such as a transformer of the so-called "leakage" or constant-current type, arranged to feed current of substantially constant volume to the circuit (H). A number of lamps (L') (L2) (L3) are shown connected in series in this circuit, each of the lamps being shunted by the resistance (R), controlled by the arm (F). Further, each lamp is shunted by a film cut-out (K'), which comes into action in case for any reason the lamp may be destroyed.

Suppose now that it is wished to light the lamp (L'). The resistance arm (F) is gradually moved in left-hand rotation to the resistance, thus cutting more and more resistance into the shunt, raising the potential across the terminals of the lamp and forcing current to flow through the fine wire (B) (Fig 1). This heats the body (A), which gradually begins to take current before the resistance is entirely cut into the shunt, so that the heating resistance, which might be destroyed by the full current, is not subjected to the current. By the time the arm has reached the position shown in connection with the lamp (L2), for example, the light-giving body will become of such low resistance that it will take current to the practical exclusion of the resistance.

The mechanical construction necessary to carry out the method of operation above described is shown in detail in Fig. 1. The socket is supposed to be built of porcelain or other non-conducting material or to be lined with insulation. The resistance (R) is coiled around an insulating support and is fastened in place by a clip (M). When the source of supply is alternating the resistance should have a core of soft iron in order to increase the impedance. The socket itself is divided into two parts which are fastened together by a screw. A metal strip (M2) bent twice around itself at right angles is supported from the socket by a bolt. This forms a support for the mechanism. The key (G) drives a ratchet wheel (M4), which in turn drives, through a pawl, a gear wheel (M5). This gear wheel drives, through a pinion, a second gear wheel (M3), which in turn, through a pinion, drives the vane (M2a). It is thus obvious that a left-handed rotation of the plug (G) (Fig. 1) will be arrested by the action of the vane, so that it will take a certain definite time before any considerable rotation can be accomplished. The shaft of the handle (G) drives the arm (F), which travels over the resistance (R).

This mechanism makes it necessary to turn on the lamp very slowly to allow time for the light-giving body to attain a proper temperature before the resistance is open-circuited; but it makes it possible to turn off the lamp very rapidly, as a right-handed rotation of the ratchet-wheel (M4) is not opposed by the pawl (M6).

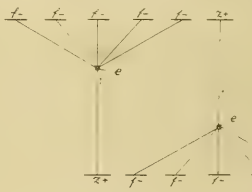
in such devices is that, though the efficiency is high, the lamp is unstable. Its resistance varies inversely with its temperature, while its temperature varies more or less directly with the amount of current flowing through it. Therefore the greater the temperature the greater the conductivity and the greater the conductivity the greater the temperature, so that if the lamp once gets beyond a certain temperature it will take current indefinitely until it is destroyed. In a test it was found that a pyro-electrolyte connected in a constant-potential circuit heated up slowly, and after reaching a proper conducting temperature instead of remaining there rose rapidly in temperature and was fused and destroyed. It has been proposed to remedy this difficulty by placing regulating resistances in series with each lamp, placing the lamps as usual in multiple on constant-potential mains. This arrangement, however, involves a considerable waste of energy and is not entirely satisfactory.

In the system of Mr. Davis (the patent for which is assigned to the General Electric Company), lamps of this general nature are utilized, but the lamps are connected preferably in series, on a constant-current circuit, either direct or alternating, as may be preferred. This obviates the objection above noted and gives a more satisfactory regulation. If the temperature of the pyro-electrolyte from any local or other cause increases above the degree proper for normal conductance the resistance decreases, but the current is constant, and hence the energy is correspondingly decreased and the temperature of the body is reduced to its normal degree. Again, if the temperature of the body decreases below the normal degree the resistance increases, and as $C^2$ is constant the energy is correspondingly increased and the temperature increases to its normal degree. The result is a permanent self-regulating pyro-electrolytic lamp; but as the

## New Method of Electroculture.

Various methods of the application of electricity to agriculture and horticulture have been described in the Western Electrician from time to time. A scheme of this nature has been patented by Eugene Pilsoudsky and Eugene Ragozine of St. Petersburg, Russia, which is novel in that it contemplates the combined effect of galvanic currents and atmospheric electricity. Figs. 1 and 2 represent the arrangement of the galvanic elements and Fig. 3 is the apparatus by which the results are to be obtained.

The galvanic elements used are iron plates as negative electrodes and zinc plates as positive electrodes. These plates should have about two square meters surface, and five iron plates are used for each zinc plate. In Fig. 1 the iron plates are represented at (f) and the zinc plate at (z). They are




FIGS. 1 AND 2. NEW METHOD OF ELECTROCULTURE.—ARRANGEMENT OF GALVANIC ELEMENTS.

buried in the earth, as indicated at the extreme right in Fig. 3, by first digging a ditch, then placing the plate in the middle of the ditch, and finally packing earth around the plate, water being preferably used to insure a good contact. All the iron plates of each set are electrically connected by wires, the distance between adjacent plates being about one meter. The metallic connection between the zinc plate and the opposing set of five iron plates is carried by insulators on posts (e), as indicated in Fig. 3.

The sets of galvanic elements, each set comprising one zinc plate and five iron plates, as stated, are set in rows about 15 meters apart, and each successive set is reversed, as shown in Fig. 2—that is, the zinc plate replaces the iron plates, and vice versa—so that the current in adjoining portions of the field flows in opposite directions.

The atmospheric electricity is collected by toothed plates (d), Fig. 3, supported on the tops of the posts (e), each plate (d) being connected to the next. The end plates of the two outer rows of the field are connected to metal plates (a), buried in the earth, as shown in Fig. 3, and a rheostat (r) is introduced into the circuit. These upper wires (c) for the atmospheric electricity are connected at intervals by cross-wires. The potential of the atmospheric electricity is constantly varying, and this sets up a current by induction in the parallel conductor, uniting the earth elements (f) and (z).

It is essential to the operation of the system that

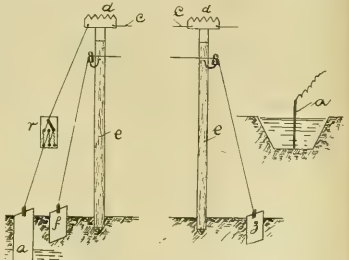



FIG. 3. ELECTROCULTURE.—ARRANGEMENT OF EARTH PLATES AND ATMOSPHERIC ELECTRODES.

the circuits be closed only during the night and left open in the daytime. Furthermore, the connections between the earth elements must be opened for 24 hours each week, in order that the electrodes may become depolarized. Every three years the iron plates must be renewed; but the rest of the installation can be used for a long time.

It will be seen that the system is simple and inexpensive to install and maintain, and the inventors maintain that their experiments have demonstrated its efficiency and utility.

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The Metropolitan Street Railway Company of Kansas City, Mo., will "electrify" the Twelfth Street line this summer. It is the last cable line in the city.

## Lighting Situation in New York City.

Some extracts from the report of the committee appointed to make a preliminary investigation on the subject of a municipal lighting plant for New York city will be found interesting.

The committee estimates that by the time the city plant is ready for operation at least 6000 arc lamps will be required and a connected load equivalent to 250,000 16-candlepower incandescent lamps, requiring a power-plant capacity of 10,000 kilowatts. The total cost of the system, including a power station with a capacity of 10,000 kilowatts will be $4,100,000. The committee estimates the total annual cost of operating a 7.5-ampere enclosed alternating-current arc lamp for 4,000 hours a year, including the costs of generation, distribution of energy, lamp repairs, carbons, trimming, inspection, globes, fire and boiler insurance, general expenses of management, depreciation at 7.5 per cent. on the total investment and interest at 3.5 per cent. on the total investment will be $75.40. For incandescent lamps the total cost at the lamps is estimated to be 5.15 cents a kilowatt-hour.

Summing up these items the total cost of operation will be approximately $906,000 a year.

These estimates include neither the cost of construction of ducts for cables nor any rental charge for duct space. These items have been omitted under instructions of the mayor and corporation counsel, who aver that the city has the right to use all the duct space that it requires and free of all charges.

After much discussion both as to the subject and the ultimate choice of names the New York state Senate has appointed a special committee to investigate public lighting in the city. Pending the investigation of this committee, Mayor McClellan has ordered that the lighting bids which were opened March 15th shall not be accepted, on the ground that they show no material reduction of prices.

An attempt is being made to improve the public lighting of the borough of Brooklyn. A. E. Allen, the engineer in charge of this work, reports that the appropriation needed for the current year will be $1,173,186.75, or $58,600.90 more than the amount allowed by the board of estimate. This sum includes $56,745 for 582 1,200-candlepower arc lamps at $97.50 each; $7,708.80 for 66 1,200-candlepower lamps at $116.80; $510,610.70 for 4,415 1,200-candlepower lamps at $124.10, and $13,030.50 for 210 600-candlepower lamps at $62.05.

## Railway Signaling Association.

A meeting of the railway Signaling Association was held at the Great Northern Hotel, Chicago, on March 14th. It was attended by about 60 members and associates from various states in the association. There were no new papers read, the meeting being largely devoted to the discussion of papers read at the January meeting of the association in New York. These papers were on the relation of the storage battery to railway signaling and upon the standardization of interlocking apparatus. The annual meeting of the association, at which matters of general interest to signal engineers will be discussed, will be held at Niagara Falls on Tuesday, October 10th. Mr. H. S. Balliet, assistant signal engineer of the Lehigh Valley railroad, South Bethlehem, Pa., is secretary of the association.

The city of Alma, Neb., has voted to issue bonds for the erection of an electric-light and water plant.

## Experimental Work of the Electric-railway Test Commission Completed.

The experimental work of the Electric-railway Test Commission has been completed, and the engineering work relative to the [illegible] from the tests still remains to be done. In an article in the Western Electrician [illegible] by Prof. Henry H. Norris, superintendent of electric railway tests, the work of the commission is outlined. Since the publication of th[illegible]

Fig. 1. Wind-test Car Fitted with Wedge-shaped Vestibule.

Fig. 2. Wind-test Car with Parabolic Vestibule.

EXPERIMENTAL WORK OF THE ELECTRIC-RAILWAY TEST COMMISSION.

However, several pictures of the test car, which were unavailable at the time, have been received, and as they are of much interest in connection with the valuable work of the commission, they are here reproduced.

Figs. 1, 2 and 3 are views of the special dynamometer car, which was completed at the shops of the Indiana Union Traction Company at Anderson, Ind., and tested upon the tracks of that company. The car was built for the purpose of ascertaining the effect of wind resistance in high-speed operation, and during the tests a speed of 75 miles an hour

FIG. 3. INTERIOR OF WIND-TEST CAR, LOOKING FORWARD FROM REAR.

was attained. It will be remembered that the car was of special construction and consisted of a dynamometer car 32 feet long, without vestibules, mounted to roll freely upon rails screwed to the top of a flat car. Special vestibules were also made, independent of the main car body, for separating the head and rear resistances from the total. The vestibules were carried by a link suspension and attached to a dynamometer.

Fig. 1 is a view of the car fitted with a wedge-shaped vestibule and Fig. 2 shows it with a parabolic vestibule. The test commission realized the necessity of making exact measurements of all the quantities involved in the test, especially as regards the speed measurements. For this purpose two plans were adopted; one being to divide the test track into sections, plainly marked, and to record the time of passing each point upon the graphical

they will no doubt prove a source of much valuable information relative to high-speed operation.

## Electric Traction Development in Indiana.

The present year will witness further important developments of the electric-railway business in Indiana. A number of new lines have been promoted, and a dozen surveying parties are at work locating the routes. The grading of the roadbed of the Evansville and Eastern traction line, between Evansville and Rockport, was completed last week. This road was financed a little over six weeks ago. Superintendent Sontag says that cars will be running by mid-summer. Work has begun on the Evansville and Princeton branch from Kings Station to Owensville, while construction work has been resumed on the South Bend, South Shore and Chicago railroad, between South Bend and Laporte; the Wabash and Rochester interurban line between Roann and Rochester; the Kokomo, Marion and Western Traction line, between Marion and Kokomo; the Dayton and Muncie traction line, between Parker City and Muncie; the Goshen-Warsaw line, between Goshen and Warsaw; the Indianapolis and Plainfield line, between Plainfield and Cartersburg, and the Indianapolis, Danville and Rockville road, between Indianapolis and Danville.

The following lines will also build extensions during the year: The Muncie, Hartford City and Fort Wayne Traction Company will build a line north from Bluffton to Fort Wayne; the Indianapolis and Cincinnati Traction Company will extend its line from Rushville to Connersville; the Fort Wayne and Wabash Valley Traction Company will build between Logansport and Lafayette, and the Indiana Union Traction Company a line between Anderson and Newcastle.

The experience in the interurban localities of the state is that farmers as well as cities are gainers by traction lines with hourly service for transporting produce. The interurbans have also greatly enhanced the selling price of land. For this reason few subsidy elections held in aid of interurban lines are opposed. A subsidy of $30,000 was voted the Evansville and Princeton line in aid of a branch to Owensville in Gibson County on March 13th, and a $20,000 subsidy to the Huntington, Columbia City and Northern Traction line in Huntington County on the 14th. This line is to be built between Huntington and Goshen, where it will connect with the Indiana Railway Company's line to South Bend. Altogether $82,500 in subsidies have been voted to this road. A number of subsidy elections have been ordered for April, and in every instance the roads are greatly desired, and it is believed that all will carry.

The Muncie, Hartford City and Fort Wayne Traction Company has filed a mortgage of $1,000,000 on its property in favor of the Guardians Savings and Trust Company of Cleveland. The money raised is to be used in completing its branch line north from Bluffton to Fort Wayne. This line has been in operation nearly two years and shows the greatest per cent. of earnings of any road in the state. S.

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## DATES AHEAD.

Ohio Independent Telephone Association (annual meeting), Columbus, March 30th.

Iowa Electrical Association (annual meeting), Hotel Julien, Dubuque, Iowa, April 19th and 20th.

American Electrochemical Society (annual meeting), Boston and Cambridge, Mass., April 25th to 27th.

National Electric Light Association (annual convention), Denver, June 6th, 7th and 8th, and Colorado Springs, June 9th, 10th and 11th.

National Interstate Telephone Association (first convention of consolidated telephone associations), Chicago, June 21st, 22d and 23d.

Ohio Electric Light Association (annual convention), Hotel Victory, Put-in-Bay, August 15th to 18th.

International Association of Municipal Electricians (annual convention), Erie, Pa., August 29th, 30th and 31st.

American Electrotherapeutic Association (annual meeting), Academy of Medicine, New York city, September 19th, 20th and 21st.

American Street Railway Association (annual convention), Bellevue-Stratford Hotel, Philadelphia, September 25th to 29th.

SINGLE-PHASE operation of electric railways is still in the experimental stage. But the system has great possibilities. Three single-phase roads are now in operation in the United States, and others are being constructed, the latest one opened to traffic being the line from Pontiac to Odell, Ill., owned by the Bloomington, Pontiac and Joliet Electric Railway Company and described in this issue. Though as yet the superiority of the single-phase motor can hardly be said to be demonstrated beyond question for interurban service, still it presents itself as a desirable solution of the long-distance electric-railway problem. It can hardly be that the cumbersome system now in vogue of employing a high-tension alternating-current transmission line to transmit current to sub-stations along the line, and then using costly machinery requiring constant attendance to transform this current into a kind to be used on the cars, is the flower of electric-railway development. Indeed it may be safe to say that such a method has only been used in lieu of something better, and now the question arises, Is the single-phase system the better method, for which the engineers have been looking? It is probable that it is, and in spite of the fact that these first attempts in the direction of single-phase operation will undoubtedly bring to the surface many defects as to details, the single-phase system, when proper time has elapsed for its development under operating conditions, is likely to prove the solution of many of the problems of interurban transportation.

OWNERS of trademarks and others interested in the subject will scrutinize with attention the new trademark law which goes into effect on April 1st of this year. The act is entitled, "An Act to Authorize the Registration of Trademarks Used in Commerce with Foreign Nations or Among the Several States or with Indian Tribes, and to Protect the Same." It supersedes all previous legislation on the subject, without, however, affecting existing rights acquired under the common law or acquired by registration under the act of 1881. The subject of the revision and modification of the laws relating to trademarks has been before Congress in one form or other since 1870. Under an act of 1898 President McKinley appointed commissioners to revise and amend the trade-mark laws. This commission, composed of Francis Forbes, Judge Peter S. Grosscup and Arthur P. Greeley, made an elaborate and exhaustive report on the subject of trademarks and prepared the bill which later became the law now about to go into effect.

The main purpose of the law is to aid, so far as is within the powers conferred on Congress by the constitution, American owners of trademarks in securing full protection for their trademarks within the United States and abroad. A further purpose of the act is to facilitate and encourage registration, that the register of trademarks may be made as complete as possible, so that the public may know what marks are in use and who asserts exclusive claim to them. Foreign owners of trademarks may obtain all of the rights in this country to which they are entitled under the provisions of treaties to which the United States is a party. The registration fee is reduced from $25 to $10. Provision is made for the registration of all marks which, under the common law, may be considered as trademarks. It is provided also that marks used in interstate commerce may be registered as well as those used in foreign commerce or commerce with Indian tribes. Various sections provide for the jurisdiction of courts and the execution of the law, although it appears that there is no provision by which a willful infringer of a trademark can be punished by fine or imprisonment. But damages can be recovered, if proved, to the extent of three times the actual damages.

Mr. A. P. Greeley, who is entitled to be called the father of the new law, believes that the provisions of the new act will be effective to secure a very general registration of all trademarks in use in interstate commerce, and, as practically all trademarks in use in the United States are used to a greater or less extent in interstate commerce, will be effective to make the register of trademarks so far complete that it may be relied on by the public for information as to what marks are in use. Certificates of registration shall remain in force 20 years and may be renewed from time to time for like periods. Certificates in force under the existing law shall remain in force for the period for which they were issued, but are renewable under the new law.

DETROIT has probably, on the whole, the best municipal electric-light plant in the United States—that is, the best and most intelligently administered and so the best representative of its class. And yet there appears the same disingenuousness on the part of the municipal-ownership advocates in computing costs of operation in Detroit as elsewhere. Thus, about a month ago the Public Lighting Commission of that city gave out a statement to set forth the cost of public lighting for the 10 years ending June 30, 1905. The figures showed that the city would have paid by contract $2,335,392.57 for arc and incandescent lighting during that period, while the entire cost under municipal ownership was $2,172,451.80—a saving in actual cash of $162,940.77, in addition to the net value of the plant, $824,021.24, making the total saving to the city $986,962.01. This is a large sum, and the showing, if as true as it is plausible, would seem to more than justify city ownership.

But it appears that the figures given are unreliable. In the first place the contract price assumed to arrive at the amount which it is said that the city would have had to pay under private ownership is $102.20 a lamp a year. This figure was taken from a bid made early in 1893, 12 years ago, by the Detroit Electric Light and Power Company—a company now defunct. Mr. Hoyt Post, attorney for the Peninsular Electric Light Company of Detroit, in a signed statement, says that at no time since 1898 has the contract price for arc-lighting service exceeded $80 a lamp a year, while a proposal for a wholesale supply of current was made two months ago at a figure that would not have exceeded $62.50 a year. Mr. Post adds, addressing the Public Lighting Commission:

In making your official record of these figures I respectfully suggest that you also note for future reference that the price, $102.20, to which you gave publicity a week ago, was a bid made 12 years ago by a company now defunct; that there was and is no connection nor continuity of interest between that company and the companies now doing business in this city; and that this 12-year-old bid was actually rejected 12 years ago because it was considered high by the city of Detroit, and it was this high price that impelled the city to enter into the business of municipal lighting.

This statement of fact renders entirely valueless the commission's figures purporting to show what the city would have paid by private contract for its lighting during the 10-year period. Again, as to the cost of municipal lighting, Mr. Alex Dow shows, by the records of the city controller, that the total cash expenditures of the city of Detroit for the public lighting plant were $2,458,557.39. The excess here over the figures of the commission is due to the curious fact that the latter simply failed to include the interest on the bonds. The third element in the computation is the value of the existing plant. This is undoubtedly too high, as a large portion of the equipment is practically obsolete. Probably 60 per cent. of the "net value" given would be near the correct figure. Then, too, there is no allowance for the loss of taxes when a public plant takes the place of a private one.

Altogether it will be seen that Detroit has made little, if any, saving by its municipal-lighting venture, and that the figures given by the commissioners in their pride of place cannot be accepted as accurate. It is no wonder that Prof. Hugo R. Meyer of the University of Chicago, in discussing the subject of municipal ownership a few days ago, used the following language: "It is a fallacy to think that governments are munificent. They are not even intelligent. We have trusted a good many years to the corporations and captains of industry to develop industries, and the industries have been developed to supply the demand." It would, in truth, be a serious thing for the heretofore self-reliant American people if it should come to rely on government to carry on its industrial enterprises. Abuses in the administration of public utilities are not to be met by crushing the spirit of initiative characteristic of a vigorous nation.

## Electric Freight Cars on City Streets.

By the sale of property at Fifteenth Street and College Avenue, Indianapolis, thousands of Indiana property owners who have been hoping to see the question determined as to whether an interurban traction company may haul its passengers and freight cars along city thoroughfares, to the alleged damage of abutting property, are perhaps destined to wait at least two years longer for a decision. The action brought against the Union Traction Company by Mrs. Lottie A. Kinsey was backed by the property holders along College Avenue, and was not only to recover damages to her property, but was for an injunction to prevent further use of the street by companies operating large passenger and freight cars. The question now is, Has the sale of the Kinsey property destroyed the life of the action at law? On this point the lawyers differ, some holding that the action in the Supreme Court dies with the sale of the property to another; that no action for injunction or damage can lie on account of alleged injuries to abutting property after the property changes hands. This holding, however, is disputed by Gaven & Davis, attorneys for Mrs. Kinsey, who cite the statute which provides that the transfer of an interest shall not abate a cause for action, so long as the cause continues.

The suit has been before the court for some time and the building of interurban freight stations is to be determined by its decision. In the Mordhurst vs. Fort Wayne and Southwestern Traction Company case it was held that the construction and operation of an interurban electric road to carry passengers, their baggage, light express matter and mail, in trains consisting of one, or, by special permission of the Board of Public Works, of two cars of the best and most approved pattern, is not an additional servitude upon the street for which the abutting property owners are entitled to compensation. But the Kinsey case contains facts and evidence such as did not exist or was not put in the Fort Wayne case.

## Philippine Tariff of 1905.

One of the closing acts of the last Congress was the passage of the "Philippine tariff revision law of 1905," which has been approved by the president and will take effect on May 1st next. It provides for a continuance of the metric system of weights and measures at present in use in the Philippine Islands, and further provides that merchandise in transit at the time the new law goes into effect may be entered under the provisions of law existing at the time of shipment. This privilege, however, will not be extended beyond the period of 60 days after the date of the enforcement of the new law.

Some of the new rates of duty are as follows:

Apparatus and appliances for the generation, distribution, testing, measuring and installation of electricity, dry and wet batteries, carbon brushes, arc lamps and their fittings, insulating materials, tapes and compounds used exclusively for electrical purposes, bells, annunciators, telephones and apparatus pertaining to the same, galvanometers, ammeters, voltmeters and wattmeters, storage batteries, dynamos, generators, exciters and all other machinery for the generation of electricity for lighting or for power, transformers and electric motors and electric fans, and insulators of glass or porcelain or other material —five per cent. ad valorem.

Incandescent lamps, mounted or unmounted, 15 per cent. ad valorem.

Automobiles for passengers or merchandise, 20 per cent ad valorem.

Carbons prepared for electric lighting, gross weight, $5 per 100 kilos.

Copper wire, galvanized or not, net weight, one millimeter or more in diameter or less than one millimeter in diameter, $4.50 per 100 kilos; copper wire covered with textiles other than silk, not specially provided for, or with insulating materials and cables for conducting electricity, net weight, $5 per 100 kilos.

## New Haven Steam Road Buys Hartford (Conn.) Traction System.

The chief recent event in street-railway circles in New England has been the purchase by the New York, New Haven and Hartford steam-railroad corporation of the street-railway system of the city of Hartford. Within a year the same steam-railroad company has acquired the New Haven system and several important connecting links in the chain of railways that run nearly parallel to the steam road in the state of Connecticut. The buying of the Hartford electric lines intrenches the steam road very firmly in the transportation business of the state. The stockholders of the absorbed system wanted $300 per share for their stock, but a compromise was finally reached at $285. The Hartford Street Railway Company has an authorized capital of $2,000,000, of which $1,000,000 is issued, and has paid thereon six per cent. dividends. It has outstanding $2,500,000 bonds at four per cent., with authority to issue $500,000 more. It has also guaranteed $200,000 five per cent. debentures of the East Hartford and Glastonbury line, which it has a right to convert to its own stock, dollar for dollar. It makes connections at its terminals with several other important lines. The total length of track is 92 miles. This gives the Consolidated lines of the holding corporation of the steam railroad the possession of 774 miles of electric railway, of which 427 are in Connecticut and the balance in Massachusetts. The holdings in Connecticut comprise more than one half of the electric-railway trackage of that state. The New York, New Haven and Hartford is also negotiating now for the purchase of the street-railway system of the city of Springfield, having offered, it is said, $225 a share for it. The capital of this company is about $2,000,000 and its trackage is about the same as that of the Hartford system.

## Electrometallurgy of Iron and Steel Discussed by the New York Electrical Society.

The 249th meeting of the New York Electrical Society was held at 19 West Forty-fourth Street, New York, on March 15th. In President Sprague's opening remarks he referred to some experiments he had made 10 years ago with an induction furnace for steel making in New York city. These tests did not lead to any commercial result at that time.

Dr. E. F. Roeber gave an address on "Recent Developments in the Electrometallurgy of Iron and Steel." Dr. Roeber dealt mainly with the manufacture of ferro-alloys in the electric furnace and discussed especially those, such as ferro-titanium, the manufacture of which requires a very high temperature, which is not attainable in the blast furnace. For other alloys which are being made to some extent in the blast furnace (for instance, ferro-silicon) the electric furnace has the advantage of rendering obtainable a high percentage alloy. Thus in the electric furnace ferro-silicon is made containing up to 75 per cent. silicon, while the usual blast-furnace alloy contains only 15 per cent. silicon.

The speaker pointed out the advantages resulting to the steel men from the use of high-percentage alloys. He discussed at some length the different methods which are in use by different companies to produce alloys or metals free from carbon. A large number of alloys of considerable value were exhibited. Some of the most interesting specimens were received from the Goldschmidt Thermit Company, the Niagara Research Laboratories and the Roessler and Hasslacher Company. The use of ferro-alloys in steel manufacture has brought about a revolution in recent years in the manufacture of special steels, especially for high-speed tools, armor plates, etc. The speaker dealt with the refining of iron, discussing the use of very hard electrolytic-iron deposits for steel facings, and described the work done by Burgess and Hambuechen in making absolutely pure iron by electrolysis on a large scale. A sample of Burgess' electrolytic iron was exhibited.

Dr. Roeber referred to the work done in making special steels of crucible-steel quality in the electric furnace, describing the induction furnace of Kjellin in Sweden, and detailing the work done in this field here by E. A. Colby and Dr. Leonard Waldo. He also referred to the successful steel furnace of Héroult and closed with a brief reference to the still-open question of the possibility of producing pig iron commercially from ores in the electric furnace.

Dr. Paul L. T. Héroult spoke on "Making and Refining Steel in the Electric Furnace." He described the construction of his furnace, in which two electrodes are used, dipping into a slag on the top of the molten metal. The current enters through one electrode, passes through the slag and the bath, and passes out again through the slag and the other electrode. By using his artificial slag he is able to remove all the usual harmful impurities, such as phosphorus and sulphur. The cost of power is insignificant, and the cost of the whole treatment in the electric furnace is below 50 cents per ton of steel, if molten steel (from the Bessemer converter or the open-hearth furnace) is introduced into the electric furnace. Dr. Héroult did not predict a revolution in the general metallurgical methods of steel making, but foretold marked improvement in the quality of the steel used for various purposes. If the refining of steel can be carried out at a very low cost, there is no further reason why better qualities of steel should not be used for many purposes.

An animated discussion followed, in which Messrs. J. T. Moorehead, E. Stutz, L. Ruhl, Drs. Leonard Waldo and C. A. Doremus took part. Dr. Doremus spoke especially on the reduction of pig iron from ores, and pointed out that it is simply a question of the relative cost of electric power and fuel. He showed, however, that there are other considerations to be taken into account, for instance, that it is not necessary to use a certain quality of coke in the electric furnace.

Dr. Leonard Waldo gave some reminiscences of early electrometallurgical work done in this country, and spoke especially on Mr. Colby's and his own work with the induction furnace, which he said is quite alive, not only in Sweden, but in this country.

Dr. Héroult, replying to several questions, thought that the induction furnace has a certain disadvantage in the difficulty of cleaning. It was found that, while Kjellin gets very good steels, they are not always exactly the same grade.

The following-named new members were elected: Thomas A. Wilkinson, Henry McDonough, H. W. [illegible] Lambert, Edward [illegible]

## Chicago Street-railway Situation.

Another complication [illegible] tangle in Chicago this week [illegible] at the suggestion of Mayor Harrison, revoked the [illegible] under which the Chicago [illegible] pany is operating its lines and ordered the corporation counsel to file forthwith in the state courts a bill in chancery annulling the 99-year franchise of the company and ordering the removal of its tracks from the streets terminated. This bill already had been prepared, and the minute the [illegible] was rushed before Judge Julian W. Mack of the Circuit Court, who had been kept in waiting in the court-room. The council then agreed that the company should be allowed to continue the operation of its lines until this bill is passed on by the state Supreme Court, a time the corporation counsel assured the aldermen should not be more than four months distant.

Mayor Harrison in a long communication said that the object of the instituting of this suit was that he had information to the effect that the street-car company intended filing a bill of its own in the Federal courts in assertion of its 99-year rights, and he wanted to forestall it by getting the case first into the state courts. In order to do this he had kept the matter a secret until the last moment, had kept the state judge in waiting, and finally had rushed the bill into his court before the traction people had a hint of what was coming. Mayor Harrison said this action by the council need not put an end to the negotiations for a fair settlement of the controversy, and he believed that the filing of the suit would strengthen the city's position in case no settlement be made.

Senator Mueller has introduced an amendment to the Mueller bill, which was passed by the Illinois Legislature about a year ago, which provides that no franchise for street railways shall be granted unless it contains a provision for compensation to the city. A further provision regulates the disposition to be made of the money thus acquired by the city. It requires that one-half shall be used for the maintenance of streets, but the other half is to be set aside as a special trust fund.

## BOOK TABLE.

ELECTRICITY IN EVERYDAY LIFE. In three volumes By Edwin J. Houston, Ph. D. New York: P. F. Collier & Son. 1905. Pp. (5½ by 7¾), iv., 584; vi., 566; vi., 609, with 1,179 illustrations and eight colored plates.

To keep pace with the progress and development of today a good speaking knowledge of electricity is a necessity. Electrical terms and phrases are fast becoming as common as household words, and a general understanding of their meaning and a general knowledge of the many kinds, applications and uses of electricity and electrical machines and apparatus are almost indispensable to the well-informed man. This knowledge "Electricity in Everyday Life" is intended to supply. The books are good. There is nothing in them that the non-technical man of average intelligence can fail to comprehend, and if carefully read and digested the reader will be well informed on the subject in hand. Professor Houston, past-president of the American Institute of Electrical Engineers, is well known to electrical men, and his wide experience as an electrical inventor and author, having written many other purely technical electrical books, fits him for the writing of a popular book on electricity. In the preparation of the books the author has drawn freely from contemporaneous literature, including various books and periodicals, together with the records of scientific societies, which contain descriptions of the more important inventions in the electric arts and sciences.

Volume I. treats broadly of the generation of electricity and magnetism. Thales and the rubbed amber are mentioned, of course, and then the reader is taken through to Faraday and his researches on the production of electricity from magnetism. The volume is divided into five parts, which treat of electricity of high electromotive force, magnetism, cells, other electric sources and electrodynamic induction.

Volumes II. and III. take up the electric arts and sciences, the former dealing with dynamos, electric lighting and electric power, and the latter with electrochemistry, telephony, telegraphy (including space telegraphy), annunciators and alarms, electric heating and electrotherapeutics. While for some reasons it might have been better to treat such subjects as electrochemistry, electrotherapeutics and electric-measuring instruments by themselves, the course taken in volumes II. and III. is no doubt better for the class for which these books were written.

The books are profusely illustrated, but some of the cuts are not good and some of the larger illustrations are inferior. The paper is also of indifferent quality. These mechanical defects tend to mar an otherwise excellent work.

## Deadening Noise on Elevated Railways.[1]

By Bion J Arnold.

The present steel structure of the Union Elevated railway in Chicago, while well designed from a structural standpoint, shows that little consideration was given to the problem of noise, which makes it very difficult to reconstruct it in such a manner as to apply what is now known regarding sound-deadening without costing a great deal more than it would have cost had the subject been given careful consideration at the time of construction. The rails rest immediately upon ties which, in turn, are rigidly secured to the upper chords of latticed steel trusses, thus giving the best condition for imparting the hammer blows caused by the wheels upon the rails directly to the structure that could have been devised, unless the rails had been placed immediately upon the upper chords or upon a metallic support between the rails and the chords. While this construction is not questioned from a railroad engineering standpoint, for it is well designed, attention is called to it to show some of the difficulties that will be encountered in attempting to modify it so as to deaden the sound to such an extent as may be found practicable. Were the present structure not in place, I am firmly of the opinion that

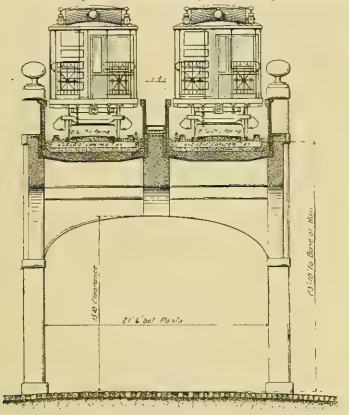


FIG. 1. TYPE OF CONCRETE CONSTRUCTION FOR ELEVATED ROADS PROPOSED BY MR. ARNOLD.

a concrete structure could be designed and built which would prevent to a large degree the noise now emanating from the present steel structure, for a cost which would not be greatly in excess of the cost of the present structure, and such a design is shown in Fig. 1; but to change the present structure into one resembling such a form is a difficult and expensive task.

In analyzing the relative merits of different classes of construction, the fact should not be lost sight of that the noise comes primarily from the trains, and a large part of this noise cannot be eliminated entirely, no matter how good the design of the structure, and the best, therefore, that can be expected is to minimize the noise caused by the operation of the trains to the greatest possible extent and prevent it being intensified by the supplemental action of a vibrating or ringing structure.

The structure shown in Fig. 1 would be built of stone or concrete reinforced with steel parts imbedded in the concrete, similar to the methods now becoming so generally utilized in the construction of railway bridges, buildings and other structures.

The use of concrete would eliminate almost all of the difficulty encountered with the present structure due to vibration, and if, in addition, the structure were carried up solid on each side of each track to a point slightly above the bottoms of the cars as shown, the noises produced by the wheels upon the joints and by other working parts of the train would be largely confined to the space underneath the train, and would to a certain extent dissipate themselves and be prevented from being immediately transmitted in a horizontal plane to the sides of the tall buildings on each side of the structure, thence upward, to the annoyance of the occupants of the upper stories as at present.

Since it would be manifestly unjust to ask that the present loop structure be removed and thus permit the erection of a design of this character, the problem then is how best to modify the present design so as to reduce the noise to the greatest possible extent without making the cost prohibitive.

There are four primary causes of the noises of the Loop, which are as follows:

1. Imperfect track construction.
2. Imperfect rolling stock.
3. Imperfect roadbed.
4. Defects in structure: (a) Elasticity of the steel; (b) lack of rigidity.

As the hammering of the wheels over the joints is the chief source from which noise is imparted to the structure, it is of vital importance that these joints and the entire track be built in as thoroughly first-class manner as possible, and maintained in this condition. It seems almost impossible to procure a type of joint over which a heavily loaded wheel will pass without imparting to the rail a blow sufficient to produce sound of considerable magnitude, and in time cause a hollow place in the rail upon which the wheel strikes after leaving the joint.

I have given careful attention to the rail and joint question and believe that the most practical thing to do under the circumstances, in view of the fact that the present rail is badly worn and would have to be renewed before experiments with any new type of rail could be conducted during a sufficient length of time to determine its practicability is to use the American Society of Civil Engineers' standard section, rerolled steel T-rail, weighing not less than 80 pounds to the yard, having its ends cut at an angle of about 40 degrees, and provided with some first-class joint of the bridge type, such as the Continuous, the Weber, or other equally as good joint. A bridge type of joint is one which allows the ends of the rails to be jointed midway between two ties and the joint itself extends from tie to tie, thus bridging the space between the ties and forming a support for the open rail ends. Fig. 2 represents such a joint as seems best to adopt under the circumstances. This joint is not new and has been used in different forms by various railroads, and especially by the Lehigh Valley railroad, where it was known as the Sayer joint, for a period of about 12 years, and to a certain extent by the Buffalo, Rochester and Pittsburg road. While it has been abandoned by the former road, due probably to the fact that the advantages gained in steam-railway service were not considered by the management sufficient to pay for its increased cost, I believe it to be the most practical thing to adopt in this case at present, for, by its use, it will be possible for the Union Loop Company to equip its road during the coming summer with new rail and thus at once eliminate a large part of the present noise. If this type of joint is used the rails should not be over 45 feet in length on account of expansion difficulties. It is important that the joint be made with shoulders on the rails as shown, thereby removing the sharp points.

The rolling stock in use on the Union Loop consists mainly of rather light cars with open running gear. Since a large part of the noise proceeds from the running gear, it is important to apply some corrective for this either on the cars or on the structure. Unless the railroad companies will maintain this apparatus in good condition and thereby prevent much of the present noise from this source, some method of enclosing the entire truck, including the wheels, with a light casing of sound-deadening, non-combustible material, such as asbestos sheeting, should be tried. This casing should come as close to the guard rails as practicable and clear the third rail, so as to intercept as much of the noise from the wheels as possible. It should have a bottom, and the sides should be hinged to permit inspection.

The latest types of cars used for intramural transportation, such as those recently put into service in the subway by the Interborough company of New York, are provided with sound-deadening material in the hollow spaces of the floors and sides. There are several fireproof substances that can be used for this purpose, and all new equipment purchased by the elevated roads of Chicago should have all hollow spaces filled with some such material. Such of the present cars as have no sound-deadening material in them should have the hollow spaces filled with mineral wool, asbestos or some other light, non-combustible material. The present cars and trucks should be put in first-class condition and kept so, and all future cars should be equipped with trucks having as few parts as practicable.

The relief opening of the triple valves of the air brakes should be provided with some device for muffling the noise of the escaping air when the brakes are released, and thus prevent the sharp whistle now common to some of the cars. This can often be accomplished by changing the size of the orifice.

In order to compare the various types of floor construction, six ballasted floors applicable to the Loop are shown in Fig. 3, designated as types A, B, C, D, E and F. These types have all been designed to support a single track only, leaving an open space between tracks for the feeder conduit and third rails, except at crossings, turnouts and junction points, where the floor would extend across this space. All floors have been figured for 12 inches of broken stone ballast, weighing 140 pounds per cubic foot, and providing for six inches of ballast under the ties. Types A and B are what may be termed ballasted steel floors. Type C is a ballasted concrete arch floor, and type E a ballasted concrete steel floor resembling the latest type adopted by steam-railroad companies for bridges. All of these are "solid" floors—that is, they form a continuous decking under the track. Type F is a type of open-ballasted concrete steel floor.

The effect of the ballast as used in these various types would be a cushioning of the rails, and a reduction of the impact due to the cars, improving the riding qualities of the track, reducing the noise and increasing the durability of the structure. By carrying the ballast up and around the rails the noise due to the singing or humming of the rail would be greatly reduced.

The ballasted steel floors are objectionable because they add to the amount of metal in the structure. This not only increases the noise due to the steel in the structure itself, as will be explained hereafter, but it likewise adds to the cost of painting and maintenance. Steel thus used in a ballasted floor is exposed to deterioration from the water, oils and greases which find their way to the bottom of the ballast.

The concrete floor, on the other hand, is free from these objections, being, in the first place, practically inelastic, and therefore almost noiseless in itself, and, secondly, being proof against deterioration from any of the agencies herein referred to. Type E would probably be made in six-foot sections weighing about 4,000 pounds each, and is adapted to be constructed in any convenient shop near the site, allowed to set and erected in place as required. This would avoid all work in the field except placing and setting, and thus greatly expedite the work and reduce the cost.

Type F is in some respects an improvement on type E. While the amount of concrete is about the same, the individual cross-troughs weigh only 1,000 pounds each, which facilitates handling and setting. The field work embraces the bolting of the connecting longitudinal troughs to the cross-troughs, and the placing of this floor in position would require the least time and therefore involve the minimum delay to traffic. An important advantage of this floor is that there is a seven-inch opening between each cross-trough which would admit light to the street below and allow snow falling on the structure to be handled as at present. In types E and F hook bolts would be provided for securing the concrete to the structure.

The drainage of the type E ballasted floor would be best provided by means of holes at suitable intervals toward which the floor slopes, discharging into ducts carried to the ground at convenient points, while that for type F would be made through suitable openings in the bottoms of the concrete troughs. The fastening of the guard rails to the ties could be lag-screwed or could be effected by means of angle clips bolted to the guard rails and spiked to the ties. There would be no great difficulty in removing the ties in any of these floors, except where side walls are provided, as hereinafter referred to, and in this case openings could be made for the removal of ties if necessary.

The principal objection, aside from its cost, that is usually brought against the use of a solid floor in a city street is the difficulty of removing snow from the track. While it is admitted that this difficulty is more serious with a solid floor than when an open-type floor is used, it is not insurmountable, since the Berlin and Liverpool roads, a portion of the Boston Elevated, and a portion of the New York Central have been successfully operated, and this objection should not be allowed to prevent the adoption of some type of solid floor if it proves efficient in reducing the sound. I am of the opinion that a type of snowplow or snow-collecting device could be perfected which would effectually remove the snow by collecting it and carrying it away in case it became necessary to operate the loop with a solid floor.

The most important characteristic of these floors is their increased weight as compared with the present floor, the greatest increment being 1,680 pounds per lineal foot of track for type E and the least 1,080 pounds per lineal foot for type F. This additional weight increases the stresses in the structure throughout and necessitates its reinforcement to secure a corresponding increase of its strength, to a greater or less degree, depending

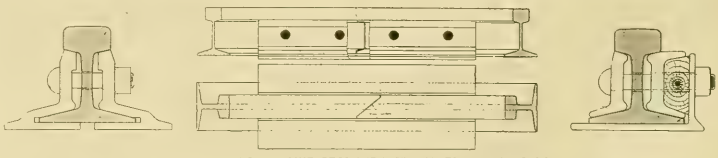


FIG. 2. TYPE OF JOINT RECOMMENDED FOR ELEVATED ROADS.

1. Abstract of Part II of a report made on March 7, 1905, to the committee on local transportation of the City Council of Chicago by Mr. Arnold as consulting engineer. In the report Part II. is entitled "Analysis of the Causes of the Present Noise, and Discussion of Different Methods Suggested for Reducing the Noise Upon the Union Elevated Loop." An abstract of Part I. was given in the Western Electrician of last week.

upon the reduction of impact due to the use of ballast.

In applying the concrete-steel reinforcement [to take care of the increased stress due to the increase of weight], the stringer, cross girder and posts of the structure would be encased in concrete, in which there would be imbedded steel bars wherever necessary to make up the deficiency in section previously referred to and also to carry the weight of the concrete itself and to support it in place. The steel would require no connection to the structure, thus avoiding to a large extent the difficulty at the fender castings in case steel reinforcement were used. The adhesion between the concrete and the present steel structure would not be depended upon for the reinforcement but would obviously furnish an additional increment of strength. To still further reduce the noise-producing effect of the steel structure it would be best to encase the laterals and transverse bracing.

The reinforcement should be applied by means of concrete steel forms, which would serve as a facing and remain in place when the work was completed. These forms should effectually prevent

[illegible] raising of the base of the rail, the minimum increase being [illegible] the maximum [illegible] type E, the increase [illegible] necessitate raising the station platforms a corresponding amount, which will involve an additional total expense of about $5000 in [illegible] loop.

While the methods suggested in this report would, in my judgment, [illegible] to a certain extent experimental, and it would therefore be unjust to demand that they be adopted and applied by the railroad company to the entire loop without their relative efficiencies having first been determined by experiments on short sections of structure, thereby keeping the experimental expense as low as practicable until the best type of construction could be determined by actual demonstration.

My recommendations for reducing the sound upon the loop and suggested methods of procedure are, then, as follows:

First—If practicable, adopt the plan of increasing

## Electrical Material Rushed 2,500 Miles by Express.

[illegible] the General Electric Company on February 8th and prompt dispatch.

[illegible] department of the company on Monday, February [illegible] terial would be required to enable the plant to resume operation, although at the time the full extent of the damage was not known. As a result of further telegrams, and consultations by telephone with the New York representatives of the customer,

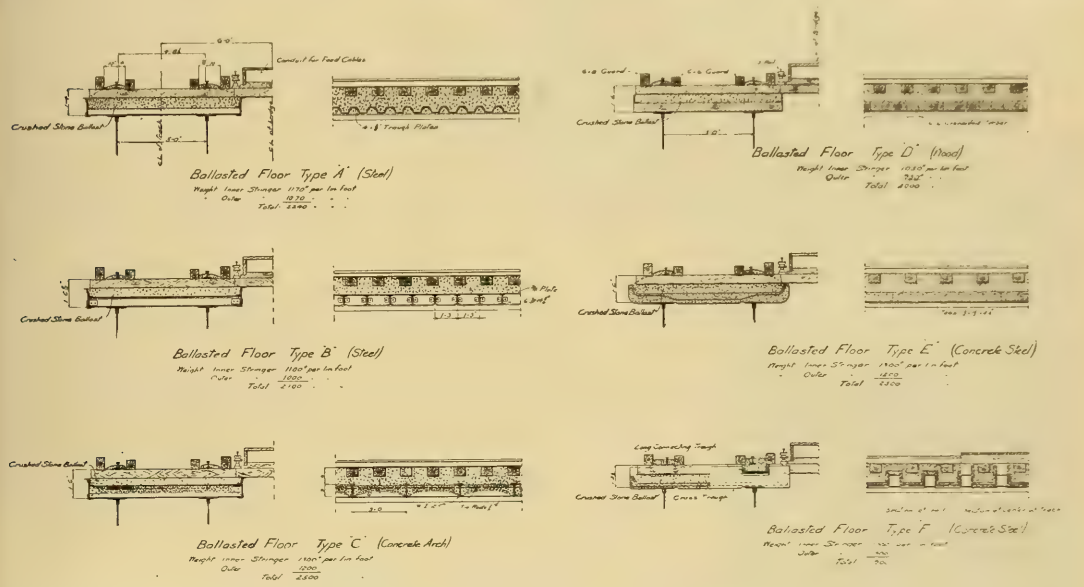



FIG. 3. VARIOUS TYPES OF FLOOR CONSTRUCTION ADAPTED FOR ELEVATED RAILWAYS.

any disturbance of the concrete while setting. After setting and when the bond between it and the steel became established it is probable that no force which the structure will bear would separate them.

The following table shows the cost of applying the various types of floors discussed, including the two different forms of reinforcement as well as the cost of blocking up the present floor during reconstruction, the necessary track work on the new floor and a percentage for engineering and contingencies.

APPROXIMATE COST OF STEEL REINFORCEMENT.

| Type. | Cost Per Foot of Double Track. Floor. | Re-inforcement. | Track and Floor Work. | Engineering and Contingencies. | Total. | Total Cost of Additions to Structure. |
|---|---|---|---|---|---|---|
| B | $53.30 | $33.00 | $1.20 | $8.75 | $96.25 | $ 962,500 |
| D | 11.00 | 33.00 | 1.20 | 4.50 | 49.70 | 497,000 |
| E | 8.00 | 33.00 | 1.20 | 4.22 | 46.42 | 464,200 |
| F | 6.25 | 22.15 | 1.20 | 2.06 | 32.56 | 325,600 |

APPROXIMATE COST OF CONCRETE STEEL REINFORCEMENT

| Type. | Cost Per Foot of Double Track. Floor. | Rein-forcement. | Track and Floor Work. | Engineering and Contingencies. | Total. | Total Cost of Additions to Structure. |
|---|---|---|---|---|---|---|
| B | $53.30 | $17.30 | $ 1.20 | $7.18 | $79.00 | $ 790,000 |
| D | 11.00 | 17.30 | 1.20 | 2.95 | 32.45 | 324,500 |
| E | 8.00 | 17.30 | 1.20 | 2.65 | 29.15 | 291,500 |
| F | 6.25 | 17.30 | 1.20 | 2.47 | 27.22 | 272,200 |

In computing these costs, concrete in floor types B and F was taken at $8 and $10 per cubic yard respectively, in place; concrete in concrete steel reinforcement at $10 per cubic yard in bulk and $15 per cubic yard in forms, both in place. Steel in steel reinforcement was taken at $65 per ton erected and in concrete steel reinforcement at $45 per ton erected. Creosoted lumber was taken at $60 per thousand in place, ballast at $2 per cubic yard in place, rivets cut out at 20 cents each, holes drilled at 40 cents each, and rivets driven at 15 cents each. All prices include contractors' profit. Engineering and contingencies were figured at 10 per cent. Cost of track not included in above figures. If concrete track enclosures are used add $90,000 to the totals of Types E and F in steel reinforcement and $80,000 to types E and F in the concrete steel reinforcement.

the capacity of the loop [shown in Fig. 2, page 210, Western Electrician of March 18]. This would eliminate the maximum amount of special work, and thus reduce the noise, due to the hammering of wheels on frogs and switches, to the greatest possible degree and at the same time increase the capacity of the loop to the greatest extent possible by track modification, and leave it in the best condition for through routing or loop operation, or both.

Second—If the arrangement shown [in the Fig. 2 mentioned] is not adopted, reconstruct in accordance with a plan which leaves all tracks at the present grades. Reinforce the structure at all junctions and provide each junction with a solid floor ballasted with crushed stone or slag.

Third—If neither of the above plans are adopted, reinforce the present structure at all junctions, and provide each junction with a solid floor ballasted with crushed stone or slag.

Fourth—Equip sections of about 300 feet each of the Market Street stub terminal of the Chicago and Oak Park road, over which trains do not now operate, with different floors, using stow slag and gravel ballast in different sections, and reinforce the structure supporting these sections with the concrete-steel reinforcement. Operate trains over this stub terminal when so equipped until the relative merits of the different types can be determined. The equipment of this terminal is suggested to prevent interfering with present traffic, but should the railroad companies prefer to conduct the trials upon the loop or elsewhere, they should be allowed to do so.

Fifth—After the type of floor and kind of reinforcement which most effectually accomplishes the elimination of noise is determined, the loop structure, between junctions, should be reinforced and the type of floor selected applied.

Sixth—In any event, reconstruct the track and special work in accordance with the suggestions contained in this report and maintain the rolling stock, track and special work in first-class condition, under rigid city inspection.

Seventh—All changes in the structure should be made in accordance with plans approved by the city

details of the order were settled Tuesday morning, and on Wednesday, February 8th, the second day from the receipt of information of the trouble, an express shipment of 30,000 pounds of switchboard instruments, switches and supplies left the Schenectady factory for the City of Mexico.

The shipment constituted a complete switchboard equipment for a 4,000-kilowatt power station, and to collect and dispatch the material in this almost incredibly short time taxed every resource of the commercial, engineering and transportation departments of the company. While most of the instruments and switches were available at Schenectady, it was necessary to obtain instrument transformers by express from Lynn, and four large rheostats for generators of German make had to be entirely built from data telegraphed from Mexico. In addition, a large quantity of wire and cable, which could not be supplied from the Schenectady stock, had to be borrowed from an installation which the General Electric Company was carrying out in New York city.

The transportation of the heavy reels of wire and cable through New York city for shipment to Schenectady was a task of great difficulty, on account of the almost impassable condition of the streets, following a severe snowstorm. In handling the shipment from Schenectady, special arrangements were made with the railroad companies to obviate transshipments in passing from one system to another, and especially in crossing the Mexican frontier, and, in addition, a special messenger traveled with the car the entire distance, to see that no delays occurred at junction points.

The shipment reached Mexico City on Tuesday, February 14th, thus placing in the hands of the customer, within seven days from receipt of the first news of the disaster, and from a factory 2,500 miles away, a complete outfit of the new material necessary to restore the interrupted lighting and power service.

The fire also destroyed two engine-driven sets, imperatively demanding the immediate installation of two 500-kilowatt Curtis steam turbine generators that were on order at the time, and one of which

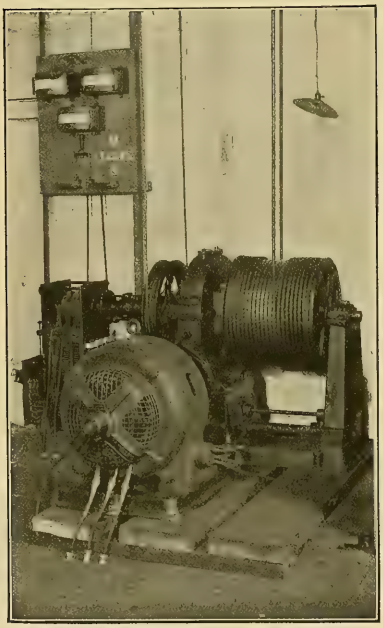
was due to arrive by freight in a few days. The second turbine had just been loaded on a freight car at the Schenectady factory, but the urgent need of the machine decided the customer to authorize its shipment by express.

Of this shipment the turbine proper, as boxed, weighed 27,000 pounds and occupied a space eight feet high by eight feet wide by 9½ feet long. The doors of the ordinary express car would not admit the entrance of a package of these dimensions, but a special car having large doors was secured and, by stripping the boxing to a minimum, the loading was effected. The generator and other parts brought the weight up to nearly 43,000 pounds, making one of the heaviest single express shipments ever made.

The total weight of the entire shipments was 73,000 pounds, the express rate on which was over $8,200.

## Single-phase Elevator Motor.

A serious handicap to the use of electric elevators in some localities has been the fact that existing types of alternating-current motors were not adapted to this class of work. The Wagner Electric Manufacturing Company has, after years of experiment, placed such a motor on the market which is illustrated herewith, the machine in the picture being a combined passenger and freight outfit, which has been running in the company's factory for several months. A technical description of this interesting



SINGLE-PHASE ELEVATOR MOTOR.

outfit cannot be given until the tests are completed. Nevertheless some reference may be made to it from data supplied by the manufacturer.

The inherent characteristics of this single-phase motor are such that the load is not applied abruptly to the circuit, but may be, with the proper controlling devices, applied with sufficient gradation to make it possible to serve an elevator motor from the same transformer carrying lights without affecting the lights to a noticeable extent.

As with all types of induction motors, the power factor of this new form of motor is less than unity. By proper design, however, a power factor of from 80 per cent. to 85 per cent. has been secured, both in starting and at running speed.

Elevator service requires an acceleration from rest to full speed of from four to 10 seconds, depending upon the frequency of stops and on the kind of duty to be performed. Freight elevators are usually accelerated in about twice the interval of the best types of passenger elevators. The inherent characteristics of this single-phase motor are such that the acceleration can be made anything desired, and in every respect practically identical with that of the best types of direct-current elevator motor.

Conditions frequently arise in elevator service under which it is very desirable to employ the braking power of the motor running as a generator on the down trips. This single-phase motor is such as to act as an induction generator when the armature is rotating at a speed in excess of synchronism.

The company is prepared to furnish this type of construction in all of the usual standard sizes, up to and including 25 horsepower. Immediate delivery can be made on the 10-horsepower size, which size is at the present time required for probably 60 per cent. of the elevator service likely to be developed on central-station alternating-current systems.

This type of motor is capable of speed control through 50 per cent. of the speed range, and this characteristic of the motor will be especially useful with ventilating fans and certain kinds of shop-tool service. The company is also prepared to adapt this motor to hoisting and traveling-crane service.

## The Arnold Company.

The Arnold Electric Power Station Company of Chicago has changed its name, for the sake of simplicity, to The Arnold Company. Organized in 1896 by its president, Bion J. Arnold, the well-known engineer, the scope of the company's work has gradually increased until it now embraces nearly all that relates to electrical, civil and mechanical engineering, and not only pure engineering, but construction work as well. The company has an organization capable of building the work it designs. It has a fine reputation for the extent and character of the work it has performed or has under way. In the electric-railway field, it can point, among others, to the Chicago and Milwaukee, the Lansing, St. Johns and St. Louis (Mich.), the Bloomington (Ill.), Pontiac and Joliet (described in this issue) and the Grand Rapids (Mich.), Holland and Lake Michigan lines. Two of these are single-phase roads, and Mr. Arnold's prominence in the field of electric-railway invention and building is well known. Among power stations designed and built by the company are those of the Imperial Lighting Company of St. Louis, Land, Title and Trust Building of Philadelphia, Chicago Board of Trade and Albert Dickinson Company of Chicago and Minneapolis. In the equipment of great building and repair shops for railroad companies The Arnold Company has been particularly active, very recently closing a contract for the complete power outfit for the new Missouri Pacific shops at Sedalia, Mo. Other shops have been equipped for the Chicago and Eastern Illinois, the Denver and Rio Grande, the New York Central, the Oregon Short Line, the St. Louis, Iron Mountain and Southern and a number of other railroads. One of the latest developments of The Arnold Company's work is the designing and building of complete hydro-electric plants. An installation of 3,000-kilowatt capacity for the Spring River Power Company is about to be put in operation, with a 33,000-volt transmission line, from the water-power plant at Lowell, Kan., to the lead and zinc mines in the vicinity of Joplin, Mo.

The company is conspicuously enterprising and energetic in pushing and completing its work while yet cautious and conservative in engineering judgment exercised for the benefit of its clients. It is progressive but careful, and its advertising literature contains much valuable engineering data. The Arnold Company has recently increased its office space to accommodate its growing business, and now occupies Suite 1536-41 Marquette Building, Chicago. The officers of The Arnold Company are: President, Bion J. Arnold; vice-president, W. L. Arnold; secretary and treasurer, Ralph G. Arnold; managing engineer, George A. Damon.

## Poles for Electrical Construction.

In the accompanying illustration is shown a view of a Wisconsin pole yard of the Valentine-Clark Company, Chicago, one of the largest dealers in cedar poles. This is one of several yards possessed by the company, from which are shipped poles for telephone, telegraph, electric-light and street-railway companies in any desired length from 16 to 70 feet. The main yards are at Pinconning, Mich., and Green Bay, New London and Prentice, Wis. Many thousands of poles are carried in each of these yards.

The following weights of seasoned white-cedar poles as given by the Valentine-Clark Company may be of interest to pole users:

| Length. | Top 4 Inch. | Top 5 Inch. | Top 6 Inch. | Top 7 Inch. | Top 8 Inch. |
|---|---|---|---|---|---|
| 16 feet | 80 lbs. | 100 lbs. | 125 lbs. | 155 lbs. | ..... |
| 18 " | 90 " | 120 " | 140 " | 185 " | ..... |
| 20 " | 100 " | 130 " | 175 " | 210 " | ..... |
| 25 " | 150 " | 200 " | 250 " | 350 " | 450 lbs. |
| 30 " | ..... | 275 " | 350 " | 650 " | 575 " |
| 35 " | ..... | 375 " | 450 " | 800 " | 775 " |
| 40 " | ..... | ..... | 625 " | 800 " | 975 " |
| 45 " | ..... | ..... | 835 " | 1,000 " | 1,200 " |
| 50 " | ..... | ..... | 1,035 " | 1,250 " | 1,500 " |
| 55 " | ..... | ..... | 1,300 " | 1,550 " | ..... |
| 60 " | ..... | ..... | ..... | 2,000 " | ..... |
| 65 " | ..... | ..... | ..... | 2,700 " | ..... |
| 70 " | ..... | ..... | ..... | 3,400 " | ..... |

## Office Appliance Exhibition in Chicago.

Chicago's first office appliance and business system show, which is to be made an annual event, was opened at the Coliseum on March 15th. Hundreds of useful time and labor-saving devices were on exhibition. Instructive lectures and practical demonstrations were also given, and during the week of the show there were many speed contests in the operation of typewriters, adding machines, etc.

There was much to interest electrical men. The first thing to attract the eye was the brilliant illumination of the large building by electric light, and the attractive electric signs which marked the spaces of the various exhibits.

There were 149 exhibits at the show. One which attracted attention was that of the Gray National Telautograph Company. The telautograph, as is well known, offers means for electrically transmitting to a distance handwriting, drawings and similar matter. The company had six instruments stationed about the building and connected together. Through these, by means of wide paper tapes, automatically operated, were posted bulletins of various special events.

Adding machines exhibited by several companies were of considerable interest. The machines were operated by small motors, which take current from ordinary direct-current lighting mains. The companies which had attractive exhibits and gave demonstrations of these machines were the Burroughs Adding Machine Company, Detroit, Mich.; Universal Accountant Machine Company, St. Louis, Mo., and the Comptograph Company, Felt & Tarrant Manufacturing Company, Mallman Addograph Company and the Standard Adding Machine Company, all of Chicago.

The machines operated by electricity are supplied with a plug which is screwed into any electric-light socket. The current is controlled by an operating button. In case of failure of current, the machines can be changed to hand operation in a few seconds.

Telephone instruments and appliances were extensively exhibited at the show, several of the companies having very attractive booths. The Stromberg-Carlson Telephone Manufacturing Company gave a very practical demonstration of its interior-communicating telephone system. A complete exchange outfit was installed in the company's booth and an operator was in charge. All the exhibits in the building were connected up, and visitors were given free use of the telephones to communicate with persons in some other part of the building. A messenger was also stationed at the telephone booth of the Chicago Telephone Company, and when anyone was called from outside the building it was only necessary to notify the operator of the interior system, and the person wanted was called. This display of enterprise by the Stromberg-Carlson company proved very popular.

The Kellogg Switchboard and Supply Company also exhibited a fine intercommunicating system and had a large display of its well-known goods.

The American Electric Telephone Company had one of the largest exhibits at the show and gave special attention to the Burns adjustable telephone for desk use.

Other companies which exhibited telephone appli-

SCENE IN A WISCONSIN POLE YARD.

ances were the Oliver Manufacturing Company, the Griggs Manufacturing Company, William P. Crockett Company, Chicago Writing Machine Company, American Book Brackett Company and the Judson Emblem Company.

The Crouse Hinds Company made a good show of its product, and attracted considerable attention with the new Hawley time recorder. The Turner Brass Works and the Joseph Dixon Crucible Company were also exhibitors.

The Benjamin Electric Manufacturing Company and the Holophane Glass Company had a joint exhibit, and their booth was one of the most attractive at the show, due to the nature of their goods. Many serviceable adjusting and extension devices and handsome clusters were shown.

The managers of the show were H. A. Cochrane and F. W. Payne, who also managed the recent office appliance show in New York. A similar show will be conducted each fall in New York, and each spring in Chicago.

## Crocker-Wheeler Alternating-current Generators.

The Crocker-Wheeler Company of Ampere, N. J., which has been a maker of direct-current machinery exclusively for the last 17 years, in view of the increasing demand, has put upon the market recently a line of alternating-current engine-type generators. This is done by co-operation with the house of Brown, Boveri & Co., of Baden, Switzerland, which has been retained by the Crocker-Wheeler Company as consulting engineers, the foreign concern, by special arrangement, giving access to its designs and data.

Illustrated by Fig. 1 is one of the new products of the Crocker-Wheeler Company—a 100-kilovolt ampere, three-phase, 60-cycle alternator. These machines are of the belted type, ranging from 30 to 250-kilovolt amperes. They are of the revolving-field class.

The stator punchings are clamped together by bolts which pass through the laminations. These laminations are then securely attached inside a cast-iron shell, which forms a support for the punchings and gives a finish to the machine.

A characteristic feature in the design of these alternators is the use of a partly closed slot. This type of slot makes it possible to reduce materially the weight of an alternator for a given rating, without affecting the behavior of the machine, and gives the additional advantage of a reduction in the total losses, which means a corresponding increase in the efficiency. The slot is lined with a heavy tube of insulating material, which is prepared and treated so that it becomes very hard, tough, and possesses the requisite dielectric strength to meet the insulation requirements. These tubes conform to the shape of the slot very closely, so as to have available a maximum of

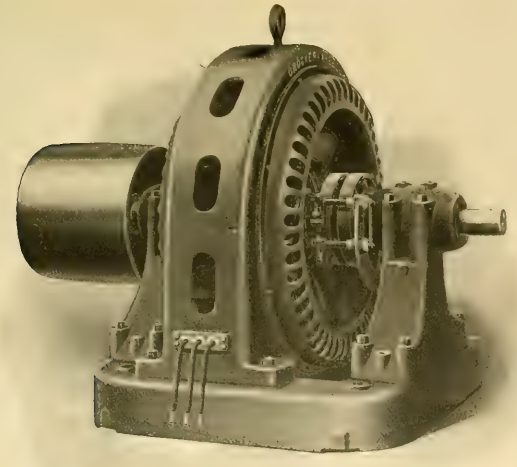


FIG. 1. CROCKER-WHEELER BELTED-TYPE ALTERNATING-CURRENT GENERATOR.

space for the winding. The top of the tube is slotted to correspond with the top of the slot.

The stator coils are form wound, being slipped through the narrow opening at the top of the slot, and then arranged systematically in the insulating tubes. After the conductors are put in place, a wooden wedge is driven over the top of the insulating tube so as to close this tube and retain the conductors securely in place. The coil ends are then heavily taped and insulated in order to give protection and add a finish to the coils.

To give additional protection to the stator winding, and add to the appearance of the machine, shields are attached to the side of the frame and project beyond the winding.

The revolving element, excepting the pole shoes, is one solid steel casting. The pole shoes are made of forged steel and bolted securely to the projecting pole cores. Because of the partly closed slot, solid pole shoes can be used. These solid shoes greatly facilitate the parallel operation of machines, which is an important consideration, as generators are more frequently run in parallel than singly.

On sizes of 200-kilovolt amperes and larger, the

FIG. 2. CROCKER-WHEELER ALTERNATOR ADAPTED FOR WATERWHEEL DRIVE.

rotor coils are made of copper strip wound edgewise. The layers are insulated from each other by means of paper, and an insulating compound, after which the whole coil is carefully baked. A coil of this kind will withstand without injury the severe mechanical strain and the great overloads to which machines of this class are subjected. On machines below 200-kilovolt amperes, the motor is wound with square copper conductor, special care being given in winding and insulating to make them perfect.

Another class of alternators manufactured by this company is a type especially adapted for direct connection to hydraulic turbines. Four of these machines will form the first installation of electrical machinery for the hydraulic development on the Chicago drainage canal at Lockport, Ill., and were described in the Western Electrician last week. Fig. 2 is an illustration of this type of generator. The machines at Lockport are of 4,000-kilowatts capacity each. They are 60-cycle generators, three-phase, and develop 6,600 volts.

New Albany, Miss., is completing arrangements for the construction of a waterworks and electric-light plant for which $20,000 in bonds has recently been voted, and bids will be received until March 28th. W. F. Wilcox, Jackson, Miss., is engineer in charge.

## Iowa Telephone Association.

[illegible]

the various operating companies in the state, to the end that less energy and time be devoted to competition and squabbles between the Independent companies themselves, and that the energy thus saved be given to the fight against the common competitor.

The association then went into executive session and heard the reports of the legislative committee and of the arbitration committee.

At Wednesday morning's session a paper was read on "The Old Way and the New," by C. H. Judson, consulting engineer of Council Bluffs. Mr. Judson's paper was in the nature of a brief history of the construction work done by the telephone companies from the early day up to the present time, and closed with some remarks on modern all-cable, multiple-tap distribution. The next paper, "The Generator Call Lamp Line Board," was by Oscar Knell of Perry, and was a complete and interesting description of a board of this type installed by the Hawkeye Telephone Company in its Winterset office.

"The Relation that Should Exist Between the Farmers' Mutual and Other Independent Telephone Companies" was then discussed by C. A. Hollis of Hudson. Mr. Hollis is a representative farmers' mutual man and his discussion proved very interesting to those present, most of whom represented larger operating companies.

The afternoon session was opened with a debate on magneto-multiple vs. central-energy multiple boards for small or medium-sized exchanges, by J. M. Plaster of Fort Dodge and R. S. Redman of Newton. This subject and the discussion following it proved one of the most interesting features of the convention, for although the majority of those who took part in the discussion preferred the central-energy board, Mr. Plaster very ably defended his side of the case.

W. L. Barth of the Sheldon School of Scientific Salesmanship then gave an address on the "Science of Modern Business Building," which was listened to with great interest, for too few of the operating companies have given very much attention to scientific business getting and building.

"The Development of Toll Business and Checking of Tolls" was the subject of a paper presented by James H. Shoemaker of Waterloo.

Thursday morning's session opened with a very able paper on the Iowa assessment law by N. T. Guernsey of Des Moines. Mr. Guernsey stated that his subject necessarily made his paper a dry one, but the delegation present found it to be an extremely interesting explanation and discussion of the law, which is certainly of vital interest to every exchange owner.

The next address was delivered by James B. Hoge of Cleveland, Ohio, and his subject was the National-Interstate Telephone Association. Mr. Hoge explained the work of the big association and the details of the organization and urged his hearers to join. Theodore Gary of Macon, Mo., followed Mr. Hoge and spoke along the same line. Following these speeches the association voted to join the National-Interstate association.

The election of officers then followed, with the following result:

President—S. S. Lichty of Vinton.

Vice president—P. C. Hohbegel of Rockwell City.

Secretary and Treasurer—Charles C. Deering of Boone.

Executive Committee—J. C. Sullivan of Creston, George N. Bandy of Des Moines, J. C. Thorne of Fairfield, J. S. Bellamy of Knoxville.

The afternoon was given to visiting the new exchange of the Mutual Telephone Company and the exhibits and displays of the various manufacturers and supply men.

The banquet Thursday evening was held in the Chamberlain. The speakers were as follows: Toastmaster, J. C. Hume of Des Moines; "General Principles," Frank L. McGillan, Chicago; "The Telephone Troubler," J. H. Shoemaker, Waterloo; "A Square Deal, That's All," J. B. Hoge, Cleveland, Ohio; "Independent Telephone Men," Theodore Gary, Macon, Mo. The banquet, to which the ladies were invited, proved as usual to be one of the features of the meeting.

Charles E. Wells of Marion, Kan., who was to have spoken on the Kansas Supreme Court decision, wired that owing to illness in his family he could not be present.

E. H. Martin, one of the organizers of the association, cabled from London his regrets at not being present and his good wishes.

## NEW COMPANIES.

Articles of incorporation have been filed at Chino, Cal., by the Home Telephone Company of Chino, which proposes to at once build and equip 20 miles of telephone lines from Rincon through Chino to Pomona. Materials have been ordered and work will begin as soon as they are received.

Among telephone companies which have been incorporated recently in Nebraska and Kansas are the following-named: Independent Telephone Company, Sydney, Neb., O. M. Stager and others, capital, $30,000; Alvo Telephone Company, Alvo, Neb., S. C. Boyles and others, capital $3,000; Chikaskia Mutual Telephone Company, Mayfield, Kan., capital $5,000; Hiawatha Mutual Telephone Company, Hiawatha, Kan., capital $10,000; Farmers' and Merchants' Telephone Company, Pawnee City, Kan., capital $5,000.

## TELEPHONE MEN.

J. A. Hall has resigned as manager of the exchange at Preston, Minn., to take charge of the exchange at Central City, Iowa.

C. H. Webber has resigned as manager of the Interstate Telephone Company at Austin, Minn., and is succeeded by John L. Gulden.

J. T. Campbell, late manager of the Northwestern Telephone Exchange Company at Anoka, Minn., has been made manager of collections for the same company at Sioux Falls, S. D.

W. S. Smith, manager of the Wisconsin Telephone Company at La Crosse, Wis., has been promoted to be district manager of the La Crosse district. A. P. Hankerson succeeds him as local manager.

W. H. Durin, secretary of the Cedar Rapids and Marion Telephone Company and one of the leading men of Cedar Rapids, Iowa, died at his home in that city last week. Mr. Durin was one of the best known and best liked telephone men in the state of Iowa. He was widely known to other electrical men through his connection with electric-light, power and railway interests. The funeral was held at Cedar Rapids on March 20th and was largely attended.

## MANUFACTURERS AND DEALERS.

The Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., reports the following contracts: Curtis Publishing Company, Philadelphia, Pa., a central-energy switchboard equipped with lamp line-signals and double supervisory signals; switchboards for Fairpoint, Ohio; Illinois City, Ill.; Maple Lake, Minn.; Lathrop, Mo.; Granger, Texas; Toledo, Ohio; Parnell, Iowa; Carmi, Ill., and Philadelphia, Pa.

The Independent telephone exchange at Hot Springs, Ark., has recently had installed, by the American Electric Telephone Company of Chicago, an increase in its switchboard capacity to a total of 1,320 line terminals, this increase being brought up from 1,000 lines. The Independent telephone company at Topeka, Kan., has also recently ordered a 1,200-line magneto-call switchboard system from the same company. The equipment consists of two-section oak cabinets, each position being fully equipped and arranged for giving service to 200 subscribers' lines. The American company's flash-light transfer system has been adopted.

Three sections of the switchboard of the Mankato (Minn.) Citizens' Telephone Company were disabled during a fire in that city. Electric-light wires fell across the wires of the company and burned out the fuses. Repairs were made immediately. The Northwestern Telephone Exchange Company's exchange was burned out in the same fire and the Citizens' company has made an offer of service to Northwestern patrons temporarily.

## Telephone News from the Northwest.

The Palisade Telephone Company has been organized by farmers and business men of Garretson, S. D., to build local and rural lines.

There is agitation for the formation of a local telephone exchange at Hoople, N. D.

Joseph M. Kelly and A. B. Kerlin will build a telephone line from Devil's Lake to Starkweather, N. D.

The Bell long-distance system is soon to be extended from Hibbing, Minn., to Nashwauk, thence to Grand Rapids.

The Rice County Rural Telephone Company of Faribault, Minn., has been incorporated with $100,000 capital stock.

The Hector (Minn.) telephone exchange has purchased the old Strom exchange and will make improvements and extensions.

Farmers in the vicinity of Edgeley, N. D., contemplate a rural telephone system.

P. R. Crothers has disposed of his interest in the telephone exchange at Hetland, S. D., and the exchanges at Hetland and Arlington have been consolidated under the name of the Arlington-Hetland Telephone Company, with C. C. Maxwell of the Arlington exchange as manager.

It is reported that the Tri-State Telephone Company will build a long-distance system west from Minneapolis along the line of the Hastings and Dakota division of the Milwaukee railroad.

The Chippewa Valley Telephone Company has bought the exchange of the Prentice (Wis.) Telephone Company. The former will extend its line from Catawba to Prentice and connect with the new property and will string additional copper lines.

The Nicollet County Telephone and Telegraph Company is changing its system to the automatic switchboard at Gaylord, Minn.

The Davison County Telephone Company has been incorporated at Ethan, S. D., and will construct several rural lines.

The Kearney (Neb.) Telephone Company has been organized with T. E. Parmlee as president and W. S. Clapp secretary.

William Sinran and others have incorporated as the Butler and Bremer (Iowa) Mutual Telephone Company with a capitalization of $10,000.

W. J. Steckel has sold the Davis County telephone system to the Midwestern Electric Company of Cedar Rapids, Iowa.

The Hastings (Neb.) Independent Telephone Company has let the contract for the erection of a new exchange building.

The New State Telephone Company of Sioux City, Iowa, has been incorporated with $1,000,000 capital. Charles G. Cockrell of Jefferson is president and Joseph Mattes of Odebolt secretary. The plans of the new company are for the absorption of most of the Independent lines in Northern Iowa.

The Bronson (Iowa) Telephone Company has been incorporated with $5,000 capital. M. G. Smith heads the list of stockholders.

The telephone companies of Minnesota will put up a strenuous fight against the bill now before the Minnesota Legislature providing for defining the telephone and telegraph companies as common carriers. R.

## Michigan Telephone Matters.

The Michigan State Telephone Company will make a raise in telephone rates in Detroit. The increase on residence telephones will be $6 a year. The old subscribers will be given better service and will be equipped with an improved transmitter as an argument for the increased price.

The Michigan State Telephone Company at Cold Water will also advance prices next October—residence telephones from $12 to $18 and business telephones from $24 to $30 a year. This exchange has about 750 subscribers, but there has recently been expended in improvements about $25,000, so that the entire investment at Cold Water is now represented by about $60,000. This large investment in proportion to the subscribers is given as a reason for increasing the rates.

Mayor Codd of Detroit has taken a decided stand against the increase in rates by the Michigan State Telephone Company, as he understands that this plan is taken by the telephone company to make up for losses in other towns throughout the state caused by the competition of the Independent telephone companies. The corporation counsel has given information that anyone desiring a telephone can demand the company to put in a residence or business instrument at the present rate charged others, so that this may shut off the company from charging a higher rate for new business. W.

## Telephone Developments in Canada.

The Dominion government has decided to take up the long-standing question of general legislation governing telephone systems. The postmaster-general foreshadowed that the government would take over and operate the telephone systems in Canada when offering the following resolution to the House: "That a select committee be appointed to enquire into and report regarding the various public telephone systems in operation in Canada and elsewhere as the committee shall determine; and to consider and report what changes, if any, are advisable in respect of the methods at present in force for furnishing telephone service to the public."

A new telephone company is being put in operation by B. Mathews, A. Sherk and John Baer of Ridgeway, Ont. They propose to establish exchange offices at Port Colborne, Ridgeway, Fort Erie and other towns and villages. They will also give telephone connections with the farmers throughout the district. Port Colborne is holding out every encouragement to the new concern, owing to the fact that many of the citizens and business men are dissatisfied with the service and cost of the Bell Telephone Company. The work of construction by the new company has already commenced and instruments are being installed. W.

## Indiana Telephone Items.

The New Winchester Farmers' Mutual Telephone Company, capitalized at $1,000, has been incorporated and will build an exchange at New Winchester. Henry Beckley, F. M. Sheets and Harvey Hays, Jr., are the directors.

The Farmers' Union Telephone Company has been incorporated with a capital stock of $1,000. The company will establish an exchange at Borden. James H. Miller, Charles M. Collins and Henry McKinley head the directors.

The Hope Independent Telephone Company has been granted a 50-year franchise by the Hope Town Board. It was discovered that the company had been operating for six years without a franchise.

The directors of the South Bend Telephone Company, the majority of whom are Fort Wayne capitalists, held a meeting in Fort Wayne on March 15th and decided to change the exchange at South Bend to an automatic system. For a beginning, boards for 500 telephones were ordered, at a cost of $16,000. Incidental to the change, the company officials have announced that there will be an increase in the rentals from $30 to $36 a year for business houses and from $20 to $24 for residences.

Albert Hall, employed by the Lebanon Telephone Company, was killed by electric shock while repairing a telephone cable which touched an electric wire.

The Weed case against the city of Columbus has been appealed to the Supreme Court. John W. Weed came in contact with a telephone wire which had been charged with electricity by the alleged negligence of the city in allowing a sagged electric-light wire to come in contact with it. Mr. Weed was killed and the coroner held the city responsible. A suit was brought, but the city filed a demurrer to the complaint, holding that when a municipal corporation maintains a public utility and where there is no gain from the utility a person cannot recover damages. This was construed to cover the electric-light plant and the court sustained the demurrer. The question is regarded as important and for this reason the Supreme Court will be asked to pass on it.

Mrs. Alice Eastwood, chief night operator in the Laporte Telephone Company's exchange, was overcome when she completed connection for a call from the sergeant of the Harrison Street station, Chicago, to the chief of police at Laporte in which the Chicago officer requested the Laporte police chief to notify Mrs. Eastwood that her son had been killed by falling between two freight cars in Chicago. Mrs. Eastwood listened to see if the wire was working well when she heard the sad news. She was afterward found unconscious on the floor of the exchange.

The Sandford Mutual Telephone Company has filed articles of incorporation with the secretary of state. The capital stock is $5,000. The company was formed to build an exchange in Sanford and to extend telephone lines into Vigo, Parke, Vermilion and Sullivan counties. C. A. Ray, J. W. D. Wolfe, Melton Smith and W. J. Tritt are the directors. S.

## Bell Output for February.

There was a larger gross output of instruments by the American Telephone and Telegraph Company in February than the record output of January, but the net was less by 6,210 than the January net. Following are the comparative figures of the February report:

| February— | 1905. | 1904. | 1903. | 1902. |
|---|---|---|---|---|
| Gross output | 134,301 | 84,102 | 91,814 | 98,584 |
| Returned | 47,577 | 37,093 | 35,188 | 36,855 |
| Net output | 86,724 | 47,309 | 56,636 | 58,729 |
| Outstanding. | | | | |
| Feb. 28 | 4,660,222 | 3,880,616 | 3,293,527 | 2,627,395 |

A committee of the Ohio Independent Telephone Association, composed of Ed. L. Barber of Wauseon, Cyrus Huling of Columbus, J. B. Hoge of Cleveland and Dwight E. Sapp of Mt. Vernon, met with Frank L. Beam, president of the state association, at Cleveland last week and completed final details for the annual convention to be held in Columbus on March 30th. The session will open promptly at 10 o'clock in the morning. It will be a one-day session. From indications the meeting will be the largest and most enthusiastic ever held by Ohio Independent telephone men. The committee decided to close the convention with a banquet, at which some prominent speakers will respond to toasts.

## Motor Adaptability.[1]

By J. W. Shuster.

The question of how to improve the load factor is one which is of special interest to the central station manager. This is particularly true where the increase in load comes at a time when the station is very much underloaded. The principal field of operation for the electric-lighting plant of the Northwest is that of furnishing light for business and residence houses and street lighting. The demand for this service is limited almost entirely to the period between dusk and 11 or 12 p. m. and the early morning hours. However, the lighting of cellars, attics, dark halls, etc., makes it very desirable to have power on the lines during the 24 hours of the day.

In many cases this last requirement is an expensive one for the station to meet, since the cost of operating a generating unit during the day would far exceed the receipts from its customers during that period. It is quite possible in many cases to secure enough extra customers when the 24-hour

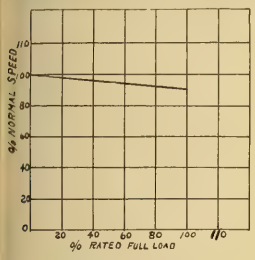



FIG. 1. SPEED-LOAD CHARACTERISTIC OF SHUNT MOTOR.

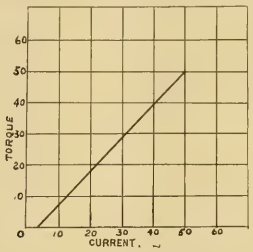



FIG. 2. LOAD-TORQUE CHARACTERISTIC OF SHUNT MOTOR.

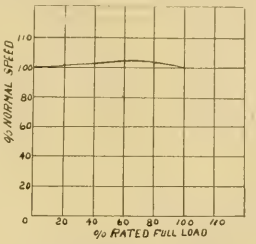



FIG. 3. SPEED-LOAD CURVE OF DIFFERENTIAL COMPOUND-WOUND MOTOR.

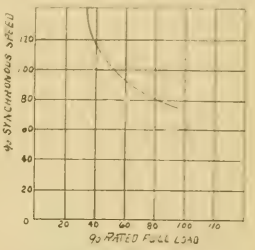



FIG. 4. LOAD-SPEED CURVE OF SINGLE-PHASE INDUCTION MOTOR.

service is offered to pay the extra expense of keeping power on the lines continuously. This is, of course, always true in the larger plants.

While lighting is the prime object of installing most central stations, there is available in the plant a large installation, which, thanks to the designing engineer, may be easily adapted to any kind of power service which the community may require. This power service coming, as it does, mainly during the day, may be supplied by the generators which are used to carry the lighting load, and thus greatly increase their daily output and decrease the cost of output per unit of power delivered. It is particularly of the availability of these lighting units for the supplying of power that I wish to speak.

Our manufacturing friends, ever on the alert to find a place where a machine can be utilized, have seen the necessity of adapting the electric motor to all classes of power service. The motors now on the market and coming onto the market attest their success in this undertaking.

The shunt, series, compound, differential compound, and numerous multi-speed continuous-current motors; the split-phase induction, repulsion induction, series induction, polyphase induction, with and without extra rotor resistance, the synchronous motor, single and polyphase, the series, the repulsion, and the concatenated induction alternating-current motor are on the list from which the consumer of power may select to suit the particular service which he requires, or from which the station superintendent may select to suit the generating apparatus which he has installed.

The characteristics of these motors are so diverse that there is very little power service to which some one or more of them could not be applied to give satisfactory results.

In this paper I wish to discuss briefly the characteristics of these motors, and hope that the discussion will bring out something of the experience of central-station superintendents in securing and operating motor loads to supplement the lighting load.

Taking up the continuous-current plant, first, it will be found that most of the demand for power will be for a variable load at practically a constant speed. This service can usually be supplied by the ordinary shunt motor which gives a speed-load characteristic similar to the curve in Fig. 1, and a torque-load curve similar to that in Fig. 2. This type of motor gives nearly a constant speed for all loads and will answer in most cases for constant-speed work. If, however, the slight falling off in speed as the load is increased is objectionable, the differential compound motor may be substituted. This motor can be designed to give the same speed at full load as at no load, if the impressed pressure remains constant, and the slight variation in speed between these two loads will be appreciable. This gives us our constant-speed motor, with a speed-load characteristic similar to the curve in Fig. 3, and a torque curve not very different from that of the shunt motor.

In case a high starting torque is required, and a constant speed for operation, the compound motor will answer admirably, as the series turns will produce the initial starting torque, and these turns may be cut out as the motor comes up to speed, and leave the running characteristics of [illegible]

Where a heavy starting torque is required and the speed regulation is not important, the series motor is ideal, providing there is always sufficient load to prevent the speed from becoming excessive. In case the load is likely to be entirely thrown off, a shunt winding sufficient to prevent the excessive speed should be introduced. This gives a compound motor, with characteristics approaching those of a series motor.

For a large amount of work, especially in connection with factories and machine shops, there is a demand for multi-speed motors. That is, for motors which will operate at constant speed over a wide range of load, and which can be controlled to give several different speeds and carry any load from no load to full load at any one of these speeds.

Motors of this class have been developed very rapidly during the last few years, and there are on the market at present several systems for multi-speed work which answer most requirements quite satisfactorily. We may notice briefly a few of the methods which are adopted to secure the operation of these systems. The three-wire system, in which the motors may be operated from any three-wire system, or a special three-wire generator, described at the last meeting of this association by Mr. Waters, lends itself very readily to this service. For the minimum speed the shunt fields of the motor are connected across the outside wires, say, on 220 volts, and the armature is connected between the neutral and one of the outside wires. Then, by means of field resistance, the speed may be increased from 60 to 100 per cent., and when the limit of rheostat control is reached, the armature is connected across the outside wires, and the fields brought to their maximum strength again. A further increase in speed is obtained by again introducing the field resistance. In another system the motors are built with two armature windings, so that the two windings may be connected in series or either one thrown across the line. With these different armature connections, and the field-rheostat control, the speed can be varied over a wide range.

Another system which promises very good results, where the required range of speed variation is not too large, is that in which the reluctance of the magnetic circuit is changed by raising a plunger in the field core. This decreases the total magnetic flux and at the same time keeps the flux well distributed, and thus prevents sparking.

Each of these and several other multi-speed systems are in successful commercial use and can be applied to any demand for power where several different constant speeds are desirable. These different types of continuous-current motors will cover almost any demand for power, and may be operated off of any constant-potential direct-current system.

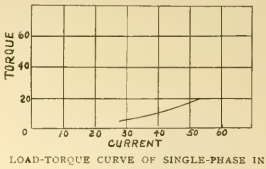



FIG. 5. LOAD-TORQUE CURVE OF SINGLE-PHASE INDUCTION MOTOR

When we consider the alternating-current motors for power service, we find that the field is almost as fully covered as it is in continuous-current work. Taking the characteristics, in the order in which they were considered in continuous currents, the alternating-current induction motor has a speed-load characteristic almost like that of the continuous-current shunt motor, and may be applied to most work where a constant speed is required. Some of these motors do not start with a very high torque, but in most cases the load need not be thrown on until the motor attains its normal speed, in which case the motor operates very satisfactorily. Normally, the single-phase induction motors are not self-starting, so that various means have been devised to bring them up to speed, and when full speed has been attained, they are thrown over into ordinary induction motors and carry their load as such.

them together and giving a short-circuited rotor, and the field windings are connected directly across the line.

[illegible] motors. This consists of placing an auxiliary winding on the field which has a different value of self-inductance from that of the field proper, and a starting torque is exerted by the action of these two currents out of phase with each other.

Another starting device which has been in use for several years is that in which the motor starts and is brought up to speed as a repulsion motor. In this motor the armature winding is connected up to a commutator, and the brushes placed in such a position that when they are connected together an induced current in the short-circuited coils will produce a starting torque and bring the motor up to speed, when all the coils in the armature will be short-circuited, either by hand or automatically, and the motor operates as an induction motor. Where a polyphase system is available, and the amount of power required is sufficient to warrant installing the circuits, a polyphase induction motor would be used, and auxiliary starting devices would be unnecessary. Any of these induction motors will give almost constant speed for any load between no load and full load, and most of them are capable of carrying a considerable overload.

If an absolutely constant speed is required of an alternating-current motor, we must fall back on the synchronous motor for this service. Since the single-phase synchronous motor is not self-starting, it would usually be inadvisable to install it, and in case it is installed, some auxiliary machine must be adopted for bringing it up to synchronous speed. The polyphase synchronous motors are self-starting, and while they require more attention than induction motors, they have certain advantages which may make them desirable for some classes of work.

Until quite recently the demand for an alternating motor with characteristics similar to those of the continuous-current series motor, could not be supplied. The attractive field open for such a motor in railway service has inspired a large amount of experimental work along that line, and has been successful to the degree that at least two manufacturing companies in this country are offering to equip railway systems with these motors. While most of the attention of manufacturers has been directed to the railway problem up to the present time, these motors will soon be developed in the smaller sizes for power purposes, and the field of the variable-speed motor with high starting torque for alternating current will be covered. These motors are being developed as series motors of special design, and as repulsion motors somewhat similar to the scheme described above in connection with the starting of single-phase induction motors.

In fact, these single-phase induction motors which start as repulsion motors give some very interesting results when operated under load as repulsion motors. The curves in Figs. 4 and 5 and Curve (C), Fig. 6, are taken from data obtained by a student at the University of Wisconsin on one of these motors. In order to get these data it was necessary to block

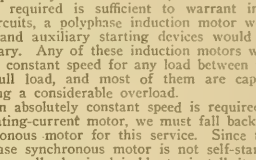



FIG. 6. POWER-FACTOR AND EFFICIENCY CURVES OF SINGLE-PHASE INDUCTION MOTOR.

1. Paper read before the Northwestern Electrical Association in Milwaukee on January 19, 1905. Mr Shuster is instructor in electrical engineering at the University of Wisconsin.

the brushes on the commutator, so that they would not be thrown out by the automatic device which is placed on the motor to change it from a repulsion motor to an induction motor when it reaches normal speed. In considering these curves, it must be borne in mind that this motor was not designed to operate as a repulsion motor under load, and that its characteristics could be considerably improved if the motor was redesigned with this in view.

Fig. 4 shows a speed curve which is very much like that obtained from an ordinary continuous-current series motor The speed is increasing very rapidly at the point of lightest load shown, and the load could not be reduced farther, on account of the motor attaining an excessive speed.

Fig. 5 shows the rate of increase of torque with current.

Curve (C), Fig. 6, shows a uniformly high-power factor for all loads covered by the data.

The efficiency of the motor working under these conditions is given in Curve (D), Fig. 6, and while it is not high, it is probably as high as should be expected. The curves illustrate very nicely the general shape of the characteristics of this type of motor.

The field of the multi-speed alternating-current motor is still comparatively free to all comers, and it is to be hoped that this gap will be successfully filled in the not-far-distant future. While I say this field is comparatively free, it may be well to mention the concatenated induction motor, which, when arranged with the proper connections and combinations of poles, will give several different speeds. It is not probable, however, that we shall soon see them as an important part of factory or central-station equipment.

The effect of a motor load on the regulation of the system must not be lost sight of, and a rapidly fluctuating load should not be taken on if it is to be operated in connection with a lighting load. Other motor loads can be operated to a considerable amount without seriously affecting the regulation of the system. When the motor load becomes heavy enough to seriously interfere with the regulation of the system, it will usually be heavy enough to warrant the installation of a separate unit to take care of the power load. Ample starting resistance must be insisted upon, and alternating-current motors should be started with a rheostat or auto-transformer, to cut down the pressure at the terminals.

From this review of the motor field, it is evident that any central-station man, whether in continuous or alternating-current work, has at his disposal power which is available for almost any class of service. It would seem that the power field might be developed into a much greater source of revenue to the central station than it now is.

The major part of the motor load comes during the day, when the lighting load is insignificant, and as the station has all its equipment in place and ready for business, it can supply power more cheaply than can the user of power who would have to install all new apparatus for that purpose.

DISCUSSION (IN ABSTRACT).

George W. Colles, Milwaukee: What is your opinion as to the advisability of a series-commutator motor coming into use as a variable-speed motor in place of the ordinary induction type?

Mr. Shuster: I am not prepared to say just what we can expect in regard to the operation on the high frequencies, as high as 60 cycles. Of course, it is being developed as a railway motor on the lower frequencies, 16 first, and then up to 25 cycles. They have it so that it operates very satisfactorily on the 25-cycle, and I presume there will be considerable difficulty in adapting it to frequencies as high as 60 cycles, but you will remember that the other railway system that is being developed is being developed in the line of the repulsion motor, which is somewhat like the curve in Fig. 1, showed here, and, with the experience I have had with our repulsion motor, which was not built to operate as a repulsion motor, I think that type of motor can undoubtedly be designed to give practically a series characteristic with direct results.

Mr. Colles: You think the repulsion motor, then, is the one that stands the best chance now for alternating current generally? Of course, I refer to central stations and isolated systems.

Mr. Shuster: From the information I have I should be rather inclined to say that the repulsion motor would probably work better on the high frequencies than the series motor, but one or the other of them, I think there is no question, will be developed so that it will give satisfaction.

W. R. Putnam, Red Wing, Minn.: You referred to the regulation in the operation of a small alternating-current plant, where you have a sudden shifting of the load, one way or the other, early in the evening or late in the morning. Can that regulation be handled with any of the regulators on the market so as not to interfere with the lighting service?

Mr. Shuster: In regard to that, I think we might say that the starting load could be handled without any special difficulty by one of the methods I mention, either by introducing an ordinary resistance in the armature circuit of the motor, if it is a system where you do not have to have a heavy torque, on the start, or you can introduce resistance and bring it up gradually and reduce to a very great extent the instantaneous rush of current that you ordinarily find in throwing an induction motor on a circuit. This can be accomplished by ordinary resistance, or the use of an auto-transformer, starting at low voltage and coming up. I think both of the methods have been practiced to a considerable extent, and it helps out markedly on the regulation at the starting of the motor, and I think it would not interfere unless you had quite a number of motors starting at exactly the same time.

J. H. Harding, Laporte, Ind.: I would like to ask if either one of the voltage regulators on the market will control a single-phase circuit and handle it so as to maintain and hold its voltage uniform during the early morning or later in the day, when they are cutting on and cutting off voltage. Also, where we are operating printing presses from our motors, can regulators be employed there? I notice that, take it along in the afternoon, when the different papers are running off their issues, there is a tendency to keep your voltage fluctuating, not enough to interfere particularly with light, but enough so that when, for any cause, they shut off a large press and throw it on again, it does pull your voltage off two or three points. I would like to inquire where there is a regulator that will overcome that difficulty on a single-phase alternating-current system.

Mr. Shuster: I intended to cover that in the paper by saying that a rapidly fluctuating load should not be operated on an ordinary lighting system, because experience shows that it is practically impossible to take care of the voltage regulation for that rapidly varying load unless you adopt a pressure regulator.

Mr. Colles: I still cannot bring myself to believe that the single-phase alternating system has yet been developed sufficiently to allow its use where you have got such things as elevators and hoisting machinery and various things requiring fluctuating loads. The various plans proposed, particularly the one which Mr. Shuster mentioned, of putting resistance into the armature, are unsatisfactory, particularly that last one, which really takes away all the advantages of the motor that you have. You must have a special winding on the rotary, as well as slip rings, and you get very low efficiency in such cases.

Mr. Shuster: There is no special winding required in that case. Quite a number of both the European and American manufacturers construct the rotaries with a variable resistance in series with the regular rotary winding. Some of them use collector rings and introduce the resistance in the regular armature winding of the motor, and others have the rheostat mounted in the armature, so that no collector rings are required at all. You remember the rotary winding of most modern electrical motors has a wound armature, the same as an alternator, and this is introduced in that wound armature.

## The Economy of the Modern Garbage Destructor.

BY A. S. ATKINSON.

Of the 160-odd towns in England where refuse destructors have been in operation for the last three years 45 and more have combined electrical works with the destructor plant within the last two years, and the results obtained are worthy of careful consideration. The kilowatt-hours generated per ton of refuse in these different towns average all the way from 20 to 40 or more, but the conditions under which the different plants are operated are responsible chiefly for the wide variation in the results produced. The experiences with these "dust" destructors and electrical generating plants furnish data which not a few engineers accept as evidence that eventually the dust destructor will be a part of the equipment of every important city's street-cleaning department, and that garbage which has no other commercial value will be incinerated, developing, to some extent, steam or electrical power.

The designing and arrangement of the destructor and electrical plant have undergone many changes and improvements in the last year or two. The present destruction of garbage is not conducted as economically as it should be. In the last year the average performance of some 17 of the plants in the suburbs of London was about 25 kilowatt-hours per ton of refuse. In order to obtain such results a great amount of coal had to be burnt also, the average proportion being from 15 to 25 per cent. of coal. But these results were obtained in destructors that were built experimentally several years ago, and their operation is today recognized as far from what could be accomplished under improved conditions.

One of the most wasteful phases of the subject is open charging. The constant opening of the furnace doors to admit the refuse causes a great loss of heat. There have been two methods of charging the furnaces with garbage, and neither gives the highest results. One is to tip a large charge into the furnace at regular intervals. Mechanical arrangements have been used in England for tipping from 3,000 to 4,500 pounds of refuse into the cell in a few seconds. The mass falls in a load, and an appreciable loss in temperature in the cell follows before the compact mass burns. The other method of charging is feeding by shovel, which is even more wasteful than the first method, because of the continued opening of the furnace doors. This method means rapid distillation and rapid ignition, and the temperature of the gases is kept high; but the cooling of the interior by the outside admission of cold air is important.

The mechanical feeding and stoking of the fire are improvements that are essential to the best results with garbage burning, and in some of the newest plants such installations, in connection with economizers and other improvements, are being made. In the present movement to dispose of garbage and city refuse in destructors in this country the data collected by the English experimenters should prove valuable. Recognizing garbage as fuel, the charge must be fed like coal to secure the highest efficiency slowly and continuously by some automatic device, and with little admission of outside cold air through the furnace door. It is well known that in the destructive distillation of coal the best method from every point of view, is to introduce the fuel regularly in small quantities, so that thorough ignition is secured and a high-combustion temperature maintained.

City refuse is not a uniform fuel like coal, and its varying quality adds to the difficulty of securing an average temperature. In rainy weather the refuse reaches the destructor heavily charged with moisture, and it has an effect upon the fire that causes considerable loss of heat. In combined works the need of heated air to dry the fuel is quite evident, and one or two destructors have been tried experimentally in this way. The greater use of coal at such times is also apparent. By means of the regenerative system, by which heated air is supplied for combustion of material, a much higher efficiency is obtained in burning garbage and coal together. This system promotes more rapid ignition and maintains a high temperature without difficulty.

In the average destructor plant in England at least 30 kilowatt-hours per ton of refuse burned can be relied upon the year through, but in the summer time the character of the refuse is of lower value than in winter. Owing to the greater quantity of green stuff mixed with the garbage in the warm months, the need of the air-drying system is more important, and if it were not that the lighting period is also less in summer than in winter many of the plants would have to be operated at a loss. Where only electric light is generated, the burning of the refuse is confined more largely to the night; but in most of the destructors in England electric and steam power are used in the daytime for other purposes, and the refuse is burnt continuously day and night. Where the plant is designed for constant use, the uninterrupted working of the destructor and electrical equipment must be assured, through the use of both coal and garbage. The mechanical handling of both coal and refuse decreases the cost of operation, but the elimination of the dust caused by handling the refuse by machinery is an important part of the problem that has not yet been satisfactorily settled.

One of the most successful destructor and electrical plants in England is located at Fulham, London, where about 30,000 tons of refuse are burnt a year, steam being used for electrical generation, and for operating a disinfector, a brick-making plant, and a clinker-working plant. Nearly 2,000 tons of coal are burnt annually at the Fulham destructor, in addition to the refuse. The destructor consists of 12 Horsfall cells in two groups of six each, arranged back to back in threes, and between these groups there are six Babcock boilers. Steam jets of the Horsfall type furnish blast to the destructor cells, and the steam consumption was 17.8 per cent. of the total steam generated. The main flue is a large one, and economizers are provided in it. Mechanical stokers complete the equipment of the steam-generating plant.

Steam is supplied to operate a disinfector some 120 feet away, and also a clinker crusher and brick-making plant. The clinker crusher has always proved an expensive part of the destructors. The disposal of the clinker cost over $2,300 at Fulham in one year, but last year the sale of the clinker at good rates reduced the loss. At the Hackney destructor station the cost of disposing of the clinker amounted some years to $3,750, but the removal of the clinker without cost has now eliminated this loss at Hackney also. The actual disposal of the clinker at cost or a small profit is one of the items of operating a modern destructor that is highly important.

The clinker crusher at Fulham is driven by an eight-horsepower vertical engine, and the engine is run 54 hours a week. Its average consumption of steam through a pipe 80 feet long is not less than 50 pounds of steam per brake-horsepower-hour. A Bellis engine, operating a fan at the base of the chimney for increasing the draft, takes about 30 pounds of steam per brake-horsepower, and is supplied through 100 feet of piping. The disinfector is operated only a part of each day, and about $750 is charged for the steam supplied to it. The brick-making plant takes an unknown quantity of steam.

The electrical plant in connection with the destructor is of more recent installation than the original part. This consists of three 300-kilowatt alternating-current generators, three 100-kilowatt direct-current exciters, five 24-horsepower centrifugal electrically driven pumps, one 20-horsepower deep-well pump, four 10-horsepower motors for driving mechanical stokers and belt conveyors, and two five-

horsepower motors for operating economizer scrapers.

The equipment of the combined destructor and electrical plant is thus more complete than any other in London or the suburbs, and its showing in results stands first on the list. The clinker took about 50 per cent. of the refuse burned, but this has been reduced the last year to about one third. The ultimate value of the steam, based on the price of coal last year, was estimated at about $25,000. After deducting the cost of operation, and making an allowance for repairs, the Fulham destructor and electrical works shows an asserted profit of $5,000 a year. This depends upon the ability of using the full heat value of the refuse, and the disposal of the clinker without cost. If the latter can be disposed of at a profit, the gain will be so much more for the plant. So far this plant holds the record for lowest total costs of destruction of any of the combined plants in England.

In spite of this, however, the Hackney plant shows a higher heat value in the summer obtained than at the Fulham plant. The latter high record for the summer is 53 units per ton of refuse for a single week, but at Hackney 60 units per ton were obtained. The units obtained throughout the year at Fulham were only 27.8, against Hackney's 41.1 units. The Hackney destructor is of the Hughes & Stirling type, in three four-cell groups, with a combustion chamber between each two pairs of cells. There are three Babcock boilers behind the combustion chambers, and the average coal consumption is about five pounds per unit generated. The electrical part of the plant consists of high-speed engines and direct-current generators. A 1,200-kilowatt-hour Tudor battery is a feature of the plant that adds to its efficiency. Electric fans increase the blast. About 34,000 tons of refuse are burned in the Hackney destructors and 1,300 tons of coal. The steam generated is used entirely for operating the electric plant. There is no clinker works or pumping operated by direct steam power.

The refuse is received at Hackney and dumped into huge hoppers prepared for it. From these hoppers the fuel is conveyed by elevators to three large bins above the cells. From these bins the fuel is drawn in automatically as needed, and efforts have been made to secure uniform charging without admitting an unnecessary amount of cold air. The feeding is probably largely responsible for a good deal of the economy of operation. It is probable that the Hackney plant would prove as profitable as the Fulham destructor if it had as good a market for its steam, but until it can dispose of its surplus power at market rates it is not likely to make a profit.

While the average units developed per ton of refuse appears comparatively low, the highest at any time is quite remarkable in both of these destructors. At the highest peak lasting about two hours, the value of the Hackney plant was no less than 104.3 kilowatt-hours per ton, and in one instance 105.8 kilowatt-hours were recorded. The highest record on the week load of the Fulham plant was 95 kilowatt-hours per ton. The question of securing a higher average for each ton of refuse burned is one of the most important features of modern refuse destruction, and the improvements in mechanical methods are steadily advancing in this direction.

Other important refuse destructors in London or its suburbs are at Stepney, Shoreditch, Bermondsey and Woolwich. At Stepney the destruction of refuse exceeds that of any other plant, fully 41,250 tons being burned there on an average each year. The amount of coal consumed with the refuse each year aggregates 2,341 tons. There is a clinker hoist and disenfector operated by the Stepney plant, as well as an electrical generating station. The drawback to this plant is that all of the steam generated is not utilized, and the steam generation is varied to suit the load of the electrical plant as much as possible. If the generator was running all the time at full load, the destructors at Stepney would prove the most economical, and the effort is being made to utilize the current in such a way that the night and day load will be nearly equal. With the current utilized for operating electrical machinery in the daytime and for lighting purposes at night, the economy of this station would prove phenomenal. As it is, the destructors come out nearly second best in the London combined stations in the matter of costs.

The Shoreditch destructors and electrical plant are of unusual interest, for the reason that they were originally installed with the idea of being operated entirely by burning refuse, and they have ended with being the largest consumers of coal of any in England. Upward of 6,400 tons of coal is burned in the Shoreditch destructors annually, and only 25,750 tons of refuse. The chief reason for this has been that the need for power and light far outran the supply of refuse as fuel, and the plant was increased to meet the new requirements, coal being burned more and more generally. Besides generating electricity for lighting the place, the destructors furnish steam for heating the baths, laundry and library and for operating deep-well pumps and other machinery. Today very few engineers entertain an idea that the electric works of a destructor can be operated on refuse alone as fuel.

## CORRESPONDENCE.

### Great Britain.

London, March 8.—A long report has been presented by the parliamentary committee of the London County Council with regard to the application by companies to supply electrical energy wholesale in London. As I have already mentioned, there are eight such applications, viz., five by existing companies for an extension of their present powers, two for the incorporation of new companies and one by a company outside London asking for the application of its present powers inside London. The report recommends a course of action to oppose the bills. After being put back for a week the report was adopted and a resolution passed to the effect that all the bills should be opposed and that a conference of all the London borough councils and the County Council should be called to consider the possibility of a joint opposition. An idea prevails in many quarters that the London County Council should take up the question of erecting a generating station for the supply of electrical energy in "bulk" to local authorities and others, and it was touched upon in the report of the parliamentary committee above referred to. Naturally the council regards the numerous proposals now before Parliament as a serious menace to existing and future municipal electricity undertakings in London, especially when it is remembered that a view held by it for many years is that it should be the one central electric power-supply authority for the metropolis. Following this line of thought, therefore, the recommendation has been made that any new company authorized should be subject to purchase by the County Council (as in the case of the existing companies in London, but a restriction never yet placed upon the large power companies), and that some arrangement should be arrived at with the existing companies with the object of securing a supply of electricity to London consumers upon the most economical basis.

The proposal to hold a representative electrical exhibition in Great Britain has now assumed definite shape and a committee is now in course of formation to settle the details. At present the idea is to hold the exhibition in London.

Some interesting figures with regard to the post-office telephone service in London have recently been published. It was in February, 1902, that the first exchange was opened, with 250 subscribers. In February, 1905, 25,138 stations had been connected up. The trunk-line service throughout the country has also been enormously enlarged since the post-office took them over nearly eight years ago. At that time there were 47,855 miles of trunk wires in use, while at present the total is no less than 102,752 miles, and the postoffice is erecting between 7,000 and 8,000 miles annually. It is proposed to send the agreement as to the purchase of the National Telephone Company's undertaking to a select committee for reporting whether such agreement is in the public interest and in accordance with the promise of the government last year.

A cotton-spinning mill is now being erected in Lancashire which is claimed to be the first such mill to have been designed originally for electric driving. The mill, which is near Manchester, will contain 41,000 mules and 34,000 ring spindles. Current will be taken from the Lancashire Electric Power Company at 10,000 volts and transformed down to 440 volts and 230 volts for power and lighting purposes. The fact that turbines are used at the power company's generating station is expected to result in a very perfect drive on the spindles, of great importance in the spinning industry. The mill in question is being built adjoining a similar size mill driven by steam, so that a very useful comparison will be available.

Mr. Marconi on Friday evening last delivered a lecture to a distinguished audience at the Royal Institution on recent developments in space telegraphy. Regarding transatlantic communication by space telegraphy, he said the daily service to the Times had had to be abandoned temporarily because the stations had broken down. New stations were now being erected, and when a second attempt was made success was practically assured.

A set of rules has just been issued regulating the use of electricity in mines. These rules are the result of the deliberations of a committee which was appointed in 1903 to consider this question, a special set of rules for the use of electricity in mines not having previously existed. Some considerable modifications have been made in the final rules as compared with the draft set issued some time ago and the general opinion now would seem to be that they are reasonable and practicable.

The National Telephone Company has been unfortunate this year in the matter of fires. Only a few weeks ago a serious fire totally destroyed one of its largest London exchanges and yesterday another similar occurrence partially destroyed the Bank Exchange.

At the meeting of the Brighton corporation last week the financial position of the municipal telephone undertaking was considered. There are at present 1,725 subscribers connected up to the system and 100 more are waiting to come on. The monthly profit is said to be between $400 and $500. Such was the statement of the chairman of the telephone committee. During a discussion, however,

[redacted]

### Dominion of Canada.

Ottawa, Ont., March 18.—The town of Orillia, Ont., has notified the Bell Telephone Company that it will not make a contract for more than one year, as investigation is being made with a view to installing a municipal system.

The annual meeting of the West India Electric Railway Company has been held in the city of Montreal. The company is controlled entirely by Montreal interests. The directors which were elected are James Hutchison, C. J. Fleet, W. G. Brown, R. McKeen, A. R. Ongley and J. McIlroy.

Application is being made to the Dominion Parliament for a charter for the Fessenden Wireless Telegraph Company. This company is seeking to get the government to install space telegraphy on Sable Island.

The city of Ottawa, Ont., has been selected as the location of the head office of the Dominion De Forest Wireless Telegraph Company, which has been incorporated under an Ontario charter with a capital of $1,200,000. The company is given authority to erect and maintain stations for sending and receiving messages by wireless telegraphy. The provisional directors of the company are L. J. Lemieux, F. J. Humphrey, J. C. Cardinal and A. Brassard, all of the city of Montreal, Que.

Arrangements have been completed for the installation of electrical machinery to operate all the locks in the Lachine Canal. Special power houses have already been completed at Montreal and vicinity. It is estimated that with the electrical equipment there will be a saving of slightly over five minutes at each lock. The plan of improvements for the different canals around Montreal during the coming summer will result in an outlay of nearly $400,000.

A statement has been issued by the Ontario Power Commission. The total available power at Niagara, as estimated by American engineers, is 5,500,000 horsepower. Two American and three Canadian companies are now in operation, and the quantity of power chartered is 675,000 horsepower. "A guess at the Ontario consumption," says the statement, "within the limits of practicable transmission, cannot be hazarded, but by common consent the 375,000 horsepower already in process of development by three Canadian corporations is considerably in excess of all demands for many years to come. The fact that the city of Toronto, with all its lighting, electric-railway and manufacturing demands upon power, consumes only about 30,000 horsepower is a partial index of the margin between consumption and development. To be on the safe side, let the average all-around cost of power to Ontario consumers be placed at, say, $35 a horsepower per annum. The Shawinigan Power Company of Quebec has quite an expensive development. The Montreal Power Company contracted to take its whole output at a uniform rate of $15 a horsepower delivered at Montreal, 89 miles from the point of development, which is sufficient to pay interest on bonds and dividends on capital stock. It may be assumed that municipal power, charged with bond interest only at a low rate, may be produced at a maximum cost of $5 a horsepower. Estimating the consumption tentatively at 150,000 horsepower, and the saving at $20 a horsepower, the net annual value to Ontario consumers of power sold at cost is $3,000,000, which, capitalized at 4 per cent. per annum, represents a capital value of $75,000,000. W.

Winnipeg, Man., March 18.—The Eau Claire Lighting Company, which has a monopoly of the electric-lighting business in Calgary, is very much opposed to the idea of a municipal plant being installed, although the voters have approved the plan. The city is in the market for a first-class plant, which it intends to install.

It is proposed to expend about $11,000 on improvements to the civic electric-light plant of Victoria, B. C., to include new dynamos, three transformers and 150 arc lamps, tenders for which will be asked for in the course of a few days.

The City Council of Pictou, N. S., is about to expend $12,000 to complete the electric-light plant and will be in the market in a few days for about $10,000 worth of electric machinery and plant.

The Archer Light, Heat and Power Company of Toronto has been incorporated with a capital of $100,000 to manufacture electric stoves, electric furnaces, fixtures, etc. The Canadian directors are R. B. Younghusband, I. T. Moore and others. H.

### New York.

New York, March 18.—The aftermath of the subway strike has been considerable but not important. About 90 per cent. of the strikers are said to have

been taken back by the Interborough company, but the public does not altogether believe this statement, seeing that normal traffic conditions have not been entirely resumed, especially on the elevated lines. The Farley strike-breakers to the number of about 4,000 were discharged on Thursday and are scheduled to be in San Francisco on May 1st for a probable traction strike in that city.

On Thursday the Interborough company declared a dividend of 1¾ per cent. on the $35,000,000 capital stock of the company, payable on April 4th.

In addition to the scheme for erecting moving platforms in a cross-town subway on Thirty-fourth Street, now before the Rapid Transit Commission, Max E. Schmidt of Schmidt & Gallatin, the promoters, expects to establish similar services on Fifty-ninth and Fourteenth Streets. This tunnel is to be 14 feet high and wide enough for two sets of platforms going in opposite directions. There will be eight feet clear above the platforms and six feet below for the machinery. There are to be three platforms running at three, six and nine miles an hour, respectively. Free transfers are to be given on a five-cent fare for passengers by the Interborough company. The platform which is to run under Fourteenth Street may possibly be continued under the river to Brooklyn and Jersey City. The seating capacity of the Thirty-fourth Street Tunnel will be about 50,000 passengers an hour.

President Winter of the Brooklyn Rapid Transit Company seems to be very anxious for the adoption of the Baxter Street route for an elevated loop between the Brooklyn and Williamsburg bridges, which, if constructed, his company has undertaken to use and rent on a basis of 4½ per cent. interest on the capital expended by the city. Mr. Winter is at the same time very much opposed to a subway loop for the same purpose and this week his agents have been collecting statistics on the passenger traffic over Brooklyn Bridge. As a result of actual count, it is estimated that 37 per cent. of the passengers alighting at the Manhattan end of Brooklyn Bridge would take a through-car service if such were available. These figures contradict an unofficial estimate that only 10 per cent. of the traffic would be effected.

The estimated cost of the electric-light plant for the new Harlem hospital is placed at $26,300, the money for which has been appropriated.

A contract is officially recorded for 30 fire-alarm signal boxes for the fire department with the Gamewell Fire Alarm Telegraph Company of 19 Barclay Street, Manhattan.

Bids are receivable on March 27th for an electrical equipment for Public School No. 64, on Avenue B and Tenth Street, the probable value of the contract being about $12,000. D. W. W.

## New England.

Boston, Mass., March 18.—The bill that was pending in the Massachusetts Legislature to permit Massachusetts steam-railroad corporations to purchase trolley lines, much after the fashion in which the New York, New Haven and Hartford has been buying them up, is not acceptable to the Boston and Maine Railroad Company, in whose interests it was originally conceived. The limitations placed upon the acquisition of stock and the issuance of new capital stock under the supervision of the Massachusetts Railroad Commission were regarded by the Boston and Maine as too onerous and the matter will be allowed to lapse.

Of the 187 motor cars exhibited at the big automobile show held this week in Boston nine were electric vehicles, including three limousines, one tonneau touring car and five runabouts. The attendance at the show has been phenomenal, far exceeding that of previous years.

Legislative hearings have been held this week which were well attended by residents of the cities and towns to be affected on the proposition to construct a high-power electric line between Boston and Providence, and much opposition from the steam railroads, represented by counsel, has developed.

The Monitor Electrical Speed Recorder Company has been incorporated with a capital of $5,000, the president being James H. Kendall and the treasurer George F. Kendall. These gentlemen are members of the boiler-manufacturing concerns of Kendall & Sons, whose plant is located in Cambridge, Mass.

Officials of the Boston Elevated Street Railway Company on Wednesday entertained for several hours a visiting party of 12 from Cleveland, who came here to inspect the Boston street-railway system and were afforded every facility by the Boston company. They were entertained at luncheon at the Exchange Club after visiting the elevated lines and the subway and East Boston Tunnel. President Bancroft and other Boston Elevated officials being their hosts. They will inspect the New York street-railway transportation systems also.

After holding the plan to equip its Newton circuit road with third-rail electrical service some time in abeyance, the Boston and Albany steam railroad has decided to abandon the project.

P. J. Smith of Lowell, a former member of the Common Council of that city, is under arrest, charged with cutting wires of the New England Telephone and Telegraph Company and stealing the same. Wire-cutting has been going on in the vicinity of Lowell for about two months. Upward of 100 pounds of wire were found in a wagon belonging to Mr. Smith and he was arraigned March 13th in the lower court, the case being continued.

Having adjusted the insurance account for the recent fire at the company's car barns, the Manchester (N. H.) Traction Company has placed orders for a new car outfit, including 18 closed and five open cars, double-truck, four-motor and air-brake equipment.

The Beacon Trust Company of Boston asks for a receiver for the electric-light company in Meredith, N. H., and the case comes up in the United States Circuit Court at Concord, N. H., this week.

The Berkshire Power Company has concluded a deal for the purchase of the Sharon Electric Light and Power Company and will take possession April 1st. The Berkshire company is erecting a large power plant on the Housatonic River. B.

## Southeastern States.

Charlotte, N. C., March 18.—Through R. D. Apperson of Lynchburg, Va., a deal has been consummated by which a controlling interest in the Montgomery (Ala.) Traction Company has been secured by Philadelphia capitalists. The traction company was recently placed in the hands of a receiver and controls about 10 miles of electric lines. The purchasers assume the bonded indebtedness of the electric lines, amounting to $318,000.

A large electric searchlight, said to be one of the largest in the world, is being put up at Fort Monroe, near Newport News, Va.

The Norfolk (Va.) Railway and Light Company has awarded a contract at $100,000 for putting underground all of the company's electric-light wires south of Queen Street.

The City Council of Raleigh, N. C., has voted to change the franchise of the proposed Raleigh-Durham Electric Railway Company, striking out the clause giving the city the right to change the charter on 30 days' notice.

The new electric-light plant for the town of Hartwell, Ga., has been completed and the lights successfully tested.

The committee on electricity of the city of Richmond, Va., has decided to report an ordinance requiring a $1,000 bond and a $25 license fee of all electrical contractors in the city.

The town of Winston-Salem, N. C., has, through the Board of Trade, named a committee to appoint a date for voting on a $37,000-bond issue, to aid in the building of the proposed electric railway to High Point, N. C.

A boiler at the city electric-light plant of Jacksonville, Fla., burst recently. The fireman was killed and the engineer fatally injured, several others being seriously hurt. The property damage will amount to about $3,000.

An ordinance has been offered in the City Council at Raleigh, N. C., to place all wires in the fire district underground. L.

## Ohio.

Cleveland, March 18.—The Cleveland Electric Railway Company will soon equip all its cars with air brakes. A tripper will be placed at a considerable distance from the draws over the river on each side of the viaducts, which will rise between the tracks automatically when the draw is opened. If the motorman should neglect to stop, this tripper will turn on the air and the car will come to a stop. The system is in use in the New York subway.

The bonds of the Muncie, Hartford and Fort Wayne Traction Company which have been held in a pool for a year have been sold to a western house at 88 net, and the pool, which included the stock also, has thus been dissolved. This brings something like $700,000 into the Cleveland banks. The stock and bonds will now go on the market.

The electric flashlight was demonstrated at the annual meeting of the Ohio-Michigan Photographers' Association at Toledo last week, as was also the process of developing pictures by artificial light.

Burglars robbed the plant of the Wooley Electrical Manufacturing Company at Lima and so damaged the machinery that it had to be shut down for repairs. The property taken is valued at $1,000.

The city of Cleveland has been enjoined from its attempt to compel the Cleveland Electric Illuminating Company to produce its books in the councilmanic investigation of charges brought by Mayor Johnson in connection with the annexation of South Brooklyn to the city.

At the annual meeting of the Bullock Electrical Manufacturing Company, Cincinnati, a few days ago the following directors were chosen: W. S. Rowe, S. R. Burton, George Bullock, Joseph S. Neave and James W. Bullock. The annual report was very satisfactory.

The Crawford Gas and Electric Company of Galion has been incorporated with a capital stock of $150,000 by S. N. Blake, Richard P. Jenks, R. O. Morgan, A. W. Lewis and R. W. Johnston.

President Horace Andrews, General Manager J. J. Stanley and Secretary Henry Davies of the Cleveland Electric Railway Company visited New York and Boston last week to investigate the subways with an idea of arriving at some conclusion as to how to do away with the congested traffic on the Cleveland streets.

It is reported that Harry Daugherty has purchased the light plant at Washington C. H.

Deeds for right-of-way of the Findlay, Fostoria and Toledo Railway Company have been filed within the last week. The line will extend from Findlay to Fostoria.

The Dayton, Covington and Piqua Traction Company is building a new freight house at West Milton.

The capital stock of the Miami Transit, Light and Power Company, Lebanon, has been increased to $600,000, of which $100,000 will be four-per cent. cumulative stock. The line will extend from Lebanon to Xenia.

A mortgage for $4,000,000 has been filed by the Toledo, Marshall and Northern Railway Company in favor of the Knickerbocker Trust Company to secure bonds to be issued by the company, the proceeds to be used for the construction work.

Some unknown men or boys threw a barbed wire over the high-tension wire of the Dayton, Springfield and Urbana and the Columbus, London and Springfield roads a few days ago and placed the ends in Buck Creek for the purpose of killing fish. Their project was successful, but the cars on both roads were held up for five hours until the trouble was found. Hundreds of fish were found floating in the stream.

Creditors of the Barriett Electric Company of Cincinnati have thrown the concern into bankruptcy. The claims of the petitioners are small. The Provident Savings Bank and Trust Company of Cincinnati was made receiver and the plant will be kept in operation. O. M. C.

## Michigan.

Detroit, March 18.—The Detroit United railway has determined to provide a new interurban terminal station, waiting rooms, baggage rooms, etc., for its patrons.

While it is thought that the resolution for municipal ownership of street railways, called the Greusel bill, will not pass the Legislature, the fight will probably be renewed in another manner, this time in the interest of the city of Detroit only. Representative George Lord, it is understood, will present a Detroit municipal-ownership bill giving the city the right of ownership of street railways, their control and operation, and also civil-service regulations governing the selection of employes.

It is understood that the new Sault Electrical Company, which will build one of the largest plants in the country at Sault Ste. Marie, Mich., is now having plans prepared by Prof. Gardner S. Williamson, who will have charge of the hydraulic work. No details will be given out to the public until these plans are completed.

The Detroit, Ypsilanti and Ann Arbor electric railway has started a movement looking toward the improvement of the properties along its line, especially the Ann Arbor and Ypsilanti region. It is understood that a general park scheme will be attempted in Ypsilanti, the location to be near the present power house and general offices of the company. It has been announced that Frederick L. Olmstead, Jr., the celebrated landscape artist, will be brought on to look over the possibilities of the Huron Valley from Ann Arbor to Ypsilanti and up through the lake region to Dexter.

The Pontiac council at a special meeting decided to give the Pontiac Standard Lighting Company a franchise to engage in commercial lighting for 10 years. This action is taken in connection with a bid for street lighting for the same period. The company has until April 10th to decide the matter.

It is understood that J. D. Hawks and Bird S. Coler, the latter ex-comptroller of New York city, are making the plans for the improvement of the Jackson city railway; also the Ypsilanti and Jackson electric railway, and that a community-of-interest arrangement has been arranged between them and W. H. Hand, representing the Adrian and Jackson railway. It is understood that the Adrian people will build to Vandercook's Lake, a resort four miles south of Jackson, and that the Jackson railway will extend to the lake. The 10 miles of Jackson city railway track to Grass Lake, paralleling the Ypsilanti-Jackson line, heretofore not operated, is now to be used jointly by the two lines. It is also understood that the projected Jackson and Lansing railway, in which these parties and the Bolands are interested will also be built this summer, as this will afford a direct line to the capital city for Jackson people from the south and will also make a lower rate of fare by electric road from Detroit to Lansing than is now in effect over the steam railroads.

The cities of Marine City and St. Clair are still in the market for lighting by gas or electricity or both. It seems that these cities as well as the "flats" have tried to close a 10-year contract with a firm for lighting, but the firm refuses to do business under a contract for that period. A bill is to be introduced in the Legislature allowing these towns to make 30-year contracts.

The Grand Rapids, Holland and Chicago railway, the electric line running between Grand Rapids and Holland, has removed its general office from Holland to Grand Rapids. C. N. Willis, freight

agent, has resigned and will be succeeded by D. O. Dewey.

H. A. Everett and William F. Moore came to Detroit this week in Mr. Everett's private car to attend the regular meeting of the board of directors of the Detroit United railway. No special business was transacted.

The Arthur Davis Electrical Construction Company of Detroit has been incorporated with a capital of $1,000. C. G. W.

## Indiana.

Indianapolis, March 18.—The Ft. Wayne and Wabash Valley Traction Company has issued an order requiring its conductors and motormen to wear white laundered shirts and linen collars, and that their shoes be polished and their uniforms clean. The company is being commended for this requirement. The employers say that it increases their self-respect, and this increases respect from others.

The constitutionality of the entire law granting townships the right to vote subsidies to railroads, especially to interurbans, is to be tested in the Indiana courts, with a beginning at Frankfort, where a wrangle is on over the petition for an election to vote a subsidy of $100,000 to the Tipton, Frankfort and Attica interurban line. The opposers propose to carry the fight to the Supreme Court.

A provision in the new Cities and Towns Law which is regarded as a distinct gain for municipalities is that empowering city councils to pass ordinances requiring railroad companies, steam or interurban, to keep and maintain lights at all points where their tracks intersect streets. The law says that the lights must be of the same kind as are in use in other parts of the city or town, unless otherwise agreed upon. Already the steam roads are arranging with the interurban roads, where possible, to furnish lights for them at such designated points. The law also prohibits the consolidation of electric-light plants or the sale of a municipal plant without first submitting the proposition to a vote of the people.

The machinery for the Bicknell Electric Light and Power Company is being placed. The plant has been erected near the shaft of the Lyons and other coal mines, and, for the first time in Indiana, electric power and light will be used in connection with coal mining.

George B. Markle of Hazleton, Pa., has purchased the General Electric and Power Company's plant in Connersville and will make extensive improvements.

Prof. George E. Wasche of the civil-engineering department, Purdue University, has been granted a leave of absence until September 1st, in order to investigate the waterpower development and the possibilities thereof in Central Indiana. Those connected with the engineering department of the university are of the opinion that many available waterpower sites for generating electricity are to be found in Tippecanoe, White and Wabash Rivers.

A franchise has been granted by the Indianapolis Board of Public Works to the Indianapolis, Newcastle and Toledo Electric Railway Company to enter the city, but, like all other companies, it must enter over the local company's line. However, the company will be granted the right to build an independent track to its proposed freight station on Peru Avenue.

A 50-year franchise has been granted the Fountain-Warren Traction Company by the City Council of Covington to use the streets of the city. The proposed line is 47 miles in length and will ultimately connect Lafayette and Danville, Ill. The headquarters of the company are in Covington.

It is rumored that an important deal is about to be consummated, involving the Indianapolis and Plainfield line and the Indianapolis, Danville and Rockville line. Options on these lines have been secured by two Indianapolis trust companies, according to report, and the purpose is to make them the important link of a chain of electric lines stretching from Indianapolis to St. Louis. Surveys were made through Clay County last week at the instance of the trust companies, it is said. That new capital has been put into the Plainfield line is both apparent and admitted.

The rapid or limited-service cars now operating between Indianapolis and Dayton, Ohio, are not popular with the village people, and quite a number of town boards have passed ordinances requiring such cars to reduce their speed to eight miles an hour, under penalty of $10 and $20 fines. S. S.

## Northwestern States.

Minneapolis, March 18.—The Fox River Valley Electric Railway Company has applied for a franchise at Kaukauna, Wis. It is proposed to build an interurban railway from Green Bay through Manitowoc to Kaukauna.

O. A. Beeman has asked for a 20-year franchise for a trolley line at Valley City, N. D.

A franchise has been granted to the Alma (Wis.) Electric Light Company.

It is reported that eastern capital has become interested in the proposed trolley line from Sioux City, Iowa, to Volin, S. D., and that a stock company will be formed at once.

The Union Light, Heat and Power Company of Fargo, N. D., [illegible] plant.

J. D. [illegible] Wisconsin River Traction and Power Company, with [illegible] capital [illegible] [illegible] City to operate [illegible] sible trolley cars.

The Interurban Railway Company [illegible] Iowa, has announced that [illegible] at once on a [illegible] and that it will be completed before fall.

The dam at Fergus Falls, Minn., which was recently destroyed, will be rebuilt immediately at a cost of about $40,000. It will be controlled by the city electric-light commission.

Stock subscription is being [illegible] pany to be formed to build a trolley line from Sioux City to Ireton, Iowa. It is proposed to capitalize at $500,000. R.

## Pacific Slope.

San Francisco, March 17.—The Kern River Power Company is operating only three of the five 2,000-kilowatt units in its new waterpower station on the Kern River. It is reported that H. E. Huntington, who is interested in this company, will erect a steampower electric plant near Los Angeles, Cal. The new plant is expected to be of large capacity, with larger generating units than those installed in the plants heretofore supplying the Huntington system of electric roads in and around Los Angeles.

The Sebastopol Light, Power and Water Company has been incorporated at Sebastopol, Cal., by W. P. Inglish, W. Y. McBride, T. L. Gates of Vacaville and G. W. Kingsbury and A. B. Swain of Sebastopol. The capital stock is $25,000.

The Stave Lake Power Company has recommenced operations for the development of waterpower at the Stave River Falls for furnishing electricity, power and light to Vancouver, B. C. Preparations are now being made for the erection of a power house. About 34 miles of transmission line will be built to Vancouver.

Within a few days work is to begin upon the construction of an electric railway from the Kern River plant of the Edison Electric Company to Santa Barbara, Cal. It will convey light and power for Santa Barbara and may largely supersede the local power plant at that place.

W. F. Conner, representing the Washington Water Power Company of Spokane, Wash., has been in Fairfield recently interesting the business men in a project to establish an electric-light system in Fairfield. It is proposed to extend wire from the line which furnishes power for the Cœur d'Alene mines and connect with various towns in which the company desires to furnish light.

Sufficient funds have been subscribed for the extension of the electric road of the Pacific Electric Company of Los Angeles, Cal., to Sierra Madre. Construction work will be commenced as soon as the money is in.

A contract has been signed by M. V. Quigg, president of the Monterey County Gas and Electric Company, in which he agrees to build, equip and put in operation an electric road for passengers and freight traffic between Monterey and Salinas, Cal., which will ultimately be extended to Hollister and later into the San Joaquin Valley and Fresno, Cal. He asks a bonus of $50,000 of the county in addition to a 50-foot right-of-way, the money to be invested in rails. Work on the road, which is to cost $300,000, will be commenced within four months after the right-of-way and bonus have been provided for.

The Big Bottom Electric Railroad Company has been organized at Forest, Wash., with a capital stock of $100,000. The object of the company is to build a railroad from Centralia, Wash., to the Big Bottom country, a distance of some 80 miles. R. B. Haskell, K. Bezemer, Anton Hylak, S. P. Gheer, H. Hoerling, J. O. Doss and John Uden are the directors.

The Petaluma and Santa Rosa Railroad Company is to extend its electric road at once from Green Valley to the town of Forestville, Cal. A.

## PERSONAL.

E. G. Porter, manager of the Owatonna (Minn.) Gas, Electric and Heating Company, died recently from the effects of burns received in a gasoline explosion.

Paoli Castelli died recently at his home in Italy. While engaged in space-telegraph tests for the Italian navy, Castelli invented the coherer with which Marconi first received signals across the Atlantic.

The marriage of William Marconi to the Honorable Beatrice O'Brien, fifth daughter of Lady Inchiquin, was celebrated in St. George's Church, Hanover Square, London, on March 16th. After a few days' trip in Ireland it is said that Mr. and Mrs. Marconi will visit the United States, and upon returning will go to Rome.

Col. M. J. Burke, United States consul at St. Thomas, Ont., since 1899, died on March 14th of pneumonia. He was a native of Ontario, but came to the United States at an early age. After being employed in the West and in Louisville, he came to Chicago and worked as chief telegraph operator in newspaper offices. He became leader of the op- [illegible] trical engineer of [illegible] capacity.

D. H. Conklin of Decatur, Ill., died at his h[illegible] telegraphing on the Ezra Cornell line on the New [illegible]

H. B. Otis, formerly in charge of the switchboard [illegible] ern Electric Company, will hereafter represent the Cutter Company of Philadelphia as manager of the Chicago office. Mr. Otis is an electrical business man of experience and good judgment and should be successful in pushing the sales of his company's circuit breakers in the Chicago territory.

John M. Lea has accepted the position of general superintendent of the International Electric Meter Company of Chicago. Mr. Lea is well qualified for his position, having had a varied experience in responsible positions with the Western Electric Company. He is a graduate of the electrical engineering course at the University of Wisconsin, having finished there in 1902, and his appointment to the position so early in his practical career speaks well for his technical and business ability.

Charles D. Knight has been appointed chief engineer of the American Electric and Controller Company. Mr. Knight was formerly connected with the engineering departments of the General Electric Company, Schenectady; National Electric Company, Milwaukee, and the Cutler-Hammer Manufacturing Company of the same place. Under his supervision the company will manufacture a full line of controllers, starters, automatic switches, solenoids, etc. Mr. Knight's address will be 12 Dey Street, New York.

The board of directors of the Indiana Union Traction Company and the Indianapolis Northern Traction Company at a recent meeting held in Philadelphia re-elected A. W. Brady president. President Brady at once appointed H. A. Nichol of Cleveland, Ohio, as general manager to succeed A. L. Drum. Mr. Nichol is general manager of the Cleveland and Southwestern Traction Company, but will resign to go to Indiana on April 1st. E. A. Turfin, chief clerk in the general manager's office, has resigned to go with Mr. Drum to the Chicago and Milwaukee Electric Railroad Company, and has been succeeded by M. E. Graston, formerly local agent of the Big Four railroad at Wabash, Ind.

## ELECTRIC LIGHTING.

A company is being formed for the installation of an electric-light and power plant at Cedarville, Cal.

The City Council of Virden, Ill., has granted a 20-year franchise to C. W. Carr for the erection of an electric-light plant.

Contracts have been let by the Adin (Cal.) Electric Light and Power Company for electric-light poles and flume timbers.

Arthur E. Banks of Monterey, Mex., has secured a concession for the installation of an electric-light plant in the city of Lampazos, Mex.

An ordinance establishing the office of city electrician at Champaign, Ill., prescribing regulations for wiring and establishing fees for electrical inspection has been passed.

A large number of concessions have been granted by the governmental authorities in the Dutch colonies of the East Indies for the installation of electric plants for lighting towns in Java and Sumatra.

It is reported that the Michigan Cold Storage and Transfer Company of Benton Harbor, Mich., will build an electric-light plant with sufficient capacity to provide light for the city of Benton Harbor.

The Choctaw Electric Company has been incorporated at South McAlester, I. T., with a capital of $150,000. A. E. Pierce is president. The company will succeed the South McAlester Electric Light and Power Company.

The town of Tuskegee, Ala., will want a complete equipment for an electric-light plant of 800 to 1,000 16-candlepower lights, including an engine and boiler of about 60 horsepower capacity, dynamo, wire, etc. W. H. Crawford of Tuskegee can furnish the necessary information.

The Gesellschaft fur Elektrische Zugbeleuchtung is the title of a new company which has been formed in Berlin with a capital of $250,000, of which one-third each has been subscribed by the Allgemeine Electricity Company, the Siemens-Schuckert Works Company and the Accumulator Works Company of Berlin and Hagen. The object of the company is the construction and supply of electric-lighting equipment for trains, both in Germany and abroad,

and according to a system which has already found considerable application in the D trains on the Prussian state railways.

Dr. W. H. Patterson, president of the Reno Water, Light and Power Company of Reno, Nev., has disposed of his interest in the corporation and has tendered his resignation as president. He will be succeeded by P. L. Flanigan.

The city electric-light and water plant at Slater, Mo., was wrecked a few days ago, together with several other buildings, by the collapse of the 50,000-gallon city water tank, which was at an elevation of 75 feet. The city is without light and water.

A company has been organized at Lyons, Kan., to install a $10,000 electric-light plant, and a 20-year franchise has been secured. An electrical engineer has been engaged to install and operate the plant. An ice plant may be added later. The company is known as the Lyons Electric Company.

The Majestic Theater in Chicago, the new $1,000,000 vaudeville house being erected by Chapin & Gore, is to have an isolated plant, and an order has been placed with the Allis-Chalmers Company for three Reliance engines and three generators for direct connection, complete with switchboard, etc. The largest girder ever hauled over the streets of Chicago is in the framework of the building—a mass of steel weighing 104,000 pounds.

## ELECTRIC RAILWAYS.

Articles of incorporation were filed March 11th in the office of the secretary of state at Springfield, Ill., of the Elgin and Belvidere Electric Railway Company. The principal office is to be in Chicago and the capital stock is nominally $2,500. It is proposed to construct an electric railroad from Elgin to Belvidere.

The Rio Grande Valley Electric Railway Company has been incorporated at Santa Fe, N. M., by Henry D. Bowman, Edward C. Wade and Joseph T. Bonham, all of Las Cruces, N. M. The company will construct an electric railway between El Paso and Las Cruces and from Las Cruces to the mining camps of Organ in the Organ mountains. The road will carry passengers and freight.

The Mansfield (Ohio) Railway, Light and Power Company, which is completely revamping its power plant, has placed an extensive order for the necessary machinery, including one 250-kilowatt and two 530-kilowatt generators, one 500-kilowatt and one 600-kilowatt railway generator, one 125-horsepower motor and one motor-generator set. The contract went to the Allis-Chalmers Company.

The electric street railway in Muscogee, I. T., was opened to the public on March 15th with a fitting celebration. Mayor Rutherford acted as motorman and C. N. Haskell, promotor of the road, was conductor of the car which made the first trip. The company announced that the two first days' receipts would go to the benefit of the Y. M. C. A. Seventy dollars was taken in on the first trip.

In its annual report for 1904 the Massachusetts Railroad Commission observes that there is an increasing tendency for steam railroads to acquire electric railways. This, the commissioners say, is inevitable, as the electric roads bring the people to the steam lines from the different cities, towns and sections which they serve and distribute them again at the end of the journey. Consequently the commissioners believe the two systems ought to work together advantageously under one management.

A press dispatch says that the municipality of Vienna will soon invite bids for the delivery of 100 electric-motor cars and 100 trailers, the cost of which is estimated at $500,000. United States Consul Guenther at Frankfort, Germany, says that if Americans should be able to secure the contract for these cars it would prove a prominent advertisement and no doubt procure many orders from other cities of the Old World. Manufacturers should have able representatives in European countries, he says, to look out for orders, and be fully prepared to submit bids and conclude contracts.

At the annual meeting of the stockholders of the Aurora, Elgin and Chicago Railway Company President L. J. Wolf stated that the net earnings for the year 1904 were sufficient to pay interest and taxes and leave a small surplus for the stock. It is the belief of owners of the property that the change in the Chicago terminal from Fifty-second Avenue to Fifth Avenue will add materially to the earnings. The annual report of the president shows passenger earnings per car-mile in 1904 to have been 20.22 cents, compared with 21.72 cents in 1903. Gross earnings per car-mile were 20.91 cents last year and 22.21 cents in 1903. Operating expenses increased from 11 cents in 1903 to 11.75 last year. The average fare per passenger was 26 cents last year and 26.15 in 1903.

## POWER TRANSMISSION.

Announcement comes from New York of the formation of the Rio de Janeiro Tramway, Light and Power Company, with a capital of $25,000,000 and a bond issue of a like amount. The company is organized for the purpose of developing a great waterpower plant near Rio de Janeiro, and it is planned, from a plant already in process of construction, to transmit electric power to the city for street-railway, industrial and lighting purposes.

It is stated at York, Pa., that the newly organized Susquehanna Electric Power Company will establish its electric power plant at Conawingo Falls, in the lower Susquehanna River. The company is capitalized at $12,000,000.

## PUBLICATIONS.

The Electro-Dynamic Company of Bayonne, N. J., manufacturer of the inter-pole variable-speed motor, described in the Western Electrician of recent date, has issued two attractive circulars descriptive of this machine.

W. J. Hammer's popular book on "Radium" has reached a fourth edition for 1905. The Italian translation, by Adolfo Hess of Turin, reached a third edition recently, and a German translation is likely to be made.

The "Proceedings of the Chamber of Delegates Appointed by the Various Governments to the International Electrical Congress of St. Louis, 1904," have been issued in pamphlet form by Dr. A. E. Kennelly, general secretary, Harvard University, Cambridge, Mass.

The April number of Graphite, the bright publication issued by the Joseph Dixon Crucible Company of Jersey City, N. J., contains many hitherto unpublished illustrations of notable bridges and buildings in various parts of the world, with seasonable talks on good paint and good painting.

A four-page folder from the Rochester Electric Motor Company, Rochester, N. Y., gives a description and some data concerning the company's outfits. It is asserted that the Rochester wing-disk fans, direct connected to the company's specially designed motors, will move more air with less current consumption than any other sets of the same size. This company has just brought out a line of generators with flywheel mounted upon an extension of the shaft to meet the increasing demand for dynamos of comparatively small sizes that can successfully be run by an ordinary gas or gasoline engine and still give steady light. Catalogue No. 52 fully describes this generator.

The Universal Electrical Directory (J. A. Berly's) for 1905 has been issued. It contains the names and addresses of members of the electrical and allied trades and professions throughout the world. It is divided into four sections, as follows: British, with 13,533 names; Colonial, with 3,744 names; Continental, with 8,160 names; United States of America, with 7,314 names, making a total of 32,751 names. Each of these sections is again divided into alphabetical and classified sections and, in the case of the British, a geographical section is also given. The entire book is carefully revised each year, and the financial information and central-station particulars are brought up to date as far as possible. The book is published by H. Alabaster, Gatehouse & Co. of 4, Ludgate Hill, London, England.

## SOCIETIES AND SCHOOLS.

The meeting of the Chicago Trade Press Association at the Hamilton Club on Monday evening, March 27th, will be observed as Ladies' Night. An illustrated lecture by John R. Rathom of the Chicago Record-Herald will follow an informal table d'hote dinner at 6:30 p. m.

The Central Illinois Independent Telephone Association will hold a meeting at the offices of the Interstate Independent Telephone Company in Peoria, Ill., on April 3d at 10 a. m. Important business will come up and a good time is anticipated. Albert Schuler of Streator, Ill., is secretary of the association.

President W. L. Bowers of Davenport and the executive and programme committees of the Iowa Electrical Association, with Secretary W. S. Porter of Eldora have arranged for the fifth annual convention, which will be held in the Julien House, Dubuque, on April 19th and 20th. The programme contains many papers on interesting subjects and there will be numerous committee reports which will be of interest to central-station men. A large attendance is expected at the meeting. Rates at the Julien House will be from $2.50 to $4 a day a person.

All inquiries regarding hotel accommodations for delegates attending the twenty-eighth convention of the National Electric Light Association, to be held at Denver-Colorado Springs on June 6th to 11th, should be addressed to the Committee on Hotel Accommodations, 405 Seventh Street, Denver. The committee is composed of W. J. Barker (chairman), J. Hernan, J. J. Cooper, J. F. Vail, S. W. Cantril, H. L. Woolfenden, Philip Cross and J. C. Andrews (secretary).

The next meeting of the Chicago branch of the American Institute of Electrical Engineers will be held at the rooms of the Western Society of Engineers in the Monadnock Building on the evening of March 28th. The general subject of discussion will be "Illumination"—not the novel of that name by the late Harold Frederics, but the commercial diffusion of light, with special reference to the use of small carbons in arc lamps. Mr. George N. Eastman of the Chicago Edison Company will present an illustrated paper on the subject, showing by lantern-slide pictures the characteristics of the craters of arc-light carbons and the like.

At the annual meeting of the Association of Electric Lighting Engineers of New England, held at the Parker House, Boston, on March 15th, the following-named officers were elected for the ensuing year: President, J. W. Cowles, Boston (re-elected); vice-president, W. I. Barnes, Providence; secretary and treasurer, C. R. Brown, Boston (re-elected); board of directors, A. E. Bliss, Malden; W. C. Woodward, Providence; W. E. Holmes, Newton; E. H. Mather, Portland; W. R. Eaton, Cambridge; George R. Stetson, New Bedford.

## MISCELLANEOUS.

During last year to March £3,847 was spent out of the General Lighthouse Fund by the United Kingdom for establishing electric communication with lighthouses and light vessels.

A Hartford (Conn.) manufacturer is building a water-pipe valve six feet in diameter to be used in connection with one of the new hydro-electric plants at Niagara Falls. This is perhaps the largest valve in the world, and its practical operation will be awaited with much interest.

Henry Heide will shortly install in the new power plant of his candy factories in New York city two Reynolds-Corliss, non-condensing horizontal tandem-compound engines. The engines, built by the Allis-Chalmers Company, will each be direct connected to a 300-kilowatt multipolar generator. The plant will be located under the driveway between the old and new buildings, and is designed to furnish light and power to both.

According to the United States census of 1900 there were 6,058 authors and scientists in the United States, 50,782 electricians, 20,153 civil engineers, 14,440 mechanical and electrical engineers, 2,908 mining engineers, 30,098 journalists, 446,797 teachers and professors, 68,936 street-railway employes, 14,765 linemen (telephone and telegraph), 75,080 telephone and telegraph operators, and 224,546 enginemen and firemen (not locomotive).

A recent consular report states that artificial rubies have been produced in France by reducing small, natural rubies into a very fine powder, which is melted in an electric furnace, cooled rapidly, and crystallized. The product obtained, from what was of little worth, on account of minuteness, possesses a comparatively high value. The main difficulty encountered is to prevent cavities and fissures in the crystals. The new process cannot be employed with emeralds and sapphires, as they become discolored by the action of the heat.

In the case of the Manhattan General Construction Company, complainant, vs. the Helios-Upton Company, defendant, involving the Baker regulator patents Nos. 684,163 and 684,340, Judge Archibald of the United States Circuit Court, Eastern District of Pennsylvania, has ordered a decree in favor of the complainant. The patent in suit is on "the method of maintaining a constant current in an alternating-current circuit, including translating devices in series and also including a reactance coil in series with the translating devices, which consists in opposing to the magnetic pull of the coil a mechanical force, and so correlating the said mechanical force and the magnetic pull that the choking effect of the coil will vary automatically to compensate for changes in the resistance of the circuit."

## TRADE NEWS.

The imports into the United States in February, 1905, were larger than in any other year, and the excess of exports over imports was smaller than in any month since June, 1897.

The Bernard Economic Arc Light Company of Chicago has been incorporated with a capital of $15,000 and its purpose is to manufacture and deal in electric-light fixtures and appliances. J. J. O'Donohue, P. F. Daly and W. J. Moore are the incorporators.

Galvanum, a compound for the protection of metalwork, is manufactured by the Goheen Manufacturing Company of Canton, Ohio, and the company is sending out a mailing card to the effect that the United States government uses Galvanum on all galvanized-iron work.

The Silver Bow Electrical Company of Butte, Mont., recently filed articles of incorporation. The purpose of the concern is the constructing, manufacturing, repairing, selling and dealing in electrical machinery, wire apparatus and supplies of every character and description. The capital stock is $5,000. Eugene Carroll, F. H. Miles and A. G. Elerick are named as directors for the first three months.

Hamilton Carhartt of Detroit, Mich., who manufactures the Carhartt overalls and distributes annually $250,000 in wages, has taken a notable step by giving free of cost to those of his employes who have rendered faithful service for a certain time thousands of dollars' worth of non-assessable, paid-up preferred stock in a now incorporated company.

The amounts of stock given the employes were graded from $500 down, according to the [illegible] rendered.

The Reliable Electric Company, formerly located at 212 West Clinch Avenue, Knoxville, Tenn., has moved to more commodious quarters at 313 West Clinch Avenue. The new quarters are now being fiteed and Mr. Sam Levy, the proprietor, expects to carry one of the best and most complete lines of electrical supplies in the city.

## BUSINESS.

A specialty of seven foot white cedar ties for street railway work is made by Perrizo & Sons of Daggett, Mich. A large stock, insuring quick shipments, and interesting prices, are offered as inducements to prospective users to correspond with this firm when in the market.

T. P. Bradley, secretary and manager of the Duluth Log Company of Duluth, Minn., says that this well-known producer has in stock poles in all lengths numbering 200,000 and about 750,000 ties. The yards are located at Duluth and throughout the Northwest, and the company has an enviable reputation among concerns of its class.

The Chicago and Northwestern Railway Company has placed an order with the Allis-Chalmers Company of Milwaukee for two Reliance 32 by 36-inch belted engines and two 250-kilowatt direct-current Bullock generators. These will be installed as two separate units in the power house of the company at Buxton, Iowa, and used for driving machinery in the coal mines there, which furnish fuel for some of the western divisions of the road.

H. W. Reade, well known to buyers of poles and ties as the secretary and treasurer of the Pittsburg and Lake Superior Iron Company of Escanaba, Mich., reports that the demand for poles this season is of an unusually promising nature. His company is particularly well situated to give orders prompt attention, having this season the largest stock in its history. These poles are located at the company's yards in Escanaba and at five branch yards in Michigan and Minnesota.

The Central Electric Company, Chicago, reports that the large increase in the sales of Okonite and Manson tapes indicates a growing demand for these high-grade tapes. The company emphasizes the fact that these tapes are made only in one quality, the best, and that all wire joints should be taped, first with Okonite rubber tape and, second, with Manson friction tape. Okonite tape is waterproof and a perfect insulating medium, it is said. It is not injured by exposure to weather, does not deteriorate when submitted to extreme changes in temperature and is not affected by [illegible] qualities which the Central Electric [illegible] are not possessed by any [illegible] market.

The Well Building Company of [illegible] contracted with the Allis-Chalmers Company for the complete unit of its new power plant [illegible] of one vertical cross-compound Reynolds-Corliss engine direct connected to a 500-kilowatt Bullock direct-current generator, engine type.

Secretary E. L. Goldschmidt of the Northern Wire and Cable Company of South Milwaukee, Wis., made a flying trip to Chicago last week. Mr. Goldschmidt reports the business of his wire works in a most prosperous condition. Among other orders, the company has just received a contract for 60,000 pounds of magnet wire from the Milwaukee Electric Railway and Light Company, Milwaukee, Wis.

The C. H. Worcester Company, Chicago, one of the largest producers of cedar poles in the country, announces that it has made preparations for a large business during the coming season. The Worcester company announces that it has a large stock of unusually fine poles to offer its customers, and solicits their favors. The company's excellent facilities for producing and marketing cedar poles are well known. The company considers the outlook for this season exceptionally good and anticipates doing a larger business than ever.

The Lindsley Brothers Company of Spokane, Wash., whose general offices are located in the Tribune Building, Chicago, says that it has recently secured a contract from the Utah Independent Telephone Company for 12,000 Idaho cedar poles, from 30 to 70 feet in length. Two years ago this company received an order from the same concern for the same number of poles, and is naturally pleased with the indorsement which attaches to this duplicate order. Facility for prompt shipments was, it is said, the main factor in the placing of the second order. The Lindsley company also announces that its San Francisco office has recently secured several orders for 50-foot poles. These are to be used in California, where the company has built up a large trade.

The Bliss Electrical School of Washington, D. C., is enjoying great prosperity. A representative of the Western Electrician, through the courtesy of Secretary and Treasurer W. N. Weston, was given an opportunity of visiting the institution during its period of maximum daily activity. Literally the building is crowded to the doors. The purpose of the school is to provide the most complete one-year practical course in electricity possible. The students do the actual electrical work with their own hands under the direction of competent instructors. Particular stress is laid by the manage- [illegible]

[illegible] to its utmost in meeting the demand for this material. [illegible] supplies can be furnished, including insulated and bare wire, incandescent lamps, fans, electrical instruments, guy anchors, flexible conduit, insulators, sockets, etc. The company says it is in a position to make attractive offers on this material.

Contracts recently entered into by the Westinghouse Electric and Manufacturing Company, including all sizes of apparatus from the smallest to the largest, not only indicate the scope of this company's output, but also that the equipment of electric railways and the installation of new roads make up a greater total output by this company in horsepower than any other branch of electrical engineering. As an extension to its system the Louisville Railway Company will install two 750-kilowatt three-phase rotary converters, six 300-kilowatt air-blast transformers, with blower outfits, and two switchboards. The United Railways and Electric Company of Baltimore has contracted for three 1,000-kilowatt rotaries and nine 350-kilowatt air-blast transformers. These will operate on a 13,000-volt line, transforming to 330 volts. Eighteen rotary converters, with a total capacity of 27,000 kilowatts, in 1,000 and 1,500-kilowatt units, will be placed in sub-stations of the New York Central railway company. Two 1,500-kilowatt direct-current generators will be built for the Carnegie Steel Company to furnish power for two 1,500-horsepower 250-volt motors. For the protection of this apparatus 10,000-ampere circuit breakers will be mounted on the switchboard. These motors will be the largest ever built for this voltage. The Westinghouse company also does a large business in small apparatus. For the driving of machines in its works the Surpass Leather Company of Philadelphia has ordered 18 induction motors, varying in size from one-half to 50 horsepower. The State company of Columbia, S. C., has contracted for 12 direct-current motors ranging in capacity from one to 20 horsepower, and Murdock, Kerr & Co. of Pittsburg will receive the same number, having various outputs from two to 70 horsepower.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued (United States Patent Office) March 14, 1905.*

784,529. Telegraphic Transmitter. Martin Armstrong, St. Louis, Mo. Application filed December 29, 1902.

Associated with a key-bar are a corresponding signal-producing member and a contact member movable independently of the key-bar. A rack is carried by the contact member. Connections between the key-bar and rack and a toothed member for imparting motion to the rack, the rack having lateral movement toward and away from the toothed member, complete the instrument.

784,546. Coin-operated Telephone-locking Device. William Calhoun, New York, N. Y., assignor to the National Telephone Lock Company. Application filed September 18, 1903.

The telephone-receiver arm is arranged so that the receiver cannot be used until after the insertion of the proper coin in a slot.

784,547. Brush Holder for Dynamo-electric Machine or Motors. John F. Card, Three Rivers, Mich., assignor to the Sheffield Car Company, Three Rivers, Mich. Application filed October 1, 1903.

The substance of one of the claims is as follows: A bracket is adjustably secured to a support and a block is detachably secured to the bracket. A pair of parallel-arranged links pivotally secured to the block carry a brush-holding plate pivotally secured. The brush is adjustably secured to the plate by a tension-spring.

784,555. Junction Box for Electrical Conductors. John Fountain, Jr., Elizabeth, N. J. Application filed November 13, 1902.

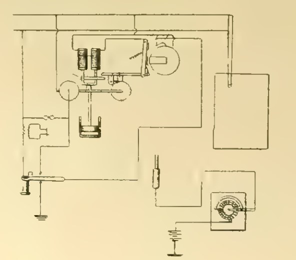
The junction box has an opening with a removable plate secured in the opening by means of adjacent indentations respectively formed in box and plate at different points around the opening and on opposite sides of the box and plate.

784,557. Telephone Call. Peter T. Geyerman, Brewster, Minn. Application filed April 29, 1904.

A toothed wheel with a spring for revolving it has means for stopping it at a desired point. A spring arm has a knob to engage the teeth of this wheel and an electrical contact spring is attached to the spring arm. Another spring is located normally in electrical contact with the contact spring and wires connect these springs with means for operating an electrical selecting-switch.

784,588. Party-line Selective System. Frank P. O'Conor and Frederic McNeill, LaSalle, Ill., Application filed February 13, 1904.

Each station is provided with a disk having a conductor normally inserted in one of the main line connections to sub-stations along the line. A second conductor is adapted to be inserted in the connection when the normal conductor is withdrawn. The details of the apparatus are: An arbor to which the disk is fixed, a ratchet wheel on the arbor, a pawl for moving the ratchet wheel, a magnet whose armature controls the pawl, means at the central station to intermittently energize the magnets, a dog holding the ratchet against back ward movement, a spring tending to return the arbor to its original position, and a solenoid whose armature is adapted to engage the dog and release it and its pawl from the ratchet wheel and which is included in a local circuit closed upon the attraction of the armature of the magnet. (See cut.)



NO. 784,588.—PARTY-LINE SELECTIVE SYSTEM.

784,592. Apparatus for Effecting Electrolysis. Herbert Philipp, Wyandotte, Mich. Application filed August 10, 1903.

An electrolytic apparatus comprises a vessel having a feed and discharge opening and a mercury-conducting trough extending spirally from top to bottom. A separated compartment within the vessel around which the trough extends has means for supplying mercury to the apparatus.

784,605. Telephone Operator's Key. Louis W. Wanemaker, Genoa, Ill. Application filed May 11, 1904.

Spring-controlled rocking contact levers co-operate with contact plates on which the levers normally bear for connecting them electrically. Signaling-circuit contact plates are situated on the opposite sides of the levers, and separate keys independently move the levers into contact with the last-mentioned plates.

784,617. Electroplating Apparatus. Herman Fleischer and Charles H. Fleischer, New Britain, Conn., assignors to the Stanley Works, New Britain, Conn. Application filed May 23, 1904.

In an electroplating apparatus are a plating tank, endless chains arranged at opposite sides of the tank and anode carriers connected with the chains. The carriers extend transversely of the path of travel of the conveyors, and the anodes are suspended from the carriers and arranged to be mechanically immersed in, moved through and removed from the tank.

784,626. Electric Sparking Igniter for Explosive Engines. George McCadden, St. Cloud, Minn., assignor to Frank Zins, St. Cloud, Minn. Application filed June 22, 1903.

Combined with a support are a stationary electrode and a movable electrode carrying a trip-block. A flat steel plate has a beveled edge and a slot to receive its fastening. A plunger having a circular top with a beveled under side is provided with means for operating it.

784,635. Relay. Micheal Setter, Chicago, Ill., assignor to American Electric Telephone Company, Chicago, Ill. Application filed April 5, 1902.

Combined with a suitable electromagnet are a swinging and pendant armature for the magnet and an armature mounting supporting the pendant armature. The latter is normally balanced, or practically balanced, about its axis, the axis being coincident with a knife-edge contact between the armature and mounting. Switch contacts are operated by the armature.

784,639. Electrical Trolley. Seneca R. Stoddard, Glens Falls, N. Y. Application filed March 21, 1903. Renewed August 12, 1904.

In an electrical trolley are a trolley shoe and a member mounted therein and movable laterally for the purpose of engaging the conductor.

784,640. Advertising Apparatus. Willis B. Worthy, Chicago, Ill. Application filed November 3, 1904.

An advertising apparatus for use in connection with railroads comprises a sign along the track and devices for electrically illuminating the sign. Means controlled by the passage of the car on the track bring the illumination devices into action at intervals and during the passage of the train or car.

784,677. Sparking Igniter for Explosive Engines. Isaiah E. Hindman and Joseph J. Albright, Co-

lumbus, Ga., assignors of one-half to John F. Weathers, Columbus, Ga. Application filed May 16, 1904.

A sparking igniter having one element provided with a series of annular flanges constituting spark-terminals, has a second element provided with a longitudinal series of flanges constituting opposing spark terminals, the last-mentioned flanges being transversly disposed across the first flanges.

784,678. Trolley Catcher and Retriever. William W. Hoffman and Francis W. Powers, West Lafayette, Ind., assignors to the Electric and Steam Railway Supply Company, Lafayette, Ind. Application filed September 23, 1904.

A winding drum, actuating means and automatic interlocking means for controlling the trolley rope are described.

784,681. Trolley Guide. John F. Jameson, Plimpton, Ohio. Application filed December 21, 1904.

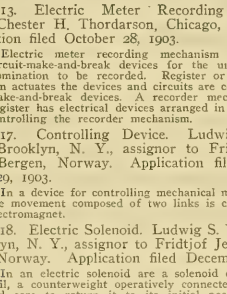
A guide for trolleys consists of a pair of spaced substantially parallel guide rails, hanger members rising from the rails, cross bars connecting opposite hangers and longitudinal bars connecting the hangers of the respective rails.

784,695. Insulating Lining. Norman Marshall, Newton, Mass. Application filed April 15, 1903.

An insulating lining consisting of a tube having end portions of different diameters is provided with an elastic and compressible portion of greater diameter than the part within which it is to fit.

784,712. Electric Central-station Recording Mechanism for Meters. Chester H. Thordarson, Chicago, Ill. Application filed October 28, 1903.

Recording mechanism for meters include tally registering mechanism and circuit-make-and-break devices, a recorder mechanism including a printing wheel and means arranged in the circuit made and broken for successively positioning the printing wheel of the recorder mechanism in accordance with the tally registers.



NO. 784,732.—ELECTRIC DISTRIBUTION SYSTEM.

784,713. Electric Meter Recording Mechanism. Chester H. Thordarson, Chicago, Ill. Application filed October 28, 1903.

Electric meter recording mechanism combines with circuit-make-and-break devices for the unit of each denomination to be recorded. Register or meter mechanism actuates the devices and circuits are controlled by the make-and-break devices. A recorder mechanism for the register has electrical devices arranged in the circuits for controlling the recorder mechanism.

784,717. Controlling Device. Ludwig S. Walle, Brooklyn, N. Y., assignor to Fridtjof Jebsen, Bergen, Norway. Application filed December 29, 1903.

In a device for controlling mechanical movement, a toggle movement composed of two links is controlled by an electromagnet.

784,718. Electric Solenoid. Ludwig S. Walle, Brooklyn, N. Y., assignor to Fridtjof Jebsen, Bergen, Norway. Application filed December 29, 1903.

In an electric solenoid are a solenoid core, a solenoid coil, a counterweight operatively connected to the solenoid core to return it to its initial position when the current is cut out from the solenoid-coil, and a contact member forming a guide for the counterweight and adapted to control the current in the coil.

784,720. Telephone Signaling Means. Klas Weman, New York, N. Y. Application filed June 4, 1904.

In combination with a battery is a circuit from one pole to the opposite pole, including a relay, a telephone switch-hook and a receiver. A second circuit runs from the armature of the relay to the primary of an induction-coil, the second circuit including a condenser. A buzzer and its armature, a third circuit from the secondary of the induction coil and back to the secondary, including a condenser, the receiver, and means for closing the circuits, whereby, when the buzzer operates the diaphragm of the receiver will be caused to vibrate, are the other parts.

784,722. Automatic Circuit Breaker. Earl P. Wetmore, Wolverhampton, England. Application filed October 22, 1903.

In the circuit breaker is a resetting coil and its shunt circuit. A controlling switch for the circuit has means for closing it. A retarding device is connected to the movable member of the switch, and consists of a cord, a drum around which the cord is passed and beyond which it is secured and an escaping device in connection with the drum.

784,732. System of Electrical Distribution. Rufus N. Chamberlain, Depew, N. Y., assignor to the Gould Storage Battery Company, New York, N. Y. Application filed June 12, 1903.

A dynamo is operated at a practically uniform speed, a consumption circuit being supplied from the dynamo. A storage battery is connected with the circuit. An opposing series coil in the consumption circuit, which is several times smaller in effect than the dynamo exciting coil, is arranged so that the differential action of the coils produces a practically constant load on the generator under varying conditions of load on the consumption circuit and at a practically uniform dynamo speed. (See cut.)

784,741. Insulated Rail-joint. George L. Hall, New York, N. Y. Application filed January 9, 1904.

Insulating material is placed between the rail ends and the bridge plate and clamping plates with means for holding the rail ends in alinement and out of contact with each other.

784,766. Electric Conductor Union. Frederick W. Sorg, Englewood, N. J. Application filed August 17, 1903.

A U-shaped union having internal co-operating ribs to form a wire-retaining pocket in the bottom is provided with substantially equally projecting edges on either side of the pocket, the free edges being bent inward to form a second wire-retaining pocket.

784,775. Lamp Socket. Henry Bayer, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 21, 1901.

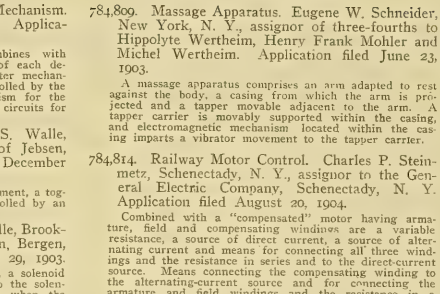
The lamp socket comprises a base having a deep narrow radial slot and a W-shaped metal strip in the slot, one end of the strip resting against the end of the base and the other end against the side of the base and carrying a binding screw.

784,790. Guide for Battery Systems. Charles F. Hawley, Heppner, Ore. Application filed April 23, 1904.

Details are described.

784,807. Dynamo-electric Machine. Henry G. Reist, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 1, 1904.

In an alternating-current motor the rotor-body carries conductors and flat plates arranged to form flat parallel rings separated by air spaces and short-circuiting the ends of the conductors.



NO. 784,805.—TRAIN-SIGNAL SYSTEM.

784,809. Massage Apparatus. Eugene W. Schneider, New York, N. Y., assignor of three-fourths to Hippolyte Wertheim, Henry Frank Mohler and Michel Wertheim. Application filed June 23, 1903.

A massage apparatus comprises an arm adapted to rest against the body, a casing from which the arm is projected and a tapper movable adjacent to the arm. A tapper carrier is movably supported within the casing, and electromagnetic mechanism located within the casing imparts a vibrator movement to the tapper carrier.

784,814. Railway Motor Control. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 20, 1904.

Combined with a "compensated" motor having armature, field and compensating windings are a variable resistance, a source of direct current, a source of alternating current and means for connecting all three windings and the resistance in series and to the direct-current source. Means connecting the compensating winding to the alternating-current source and for connecting the armature and field windings and the resistance in a closed circuit are supplied. Other means vary the amount of the resistance in circuit and reverse the relative connections of the armature and field windings.

784,843. Trolley. Michael O. Day, Newcastle, Pa. Application filed December 20, 1904.

A stub shaft of the trolley harp fits into a casing mounted on the end of the trolley pole. The shaft may not move in and out of the casing but may be rotated, being supplied with means for bringing it back to the normal position.

784,860. Traingraph. William A. Inwood, Colorado Springs, Colo. Application filed August 16, 1904.

In a train-telegraph are a pair of line conductors insulated from one another, open or dead at one end, and connected respectively at their opposite ends remote from one another to opposite poles of suitable generators or batteries. A telegraph receiving instrument on normally closed circuit is placed across the conductors and a telegraph key is normally open and connected across the terminal of the instrument.

784,865. Electric Train-signaling Equipment. W. Britton Lane, Evanston, Ill. Application filed December 21, 1904.

A block system comprises a line of parallel rails between the track rails divided into longitudinal sections insulated one from the other and forming blocks, with one side of each section electrically connected with the other side of the next section but one. The rails forming one side of the line are higher than those forming the opposite side. A locomotive electric-signal-containing equipment comprises a battery circuit containing the signal, a pole-changing device in the circuit, depending resilient toggles carrying brushes to engage the line rails and included in the circuit and a rod connecting one of the brushes with the switch lever of the device. (See cut.)

784,869. Electric Elevator Control. Nils O. Lindstrom, Jersey City, N. J., assignor to Alonzo B. See and Walter L. Tyler, New York, N. Y. Application filed November 17, 1904.

A manually operated control circuit includes a door circuit breaker and a resistance solenoid adapted to be thrown into circuit with the door circuit breaker, and itself adapted to control the control circuit.

784,872. Relay. Ray H. Manson, Chicago, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Application filed August 3, 1903.

A magnet structure contains an armature lever having one arm extending across in front of one end of the magnet of the structure and adapted to be attracted by the magnet. The other arm extends rearwardly at the side of the structure, the armature lever being pivoted to the structure. A set of superposed switch springs are disposed longitudinally of the structure and having their free contact carrying ends extended to near the forward end and outside of the rearwardly extending arm. Thus the movement of the armature operates the springs without obstructing a full view of the contacts from directly in front of the magnet structure.

784,885. Method of Extracting Metals from Ore by Electricity. Edward L. Priest, Oakland, Cal. Application filed April 5, 1904.

Extracting metals from ores by electricity in this method is done by forming a body of comminuted ore into a coherent mass, associating an electric conductor with the mass, positioning the mass with its conductor in contact with a liquid electrode and passing an electric current through to form an arc.

784,897. Automatic Awning Attachment. Abraham I. Schwinger, New York, N. Y. Application filed October 11, 1904.

Retaining means normally hold the awning up but when the temperature exceeds a certain degree, or when rain or snow falls and is connected in a cup containing the terminals of an electric circuit, the circuit is closed and electromagnetic means release the awning which falls.

784,928. Rail Joint. William Daves, Bloomington, Ill., assignor of one-fourth to W. A. Freese, Bloomington, Ill., and one-fourth to G. W. Quackenbush, Marshall, Mo. Application filed November 23, 1904.

Insulating material is interposed between the base plate and the rail and between the rail and the fish plates.

785,004. Electric Motor. Rudolf Klemm and Felix Reiss, Berlin, Germany. Application filed May 26, 1904.

A small motor of unusual design embodies in its construction a cylindrical metal casing. Transversely through one end of the casing extends an iron core for the field coil, the core having fastened to its ends long strips for pole pieces extending the full length of the casing and shaped in cross section as sectors of the circle which is the cross-section of the casing. The armature is then mounted within the casing and is embraced by the poles.

785,026. Electric Open-switch and Stop Signal. John B. Smiley, South Omaha, Neb. Application filed December 14, 1904.

Auxiliary contact rails are placed between the track rails. When the switch is opened the circuit through these rails indicates the fact in the locomotive cab and also by a signal beside the track.

785,031. Block System. John W. Anderson, Jr., Woodland, Ill. Application filed December 26, 1903.

A semaphore signal for each block is supplied with actuating means for causing movement of the signal to safety, caution, or danger positions. Signal controlling devices for each semaphore and circuits connecting the controlling means of adjacent blocks in series are the other features.

REISSUE

12,324. Trolley-wheel Guard for Electric Wires. John L. Sullivan, Warren, R. I., assignor of one-half to Joseph Harris, Warren, R. I. Application filed January 26, 1905. Original application dated December 6, 1904.

A trolley wheel guard comprises a frame having one relatively fixed and one relatively movable member. Means carried by the free ends of the members contact with the electric wire and a signal means first moves the movable member laterally as regards the wire and then the frame bodily in line with and away from the wire.

## EXPIRING PATENTS.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on March 20, 1905:

379,567. Application of Electricity to Car Lighting. C. A. Faure, New York, N. Y.

379,572. Electric Storage Battery. C. D. P. Gibson, New York, N. Y.

379,689. Dynamo-electric Machine. M. Deprez, Paris, France.

379,758. Electric Annunciator. B. N. Botts, Paso Robles, Cal.

379,779. Incandescent Electric Lamp. T. A. Edison, Menlo Park, N. J.

379,771. Regulator for Dynamo-electric Machines. T. A. Edison, Menlo Park, N. J.

379,772. System of Electrical Distribution. T. A. Edison, Menlo Park, N. J.

379,792. Electric Arc Lamp. E. R. Knowles Brooklyn, N. Y.

379,862. Electromechanical Movement. J. F. McLaughlin, Philadelphia, Pa.

379,815. Apparatus for Increasing the Traction of Vehicles and Motors. E. E. Ries, Baltimore, Md.

379,816. Electromagnetic Traction-increasing Apparatus. E. E. Ries and A. H. Henderson, Baltimore, Md.

379,822. Electric Heater. C. Seiler, Philadelphia, Pa.

379,822. Electrical Stop Motion for Knitting Machines. W. Talcott, 2nd, Rockford, Ill.

379,904. Elevated Railroad and Conduit for Electric Wires, etc. A. C. Oehrle, Philadelphia, Pa.

379,909. Traction-increasing System for Electric Railways. E. E. Ries, Baltimore, Md.

379,911. Galvanic Battery. A. Schanschieff, Gipsy Hill, County of Surrey, England.

# WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXVI. CHICAGO, APRIL 1, 1905

## The Terminal Electrification of the New York Central Railroad.

While the Western Electrician has from time to time published articles relating to various features of the extraordinary improvements making by the New York Central and Hudson River Railroad Company in and contiguous to New York city, it is believed that the readers of this journal will at this time be interested in a brief resumé of the entire work contemplated by that company in what it terms the "New York Zone," which comprises the territory on its main line, or Hudson Division, from Grand Central Station to Croton-on-Hudson, a distance of 34 miles, and to North White Plains on the Harlem Division, a distance of 24 miles.

The most noteworthy feature of the work is the departure from the use of steam as a motive power and the substitution therefor of electricity, and the decision of the New York Central company to take this step marks, perhaps, the beginning of a new era in railroad history. With a daily movement in and out of Grand Central Station now averaging 640 trains carrying 45,000 passengers, and constantly increasing, and which movement, owing to the peculiar geographical characteristics of New York city, is, during the busiest hours, almost wholly in one direction, the complex nature of the problems to be solved is at once apparent, especially when it is considered that the commuting public residing in the cities and villages along the railroads terminating at Forty-second Street is almost entirely dependent upon those lines for transportation, and that the necessary changes and improvements must be consummated without interruption to the regular movement of this traffic.

Notwithstanding the fact that within very recent years extensive improvements and additions have been made in and around Grand Central Station, it has for some time been realized by the company that the existing facilities were rapidly becoming inadequate to the demands upon them, and that more room, especially in the yards, must be provided.

A large amount of real estate in the territory immediately adjoining the present yard, was purchased and the buildings thereon, to the number of nearly 200 residences, stores, apartment houses, churches and hospitals, have been, with few exceptions, demolished, and since August, 1903, the contractors have been engaged in the task of excavating for a sub-surface yard, to be 35 feet below the level of the present yard, and for the depression of the surface yard, not only over the present

Grand Central Yard Excavation, Looking North from Forty fifth Street.
Support of Buildings and Excavation at Park Avenue, Looking South from Fifty-third Street.
THE TERMINAL ELECTRIFICATION OF THE NEW YORK CENTRAL RAILROAD IN NEW YORK CITY.

area, but that of the newly acquired land, to a depth of 15 feet below its present level, the whole involving the removal of nearly 2,000,000 cubic yards of material, largely of rock, and in places fairly honeycombed with gas, water and sewer pipes, the necessary changes in location and temporary support of which have added greatly to the difficulties encountered.

The sub-surface yard, which will cover about 11 acres, will contain three miles of tracks, and will connect by easy grades with the surface tracks at Fifty-third Street. All suburban trains will enter and depart from this station, utilizing a double-track

the cross streets from Forty-fifth to Fifty-sixth, in-

traffic.

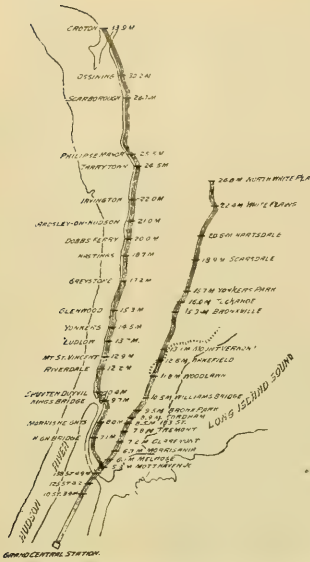
The area of the surface yard will be increased nearly 18 acres by the reclamation of the reclaimed land, which will provide for more than four miles of tracks. The combined area of upper and lower yards will be about 51 acres, with more than 20 miles of tracks, as contrasted with less than 23 acres and about 11 miles of tracks now available.

The surface facilities will be used for the movement of the through trains, and upon the site of the present station will be constructed an entirely new passenger station and railroad-office building, including a branch postoffice and facilities for the express companies. The area to be covered by the terminal buildings is as follows: From Forty-second Street north along Vanderbilt Avenue to Forty-fifth Street, a distance of 680 feet; thence east along Forty-fifth Street 625 feet to Lexington Avenue, following that street south 460 feet to Forty-third Street; thence west on Forty-third Street 275 feet; then south along Depew Place to Forty-second Street, and west 300 feet to the place of beginning.

The buildings will be set back 40 feet from Forty-second Street and 70 feet from Vanderbilt Avenue, which, with the street, gives 140 feet of open space on Forty-second Street and 130 feet on Vanderbilt Avenue.

The main entrance will be on Forty-second Street, with side entrances and exits on Lexington Avenue and Depew Place. The general scheme of architecture at this entrance will be three arches, each 33 feet wide and 60 feet high. Beyond will be the ticket-office space, 90 by 300 feet. On the street level, adjoining it on the right, will be the outgoing baggage room, the proximity of these two features being exceptionally convenient for the traveler.

Adjoining is the gallery overlooking the grand concourse, which will be on the level of the express




SKETCH MAP SHOWING ELECTRIC LOCOMOTIVE SERVICE ZONE OF NEW YORK CENTRAL.

tracks, and will be reached from the gallery by four massive stairways, each 25 feet wide. The concourse itself will be the largest in the world, being 160 by 470 feet and 150 feet high, with wide entrances at each end from Madison and Lexington Avenues, respectively. Adjoining the concourse will be the waiting rooms, with double the capacity of those in the present station, the telegraph offices, cafes, etc.

Separate entrances will be provided for the suburban passengers, with ample facilities for easily passing from one level to the other by means of broad stairways. The suburban station will be provided with its own concourse, commodious waiting and retiring rooms, and other facilities for the comfort of the public.

The arrangements contemplated for handling baggage are exceptionally complete, and will care for the heaviest movement without delay or congestion.

The express and postoffice buildings will be equipped with every modern device for expediting the enormous amounts of such traffic daily received at and dispatched from this terminal.

The extremely frequent train service contemplated with the commencement of electrical operation renders it absolutely essential for the safety of the public and the efficient movement of the traffic that all grade street crossings within the limits of the electrical zone be abolished. This will be accomplished at some points by means of overhead bridges; at others by carrying the streets under the elevated tracks. Such improvements will be made at High Bridge, Morris Heights, University Heights, Yonkers, Hastings, Irvington, Tarrytown, Ossining and other points on the Hudson Division; and at Woodlawn Junction, Mount Vernon, White Plains and other crossings on the Harlem Division; also at grade street crossings between Westchester Avenue and Long Island Sound upon the line of the Port Morris branch.

At many points new stations will be constructed, designed to meet the requirements of the heavy increase in suburban travel which has for several years been apparent, and which will undoubtedly be much greater in the future. These will generally be of the overhead type, shown in the accompanying illustration. At all stations the platforms will be raised to the level of the car floors, thereby greatly facilitating the movement of passengers. The number of tracks on the Hudson Division will be increased to four at all points; in many places six, and in some, eight. The Harlem Division, which already has four tracks to Woodlawn, will be similarly equipped from that point to North White Plains. These additional tracks provide throughout the electrical zone a local and an express track in each direction, thereby separating the local from the through service and facilitating the movement of both.

At Marble Hill, in the Borough of the Bronx, an important straightening of alinement is in progress. Beginning at a point near Kings Bridge station, the tracks will be carried along the Harlem Ship Canal through a four-track single-arch rock tunnel 648 feet long, the first of its kind ever constructed; and thence to a connection with the existing line near Spuyten Duyvil. This work, known as the Marble Hill Cut-off, will shorten the distance three-quarters of a mile, save about 2½ minutes in time, and eliminate seven grade crossings.

This policy of rectification of alinement will also be followed at many other points along the Hudson Division, the tracks being at times carried further inland, and at others across indentations of the Hudson River. This will mean not only some decrease in distance, and a consequent improvement in schedules, but it will also largely contribute to the comfort of the passengers, prolong the life of both track and equipment, and reduce the cost of maintenance.

At Croton-on-Hudson and North White Plains, the northern termini of the electrification zone, facilities will be provided for the change from steam to electric locomotives for the through trains and suitable shops erected for necessary repairs to the electrical equipment.

Two power houses will be provided, one located at the end of the Port Morris Branch, on Long Island Sound, the other at Glenwood-on-Hudson, a suburb of Yonkers. A brief description of the Yonkers station will suffice for both, as they will be practically identical in construction. The building will be founded upon made land in the Hudson River. The foundation proper will be of concrete, rising above the ground some four feet in height, forming a base for a superstructure of brick, trimmed with terra cotta. The actual support of the floor systems, roof and stacks will be a steel skeleton frame independent of the brick enclosing walls.

The purposes of the building will divide it into two main divisions—one for the boilers and coal pockets, and the other for the turbo-generators and other apparatus. These main divisions will be emphasized by the two steel skeleton monitors extending above the brick enclosing walls. The frame work of windows will be of steel shapes made to harmonize in appearance with this skeleton framework of steel.

The interior, by the use of enamel and pressed-brick linings of the walls and by exposing the steel skeleton, will provide a simple treatment in which constructional parts of the building form the main decoration.

The main building will be 236 feet long, 164 feet wide and 100 feet high. The twin masonry smokestacks, 290 feet high, 24 feet in diameter at the base and 18 feet six inches at the top, with 17 foot flues, will be landmarks for miles. The general aim has been to provide all possible architectural beauty consistent with utility.

The generators will be driven by 5,000-kilowatt steam turbines of the Curtis type, fed by water-tube boilers in units of 625 horsepower each, equipped with internal superheaters, generating steam at 200 pounds pressure, and superheated to 200 degrees. The maximum capacity of each station is 40,000 horsepower, and the two stations will be cross-connected, so that in the event of accident either station may carry the entire load. Normally, however, the Yonkers station will furnish power for the Hudson Division, while the Port Morris station will supply the Harlem Division. In each case the stations are so located as to be accessible by both rail and water, thus providing the cheapest possible transportation for fuel coal required.

TYPE OF OVERHEAD STATION FOR ELECTRIC SUBURBAN TRAFFIC ON NEW YORK CENTRAL.

A feature of interest is the placing of the high-tension switches in a separate building, the switches being controlled from a board in the main station, thus making it possible, in case of accident, to cut the current off from the station itself.

From the main stations a three-phase alternating current will be transmitted at 11,000 volts to eight sub-stations located at various points along the line and there transformed to 660 volts direct current.

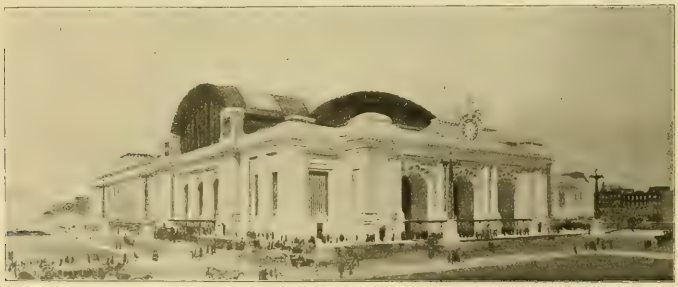
At the sub-stations provision has been made for the installation of storage batteries for the purpose of insuring uninterrupted service. Experience has shown that no electrically operated system can wholly eliminate the possibility of short-circuiting of cables, accidents in power stations, etc. Generally these matters can be remedied within a comparatively short time, and for the purpose of insurance against delay from such causes the battery installation will be sufficient to carry the full load.

Actual operation will also frequently require the movement of a number of heavy trains over the line at one time, many of which might naturally be starting at the same instant, so that for the moment the demand upon the current would be excessive, and the batteries will also care for such violent fluctuations.

The third-rail system will be used, except at road crossings and in yards, where overhead transmission will be employed. By means of an ingenious device the contact shoe will be automatically lifted from the third rail just prior to its termination at such points, while at the same time the overhead contact will be made, thus preserving the continuity of the current.

For the movement of the through trains powerful electric locomotives will be used, a full description of which was published in the Western Electrician of November 19th last.

The suburban traffic will be cared for by the multiple-unit system, thus avoiding the use of switching



PROPOSED NEW TERMINAL STATION OF THE NEW YORK CENTRAL IN NEW YORK CITY.

engines at terminals, and doing away with the present necessity for flying switches with incoming trains.

The entire work, involving an expenditure of approximately $50,000,000, is under the direct supervision of Vice-president William J. Wilgus of the New York Central Company, who has the advice and aid in electrical matters of the Electric Traction Commission, consisting of Mr. John F. Deems, the company's general superintendent of motive power, rolling stock and machinery; Mr. Bion J. Arnold of Chicago, Mr. Frank J. Sprague and Mr. George Gibbs of New York. Mr. Wilgus acts as chairman of this committee, and Mr. Edwin B. Katte, the electrical engineer of the company, as its secretary. In the Western Electrician of February 14, 1903, was published a detailed account of the personnel and work of this commission, with portraits.

FIRST FORMAL TEST OF NEW YORK CENTRAL ELECTRIC LOCOMOTIVE AT SCHENECTADY, N. Y.

The construction committee, of which Mr. Wilgus is also chairman, includes among others, Mr. H. Fernstrom, chief engineer; Mr. Olaf Hoff, engineer of structures; Mr. C. A. Reed, architect, and Mr. A. B. Corthell, terminal engineer.

## Dr. S. S. Wheeler Nominated for President of the Institute.

The board of directors of the American Institute of Electrical Engineers has nominated Dr. Schuyler Skaats Wheeler for election to the presidency of the Institute at the coming annual meeting. In choosing Dr. Wheeler the directors have selected a man well qualified to bear the responsibilities and uphold the dignity of the office. Dr. Wheeler is the president of the Crocker-Wheeler Company of Ampere, N. J., and has attained to that position after a varied experience in the electrical field, the earlier part of which was in the direction of electric-lighting and central-station work. He was born in 1860, in New York city, and was educated at Columbia University. In 1886 he went into the manufacturing field, first as electrician for the Herzog Teleseme Company and afterward establishing a connection with the C. & C. Electric Motor Company, of which Francis B. Crocker was a member. In 1888 Messrs. Crocker and Wheeler severed their connection with this company and organized what is now the Crocker-Wheeler Company.

DR. S. S. WHEELER.

Dr. Wheeler possesses a true engineering mind, as well as great executive and business ability, and his selection by the board of directors, which undoubtedly amounts to election, will be looked upon with favor by those having the affairs of the Institute at heart.

The full ticket nominated by the directors of the Institute is as follows: For president, Schuyler S. Wheeler of Ampere, N. J.; for vice-presidents, Chas. A. Terry and Townsend Wolcott of New York, and Gano S. Dunn of Ampere, N. J.; for managers, C. C. Chesney of Pittsfield, Mass., Calvert Townley of New Haven, Conn., Bancroft Gherardi of Brooklyn, and Charles L. Edgar of Boston; for treasurer, George A. Hamilton of New York; for secretary, Ralph W. Pope of New York.

## American Railway Engineering and Maintenance of Way Association.

The sixth annual convention of the American Railway Engineering and Maintenance of Way Association, which closed at the Auditorium Hotel, Chicago, on March 23d, was the most successful meeting ever held by the association. More than 150 members, largely from states east of the Mississippi River, besides many other interested engineers, were present, and the three-day convention was too short properly to consider all the valuable reports on the various subjects relative to railroad maintenance.

President Hunter McDonald of Nashville, Tenn., delivered an excellent address, which was heartily received. Touching the subject of the electrification of steam roads he said:

"Our special committee on classification of steam railroads is at work, but it is to be regretted that its results will not be available in the preparation of the reports for the next year. The labors of this committee, under its instructions, are confined to steam railroads. The extensive experiments now in progress on the New York Central may result in such sweeping changes in our lines having dense traffic and heavy passenger business as to compel the revision of the instructions to this committee before its report is forthcoming. How rapidly the electrification of steam railroads will take place cannot be foretold with accuracy, but the feverish energy with which the problem is being studied and the rapidity with which the railroads in self-defense must adopt improvements which promise economical results or increase in speed or comfort of travel, places it entirely within the probabilities that many of us are likely to be called upon to take up in earnest the study of electricity before our days of usefulness are over, or else bring those days to a very brief and sudden conclusion."

There were 16 committee reports on as many subjects, such as bridges and trestles, roadway, iron and steel structures, signaling and interlocking, masonry, ballasting, ties, rails, etc. These reports were considered and put in final shape for publication in the Manual of Recommended Practice, which is intended to express the association's best opinion on all subjects contained therein.

The report on signaling and interlocking comprised, with illustrations, Bulletin No. 57 of the association reports. The report consists of (1) standard arrangement of signals at interlocking plants and (2) telegraph and controlled manual block signals; specifications for construction of telegraph block signal and connections; definitions; tables showing extent of use of manually operated telegraph block system, and of manually operated electrically controlled block systems; recommended standard location of telegraph block signals; detail of semaphore arm-casting; standard semaphore arm for telegraph block signal, and lead-out and pipe runs for telegraph block signals.

This committee also presented a supplementary report in Bulletin No. 61, which contained historical data of interlocking. An abstract of this report is printed elsewhere in this issue.

The officers elected for the ensuing year are: President, H. G. Kelley, chief engineer Minneapolis and St. Louis railway, Minneapolis, Minn.; first vice-president, James Dun, chief engineer Atchison, Topeka and Santa Fe railway, Chicago; second vice-president, A. W. Johnston, general superintendent New York, Chicago and St. Louis railway, Cleveland, Ohio; secretary, L. C. Fritch, assistant to the general manager Illinois Central railroad, Chicago; treasurer, W. S. Dawley, maintenance-of-way engineer Chicago and Eastern Illinois railroad, Chicago; directors, Walter G. Berg, New York city; W. L. Breckenridge, Chicago; W. C. Cushing, [illegible]

## Electrostatic Discharge Produced on a Photographic Plate.

The accompanying picture is reproduced from an interesting photograph which was taken by Mr. Albert Scheible of Chicago. The photograph was taken on a cold, crisp day, an Ansco film being used and the camera a No. 2 Bullseye kodak. Upon developing the film some fine specimens of frictional discharges were shown, as seen in the picture. The only explanation that Mr. Scheible can offer is that the discharges were due to the friction of the film on the rollers.

This phenomenon, although unusual in photography, is not absolutely unknown, as will be seen by the following, quoted from Mr. A Savage Landor, describing his ascent of Lumpa Peak in the Himalayas to the highest altitude ever reached by man—23,490 feet above the sea level. Mr. Landor, in an article in Harper's Weekly, says: "I was lucky enough to obtain several excellent photographs and sketches, but a few negatives of lesser importance were injured, owing to a most uncommon occurrence. In my magazine camera the plateholders were of metal, and slid one on the top of the other when being changed for exposure. Owing to the dryness of the atmosphere the friction of metal on metal produced an electric spark inside of the camera, which marked some of the plates across like a streak of lightning, and somewhat clouded them—defects which I did not, of course, discover until I developed them."

ELECTROSTATIC DISCHARGE PRODUCED ON PHOTOGRAPHIC PLATE.

## The Trolley Song.

The prize "Trolley Song" of the Detroit United Railway, entitled "Come Along"—an electrical name in itself—has been published and bids fair to be popular. It is by Paul Hoffrichter and is copyrighted by the Paul Publishing Company of Detroit. One stanza reads as follows:

For a day's sport or fun take your cam'ra or gun,
Or your rod, and be free from all care:
Board the fast trolley line—there's enjoyment divine—
Get your fill of the pure country air.
Maybe you're called away on business one day,
But arrive for your train too late;
Well, you need not despair; your "suburban" is there,
With its comforts and speed up to date.

Chorus—
Come along, ding-dong, hear the clanking gong!
All aboard for a ride on a trolley!
Let us sing aloud with the merry crowd—
Come along, come along, and be jolly!
The rich and poor are on a par
When riding on a trolley car.
Come along, ding-dong, hear the clanking gong.
Come along, come along, come along.

## Standardization of Electrical Units.

The London Telegraph says that the British Foreign Office is considering the matter of international uniformity in electrical units on the report of the British delegates who attended the International Electrical Congress at St. Louis last September. It may be that the international commission suggested by the St. Louis Congress may meet at Geneva or The Hague to endeavor to secure practical uniformity in electrical units. In many countries, including Russia, Norway and Sweden, Denmark, the Netherlands, Portugal, Italy and Japan, no electrical units have yet been legalized.

## Electrically Operated Rolling Road in Cleveland.

An electrically driven "rolling road" is being operated in Cleveland, Ohio, for the purpose of conveying loaded wagons with the teams attached up a steep incline, which would otherwise necessitate "doubling up" or drawing much smaller loads. The installation is the first of its kind ever attempted and it attracts considerable attention. The road is operated by electric motors and as the service is of an exacting nature the motors had to be especially designed. Col. Isaac D. Smead, who owns the road, in ordering the motors, specified that the four must operate in unison with one controller. A variation of a fraction of a second in starting or stopping or in the speed would cause trouble; the

ROLLING ROAD IN CLEVELAND IN OPERATION.

huge belt would "crimp," in other words, and be useless. After several months the colonel obtained what he wanted, and the result was four compound-wound motors of 40 horsepower each, under the control of a single controller. The motors may be worked in series or parallel and are operated similarly to street-car motors.

As may be seen from the accompanying pictures, the rolling road consists of a great belt or moving platform eight feet wide carried upward on a level with the concrete enclosure and back underneath. It passes around a sheave at each end and is supported above by four rows of idlers turning on roller bearings and so arranged that two in each row are always under every truck of two boards each in the belt. The lower half of the belt, passing back down the grade, is supported on two rows of idlers, one at each side. The belt itself is made up of heavy boards arranged crosswise and divided into trucks of two boards each. These are securely fastened together and the trucks are connected with strong metal links. The boards are metal bound on the edges, so that they will last for years. Two safety cables extend the entire length of the belt, and at short intervals links pass up through the belt from them, to which the wagons and vehicles are clamped.

UPPER END OF ROLLING ROAD IN CLEVELAND, SHOWING CONTROLLING STATION.

The length of the road is 420 feet and the rise in that distance is 65 feet. Owing to the heavy construction of the belt—it weighs 106 tons—at first thought its operation would seem impossible, but when it is considered that the returning half is descending the grade underneath the ascending half it will be plain that the power necessary to operate it is only that necessary to overcome friction and raise the wagons.

Four Westinghouse motors are arranged, one at each end and two between at equal distances apart. They revolve at 850 revolutions a minute and are provided with a 17 to 1 reduction gear; each carries a sprocket chain 36 feet long, running over wheels at each end, and these in turn engage a large chain running the entire length of the belt. This is accomplished by placing teeth on the outer side of the motor chains, which engage the endless chain both above and below, in this way evening up the pressure on the belt. The endless chain is placed in the middle of the belt, so that the power exerted is distributed evenly. The small chains, by engaging above and below at the same time, actuate a large portion of the entire length of the belt continually.

The superstructure is of steel and concrete and is of excellent workmanship. This enabled the engineers to place the motors in the upper portion of the structure rather than on the floor, and in this position they give the best of service. Most of the machinery is well up and this leaves all the ground space clear.

Colonel Smead worked for three years and spent $11,000 on the drawings of this road before he felt that they would fulfill his expectations, but the results show that he provided for everything before he attempted to put his plans into operation. Another year was spent in completing preliminaries and getting a bill through the Legislature allowing cities to grant franchises for rolling roads. Then, out of all the sites examined for a trial of the road, the difficult place on Factory Street, from the "Flats" on the river to the level of the city, 65 feet higher, was selected as being ideal for the purpose. Probably no other street would present such difficulties as this.

It has been found that the mechanism requires only seven-seventeenths of the power that has been provided for the operation. While the motors are of greater capacity than actually necessary, they are installed to provide for times requiring extra power. It was supposed that it would be necessary to turn the controller to the third notch to start the belt, owing to the fact that the entire weight would have to be moved from a position of rest, but turning the lever one notch accomplished the purpose with ease. The road is not kept in continual motion, as it is necessary to stop it for teams to drive on and off. It can thus be easily seen how necessary absolute control over the machinery is. The Western Electrician correspondent stood on the belt when it was put in motion and hardly knew when it was started so completely is it under the control of the motorman.

That the road presented many difficulties in engineering can be seen from a glance, but they were all overcome by Colonel Smead, who has been assisted for some time by his two sons, Burton A. and Edward L. Smead, both engineers. It was impossible to make a working model or test the road in any way until it was entirely completed.

But two and one-half to three minutes are necessary for the transportation of a wagon from the foot of the hill to the top. And the road will carry all the wagons that can be driven on to it. As high as seven or eight have been taken up at one time. The saving in time from points about this place, where many coal and lumber yards, factories and warehouses are located, is about 50 minutes. The Baltimore and Ohio railroad is building a fruit depot near the road and this will give it a large amount of business. It is probable that another road will be built at a point where wagons from several other large freight depots may be taken up the hill in this way.

ROLLING ROAD IN CLEVELAND DURING CONSTRUCTION, SHOWING BASE OF INCLINE.

Colonel Smead is the inventor of the well-known Smead hot-air heating and dry-closet systems and for the last five or six years since selling his interest in that business has been engaged in the construction of hot-water heating plants in cities in various states. He has built several in which as high as 10 or 12 miles of conductor pipe was put in. His ability as an engineer is of a high order. One of the accompanying pictures shows the top of the incline, with Colonel Smead and his two sons, one of the latter in the motorman's cabin and the other leaning against the rail.

## Chicago Street-railway Situation.

Traction matters in Chicago, so far as negotiations relative to franchise matters involving the surface car lines are concerned, are quiet at this time, everyone apparently awaiting the result of the election on April 4th. The two principal candidates for mayor have made many speeches, and the "traction question" and "municipal ownership" have been mingled with the very air which Chicagoans breathe.

The daily papers have published articles giving the views of eminent lawyers and experienced street-railway men on the legal and physical questions which will arise if municipal ownership is attempted, and the means for paying for the car lines if acquired by the city, as provided by the Mueller law certificates, have been discussed by financial men. The magnitude of this experiment in municipal government is pointed out on all sides, yet even those most enthusiastic for municipal ownership seem to be indifferent to the facts in the case.

The form of three proposed questions of public policy, as issued by the Board of Election Commissioners, which will be submitted to the voters on April 4th is as follows:

Shall the City Council pass the ordinance reported by the local transportation committee to the City Council on the 24th day of August, 1904, granting a franchise to the Chicago City Railway Company?

Shall the City Council pass any ordinance granting a franchise to the Chicago City Railway Company?

Shall the City Council pass any ordinance granting a franchise to any street railroad company?

## Ohio Interurban Monthly Meeting.

At the monthly meeting of the Ohio Interurban Railway Association at the Gibson House, Cincinnati, on March 23d, a committee of the Indiana association was present with a proposition to make the mileage-coupon books of the two states identical so that an interstate business may be done. The matter was left over to be discussed at the April meeting. Another matter of importance was the discussion of interline business or coupon tickets. This subject will also be taken up at a future time. It is the desire of all to have tickets that will be good on all the roads of the state, but just how to get at the matter is a question. Carrying mail matter was another topic that came in for a prominent share of the discussion.

After the meeting the members were taken on two special cars to visit the Bullock electric plant. They were in charge of L. Lowenberg of the publicity department and L. C. Marburg and F. W. Garrett of the electric-railway department. Later they inspected the direct-current generator at the Plum Street station of the Cincinnati Gas and Electric Company. About 50 persons were present. Several visitors from Pennsylvania and Indiana were in attendance.

## Death of C. C. Warren.

Charles C. Warren, president of the Warren Electric Manufacturing Company of Sandusky, Ohio, died at his home in that city on March 22d from a stroke of paralysis. He was nearly 70 years old, but a man remarkably well preserved and energetic for one of his age, and although his health had been somewhat poor for a few months before his death his friends believed that with due care he would be spared for many years to come. He was a useful citizen and a tireless worker in many fields, chief among which of late years has been the field of electrical manufacturing.

C. C. WARREN.

Mr. Warren began his business career in Michigan as a merchant, served for a time as cashier of a national bank and subsequently became the founder and proprietor of what afterward developed into the Woolson Spice Company of Toledo. He remained in this business until 1878, when he turned his attention to electrical things. From 1881 to 1890 he was the western manager of the old United States Electric Light Company. Mr. Warren later managed the affairs of the United Edison Manufacturing Company in the West, outside of Chicago, on Lake Erie and vicinity, and the Western U[illegible] the [illegible] direction of Commodore W[illegible] than once demonstrated [illegible]

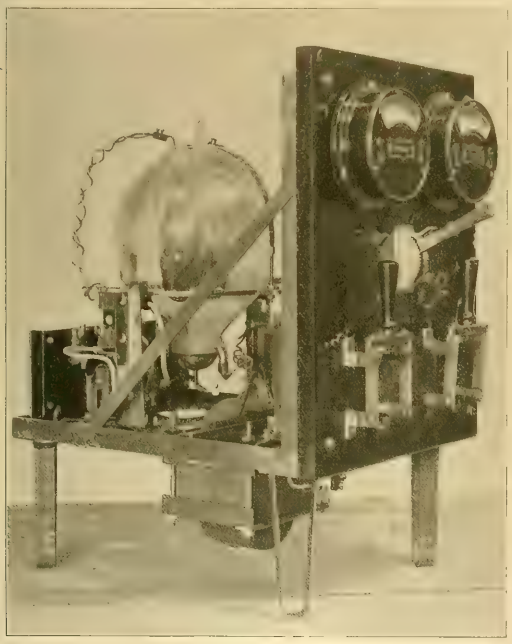
In social circles Mr. Warren was [illegible] He was a Free Mason and a member [illegible] Elks. He also took a great interest in the Men's Literary Club of Sandusky and had been a member since it was organized. As a writer he had a [illegible] liarly forceful and original style, which upon occasion he could use with telling effect. He was a business man of energy and ability, and by study and observation had accumulated a large fund of technical information. His long experience and his prominence in the electrical business had made him widely acquainted, and electrical men in all parts of the country will regret his death. He is survived by his wife and a son, Mr. H. B. Warren.

## Cooper Hewitt Mercury-vapor Converter for Charging Storage Batteries.

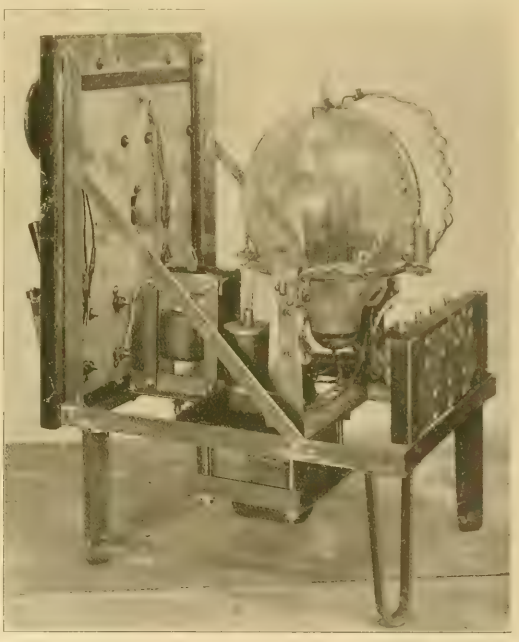
Readers of the Western Electrician are familiar with the very interesting property, styled negative electrode resistance, which is utilized to make a working converter of a modified form of the mercury-vapor lamp invented by Peter Cooper Hewitt. Such a converter, illustrated herewith, is intended to take the place of the ordinary alternating-current-direct-current motor-generator set for the converting of alternating to direct current. The direct current from the converter may in general be used for any apparatus for which direct current is suitning throughout the full range. The apparatus is stable and will operate throughout any reasonable range of voltage.

As shown in the pictures, there is a glass bulb about nine inches in diameter mounted on a suitable holder which is entirely enclosed, with a small switchboard mounted on the front. On the front of the board are placed a direct-current ammeter, voltmeter, two double-pole switches and a regulator to give current adjustment. This entire apparatus occupies a space [illegible] long by 20 inches deep. It can conveniently be placed on the floor or mounted against the wall.

With alternating-current voltages not exceeding 450 volts, an autotransformer is used for obtaining the proper potential for operating the converter. On higher voltages a transformer with separate primary and secondary is used. The maximum capacity of the converter is 50 amperes continuous running, and the current is adjustable as low as six amperes. It may be adapted to any direct-current voltage up to 115 volts. Its efficiency at 30 amperes and 115 volts is approximately 80 per cent. This efficiency



Front View.



Rear View.

COOPER HEWITT MERCURY-VAPOR CONVERTER FOR CHARGING STORAGE BATTERIES.

until the fall of 1891, when he went with the Westinghouse company.

In 1892 Mr. Warren together with his son, H. B. Warren, designed and patented an inductive type of alternating-current generator, now well known as the Warren alternator. In 1896 the Warren Electric Manufacturing Company was organized, and this company erected a plant at Sandusky, Ohio, for the purpose of building these alternators and other electrical machinery. Mr. Warren was president and general manager of this company at the time of his death, and since the beginning had managed its affairs with conspicuous ability and with an eye to the welfare of all connected with the company, whom he considered as members of his industrial family alike interested with himself in the common good.

Outside of his business interests Mr. Warren found time for healthful recreation and was an enthusiastic yachtsman, owning one of the finest yachts on Lake Erie, the Wemco II. He was honored with the office of commodore of the Interlake Yachting Association, composed of yacht clubs able, but for different uses different arrangements of circuits are preferable. The converter adapts itself especially well to charging storage batteries and running vapor lamps.

The commercial apparatus as now manufactured by the company is intended for charging storage batteries and for electrolytic work only. (It will, however, operate well on a resistance load such as incandescent lamps.) The outfit can be readily installed in any garage where only alternating current is available and operates without expert attention. As there are practically no movable parts, there is little chance of anything getting out of order, and therefore no especial care is necessary. It is especially adapted for charging electric vehicles. It is asserted that its cost is lower and its efficiency higher than the motor-generator set, and no attendant is required. The apparatus being protected by fuses, may be left running over night, provided the batteries be not overcharged thereby.

The outfit illustrated is automatic—i. e., it starts on the closing of the alternating-current and direct-current switches, and, should for any reason the tends to increase as the current falls off. The apparatus is designed for any single-phase constant-potential supply circuit of 60 cycles.

In installing this converter it is necessary to know the nominal voltage and the frequency of the supply circuit, together with the variation of voltage up and down, and whether the supply circuit has three wires. The number and character of battery cells to be charged must also be known. The Cooper Hewitt Electric Company of New York city is the maker of this interesting device.

## The Copper Market.

Market conditions in copper of late show little [illegible] Prices quoted the latter part of March were 15⅝ cents a pound for electrolytic wire bars and 15½ cents for Lake. The movement to China alone in January and February required a shipment of about 7,300 tons, and during March and April shipments to Chinese ports are expected to reach 12,000 tons. For the first two months of this year the total exports of copper have averaged over 19,000 tons a month, and the home consumption is estimated at about the same quantity.

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## DATES AHEAD.

Iowa Electrical Association (annual meeting), Hotel Julien, Dubuque, Iowa, April 19th and 20th.

American Electrochemical Society (annual meeting), Boston and Cambridge, Mass., April 25th to 27th.

National Electric Light Association (annual convention), Denver, June 6th, 7th and 8th, and Colorado Springs, June 9th, 10th and 11th.

National-Interstate Telephone Association (first convention of consolidated telephone associations), Chicago, June 21st, 22d and 23d.

Ohio Electric Light Association (annual convention), Hotel Victory, Put-in-Bay, August 16th to 18th.

DR. SCHUYLER SKAATS WHEELER has been nominated to be president of the American Institute of Electrical Engineers, and it is to be expected that in due course he will succeed President Lieb. Dr. Wheeler is well equipped by his training, his experience, his tastes and his practical technical and business ability to fill this honorable position, and in this case, as in all the recent elections to the Institute presidency, the office and the man are well met. He takes a keen interest in the affairs of the Institute, to which he has already given substantial evidence of his regard and also his time and his counsel, which are more valuable still. He is particularly interested in the United Engineering Building, which will come into being, very likely, during his administration, and in every way his selection is a felicitous one.

ELECTRIC SMELTING and the general subject of the electrometallurgy of iron and steel have possibilities that have attracted attention during recent years. A brief report of the discussion of this interesting subject at the last meeting of the New York Electrical Society was given in the Western Electrician last week, and the topic has formed the burden of many other papers and articles. An intelligent summing up of the suggested electrical methods is made by Mr. J. B. C. Kershaw in a late issue of the London Times' Engineering Supplement, and one paragraph is worth quoting. It is as follows:

In the present writer's opinion the electric-furnace methods of producing pig iron or ordinary structural steel are unlikely to make much headway until the present centers of iron and steel production in England, Germany and the [United] States have exhausted their supplies of cheap fuel. The passing of the blast furnace and the substitution of the electric furnace in the iron and steel industries may therefore be reserved for the next generation. But in the meantime electric-furnace methods of producing high-class steels and special alloys by a refining process are certain to develop and become of considerable industrial importance. At present these developments are occurring in centers where electric power is cheaply developed from water-power; and this development is likely to continue. There is no reason, however, why the waste gases of blast furnaces should not be utilized in large gas engines for generating the electric current required to work electric furnaces, and this method of producing the power required for working the new processes is being exploited already in Germany.

This seems to present the gist of the matter fairly. Cheap electric power can be utilized to advantage in the metallurgy of iron and steel; and there seems little question that the use of blast-furnace gas will work out economically in this way. At any rate, the blast-furnace gas is a valuable by-product which should be profitably utilized to generate current for general power purposes if not for the electric furnace.

TRANSMISSION plants are usually built in this country to utilize at a distance the cheap power of waterfalls. But it is, of course, equally feasible to transmit the energy of coal burned at the pit's mouth, where the cost of the fuel is the lowest. This is sending over wires power from the coal rather than shipping the coal itself. This has been actually accomplished, with satisfactory results we believe, in England; and it is now proposed to do the same thing by erecting a large power plant in the heart of the Indiana coal field, and from this plant to supply the power needed by the electric railways of Southern and Central Indiana. The plan is to secure a large tract of land, probably in Greene County or in Sullivan County, and to erect thereon a large power house at an advantageous location, transmitting the power to consumers, principally electric-railway companies, within the economical radius of transmission. The project is as yet in the preliminary stage, but we are assured that it is receiving the serious attention of men of large capital and that engineers have been investigating the subject. The points to be determined are financial—whether there is a market for the power within a practicable area and whether it can be profitably supplied to consumers at a price less than the latter can produce the "juice" for themselves. A project of this kind demands careful canvassing and conservative figuring in advance; the engineering side of the proposition appears to present no difficulties. It will be interesting to see whether the plan is carried out, and if so to what extent.

WHAT is the physiological action of the electric current? Like so many other phenomena of Nature, this is imperfectly understood. Mr. V. Kammerer, a foreign investigator, says that the explanation that this action is due to inhibition of the nervous centers, causing asphyxia for currents of high tension and paralysis of the heart for currents of low tension, does not appear completely to elucidate the question, since the treatment for asphyxia has revived victims of both high and low-tension currents. It is rather the intensity of the current passing through the organs which determines the dangerous effects. Twenty or 30 milliamperes passing through the body is considered to be about the limit which can be supported without danger by most persons; 50 to 60 milliamperes may occasion serious trouble, while an intensity of 100 milliamperes must be regarded as almost always fatal. Observation seems to indicate that for those intensities which are supportable the resistance of the body to the constant current is about three times as great as that to the alternating current. This is probably partly due to the oxidation which is produced at the anode by the constant current. The author estimates that a man holding some conducting surface with one hand and touching the conductor with the finger of the other hand could support 1,250 volts continuous or 400 volts alternating; but if he grasp the conductor with the whole hand not more than 150 volts continuous or 55 alternating can be endured. The degree of moisture of the outer layer of the skin is also an important factor. When the current traverses the body from the hands to the feet the degree of moisture of the soles of the boots is of great importance. The author found that a piece of dry leather placed between two metal electrodes presented a resistance of one megohm per square decimeter, while if the two surfaces are moistened the resistance falls to 5,000 ohms, although the interior of the leather remains dry, and if the leather be thoroughly soaked the resistance only amounts to 100 ohms per square decimeter. Therefore, the electrical worker has a very strong incentive to avoid damp footwear. He should keep, not his powder, but his shoes, dry.

SOME time ago we commented with pleasure on the course of lectures instituted by the laundry girls' union in Chicago, and said that it would be well if other trades unions, electrical and otherwise, followed the laundresses' example. We note now, with much satisfaction, that the Philadelphia branch of the International Union of Electrical Workers has organized a school in electricity. The course was opened by a lecture on "Alternating Currents"—grappling at once a good, hard subject—delivered by Mr. George T. Coleman. Sessions of the school will be held each Tuesday night, instruction to begin with a lecture. Members who are proficient in any branch of their calling will be called upon to provide this instruction, subject to the approval of the board of trustees. A question box is placed at the entrance of the meeting hall, and after the lecture the secretary will read the questions, and the information sought is to be given by open discussion. The union has 200 members, and fines are to be imposed for failure to attend the sessions.

This movement for self-improvement is worthy of all praise. We are all so ignorant that it is necessary to assimilate crumbs of knowledge whenever and wherever we can if we wish to keep pace with the times. Every progressive man must of necessity be a learner, a student, all his life long. In the last analysis every man is self-educated; and as one acquires knowledge—just a tiny bit—his eyes are opened to the vast extent of what remains that other men know and he does not, and to the inconceivably greater mass of laws, of processes, of phenomena, of developments, of causes and effects, of which all men are ignorant—the Unknown Ocean on the shore of which the great Sir Isaac Newton described himself as picking up a bright pebble or two. The members of the Philadelphia union do well to pick up such pebbles of knowledge as they may. The process has a humbling, broadening and mellowing effect, for it is true that the indirect benefits of education are greater than the direct ones. But the direct and tangible results are valuable, too. It was these, no doubt, of which the business agent of the Philadelphia union was thinking when he said: "We have adopted this system of instruction for our members in self-protection. There are so many improvements and new 'wrinkles' in the application of electricity that one must read and study constantly to keep pace with them."

From every point of view, including that of the most practical self-interest, the pursuit of knowledge will do good to the trades unions. The members will be better and more valuable men and they will have a more just conception of their duties not alone to their fellow unionists but also to all their fellow-men.

## Institute Meetings and Announcements.

The regular March meeting of the American Institute of Electrical Engineers in New York was held on March 24th at Carnegie Hall. President Lieb occupied the chair. At this meeting the paper of George A. Damon of Chicago was read. It is entitled, "Line Construction for High-pressure Electric Railways." There was also presented the paper of Theodore Varney of Pittsburg upon a similar subject. This paper is entitled, "High-pressure Line Construction for High-pressure Railways." An abstract of Mr. Damon's paper is given in succeeding columns, Mr. Varney's being reserved for future publication. The directors nominated officers, as required by the constitution. The list is given on another page.

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An exceptionally interesting meeting of the Chicago branch of the American Institute of Electrical Engineers was held on the evening of March 28th. Mr. P. Junkersfeld, local honorary secretary, presided, in the absence of K. B. Miller. The general subject was "Illumination," and it was introduced by a short paper by George N. Eastman of the Chicago Edison Company on "The Use of Small Carbons in Enclosed Arc Lamps." Mr. Eastman illustrated his paper by lantern-slide pictures and by a projection on the screen of two electric arcs in operation—one with five-sixteenths-inch carbons and one with one-half-inch carbons. This demonstration was beautiful and interesting. Mr. Eastman urged the use of small carbons for small enclosed lamps. W. D'A. Ryan of the General Electric Company, Schenectady, opened the discussion and described a new device for distributing effectively the light of interior arcs in stores. He called it the light balancing selective diffuser ceiling system. E. P. Warner of the Western Electric Company said he didn't believe much in the effectiveness of reflected light. Carl Wiler of the same company gave good data on arc carbons and current density, collected on a trip to Europe last year. T. J. Smith, superintendent of the arc-lighting department of the Chicago Edison Company, told of his favorable experience with small-carbon lamps. Van Rensselaer Lansingh of the Holophane Glass Company, now of New York, described, with curve-sheets and demonstrations, some tests in street arc lighting, with various types of inner and outer globes. Mr. Junkersfeld, J. Blaine Replogle of Chicago and others took part in the discussion, which was instructive and highly interesting. All speakers seemed to favor the small carbons for small enclosed arcs.

More detailed reference to this good discussion will be made in a future issue of the Western Electrician.

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The annual convention of the American Institute of Electrical Engineers will be held in the South this year, Asheville, N. C., being the place chosen and June 19th to 23d the date. Arrangements have thus far been made for the following partial list of papers: "Appalachian Water Powers," by Dr. F. A. C. Perrine, consulting engineer of New York; "Three-phase Traction," by F. N. Waterman, mechanical and electrical engineer of New York; "Coil Reactances," by D. B. Rushmore, electrical engineer Stanley Electric Manufacturing Company, Pittsfield, Mass.; "Limits of Injurious Sparking in Direct-current Commutation," by Thorburn Reid, consulting engineer, New York; "A Study in the Design of Induction Motors," by C. A. Adams, assistant professor of electrical engineering, Harvard University, Cambridge, Mass.; "Choice of Motors in Steam and Electric Practice," by William McLellan, University of Pennsylvania, Philadelphia, Pa.; "High-potential Oscillations of High Power in Large Power-distribution Systems," by Charles P. Steinmetz, electrical engineer, General Electric Company, Schenectady, N. Y.; "Theoretical and Experimental Investigations on the Disruptive Strength of Air at Very High Voltage," by Charles P. Steinmetz, electrical engineer, General Electric Company, Schenectady, N. Y.

The April meeting in New York will be in Carnegie Hall on April 28th. The papers of the evening to be read are: "Polyphase Metering," J. D. Nies, instructor in Lewis Institute, Chicago; "Notes on the Use of Instruments on Switchboards," by F. P. Cox, electrical engineer, General Electric Company, Lynn, Mass.; "The Oscillograph and Its Uses," by Louis T. Robinson, associate electrical engineer, General Electric Company, Schenectady, N. Y.; "Maintenance of Meters," by W. J. Mowbray, electrical engineer, Brooklyn Edison Company, Brooklyn, N. Y.

The next meeting of the Chicago branch of the Institute will be held on April 25th. M. C. Rorty, a Bell telephone engineer, will speak on "Effects of Laws of Probability on Telephone Traffic."

The annual meeting of the Institute will be held at Carnegie Hall, New York, on May 16th.

## Line Construction for High-pressure Electric Railroads.[1]

By George A. Damon.

The successful use of a single high-pressure trolley wire will have a marked tendency upon three distinct branches of the electric-railroad art:

1. Moderate speed and inexpensively equipped electric lines for country districts.
2. High-speed interurban roads for service between large centers of population.
3. Electrification of steam railroads.

This will leave the city systems with their suburban extensions to be served, for the present at least, by the direct-current motor. In studying the methods of line construction, it will be desirable, therefore, to keep in mind that each of the three classes of roads indicated will have its own individual problems and requirements.

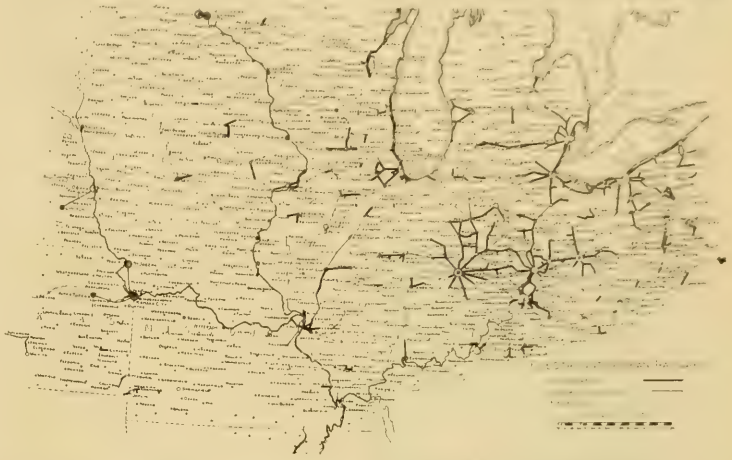


FIG. 1. MAP SHOWING ELECTRIC INTERURBAN RAILWAYS IN MIDDLE WESTERN STATES.

For moderate-speed lines in the country districts, the full benefit of the high-pressure system will be obtained only when the first cost of such a road has been reduced to a minimum, consistent with good work. A study of the map (Fig. 1), which shows the electric-railway situation in the middle western states, will emphasize this point. It will be seen that nearly all the territory which promises even a fair return on the investment has been preempted, and that some roads are even now being built where there may be some doubt as to their being able to stand the fixed charges resulting from the cost of the illogical synchronous-converter substation system. There are still left whole sections of rich, productive agricultural districts which will remain unserved by a trolley road until a system has been developed which is so simple in its requirements that it can be built and equipped complete for less than $15,000 per mile, and operated on a basis equally economical. This class of installation means a trolley pressure as high as possible, as well as transformer sub-stations operating without attendance and working in parallel from one transmission line.

For high-speed interurban roads the high-pressure trolley opens up new possibilities. Heavier cars, with more powerful motor equipments, can now be operated at high speeds between cities without prohibitive first cost. "Limited" electric-train service with speed schedules of 60 miles an hour from the heart of one city to another will soon be in vogue, and without the necessity of changing from third rail to trolley in passing from private right-of-way at corporate limits. Roads of this character, with their better earning capacity, can afford such refinements in line construction as a sectionalized trolley, individual transmission lines to each sub-station, and separate pole lines for the trolley and the transmission systems.

The electrification of steam roads will present a different set of conditions. Here the steam locomotive will share the tracks with its electric successor for some time, and will do all it can with its acid-charged gases to destroy the handiwork of the electrical engineer. This will make the installation of a contact wire anywhere except at the side of the track a doubtful proposition, and thus calls attention more strongly to the statement that line-construction problems must be divided into classes.

It will be instructive to examine the details of construction of several high-pressure trolley lines already in operation. There are details available of three installations in Europe—Valtellina, Spindersfeld and the Huber system. There are several other lines building in Europe, but either the details of

1. Abstract of a paper presented at the meeting of the American Institute of Electrical Engineers, New York, March 24, 1905. Mr. Damon is managing engineer of The Arnold Company of Chicago.

Milan, Italy, and has been in operation since September, 1902. The trolley pressure is 3,000 volts at 15 cycles. The transmission line, at 20,000 volts, is carried on the trolley poles. (Fig. 2.) The contact wires are fixed at a height of 20 feet in open stretches and at 16 feet in tunnels. The trolley wires are hard-drawn copper wire of eight millimeters diameter, and the span wires consist of galvanized-steel wires of five millimeters diameter. The span wires which hold the trolley wires, after the usual suspension method, are attached to the poles by means of porcelain insulators of a special type. The contact wire is suspended by ambroin insulators, consisting of a cast-iron bell holding a steel bolt embedded in ambroin and having a mechanical clip at its lower end. The insulators are tested to 10,000 volts.

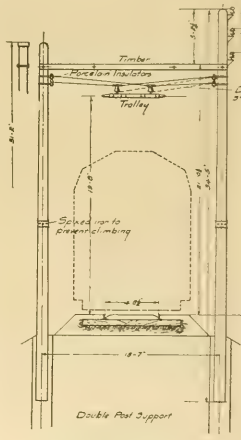



FIG. 2. LINE CONSTRUCTION ON VALTELLINA RAILWAY IN ITALY.

On tangents and on curves with a radius greater than 3,000 feet, single-bracket poles are used; on curves the contact wires are suspended on double poles with span construction. At stations double-bracket poles are used. A peculiar detail is a circlet of iron with protruding spikes to prevent people from climbing the poles.

The current collector consists of a roller of electrolytic copper of 3.125 inches diameter and two feet 1.625 inches long. The current is taken from the roller by contacts rubbing on both ends of the roller. One break of the contact wire on this line is reported, the wire falling on the roof of the car, which

was thoroughly grounded, and thus no harm was done.

Spindersfeld.—This is a single-phase experimental electric line installed on the state railroad near Berlin. The line is three miles long; it was put in operation in June, 1903. The trolley pressure is 6,000 volts at 25 cycles, single-phase system. The trolley wire is hung from two steel catenary wires, with suspensions every 10 feet. The steel wires also act as current conductors.

Huber System.—An experimental line has been built by the Oerlikon Machine Works after the plans of E. Huber, technical director of the company. The line uses a single-phase current at 14,000 volts directly on the conductor wire. The current-collecting device is of novel design; it consists of a curved

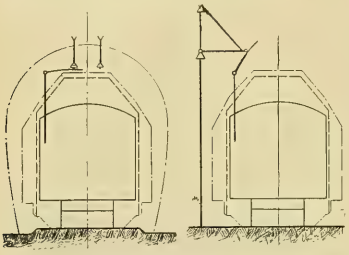


FIG. 3. ARRANGEMENT OF CONDUCTORS AND COLLECTORS OF HUBER EXPERIMENTAL LINE.

metallic stem with its convex surface bearing lightly on the top of the current-carrying conductor. Normally the wire is located at the side of the car, but in passing through a tunnel or under an overhead crossing, the wire can be brought over the center of the track. (See Fig. 3.) The collecting stem has a rotary motion in a plane perpendicular to the track; the position of the stem at any time is regulated automatically by the location of the overhead-conductor wire.

Lansing, St. Johns and St. Louis electric railway.—This was the first single-phase electric road to be built. It runs 20 miles north from Lansing, Mich. The line was the scene of the pioneer single-phase work done by Bion J. Arnold in 1900-1904. The line has been operated with a pressure of 6,000 volts on the trolley wire. The general method of suspending the trolley wire followed in direct-current work was adopted for this line, but the usual hanger was replaced with a large special insulator of annealed glass, tested to 30,000 volts.

Bloomington, Pontiac and Joliet Electric Railway.—This line will be 90 miles long, connecting Bloomington and Joliet, Ill. The trolley pressure is 3,300 volts, and the wires are held in place by catenary construction. (Fig. 4 shows the cross-suspension for city streets.)

Indianapolis and Cincinnati Traction Company.—This is a high-speed interurban line, 41 miles of which are practically finished. Sixteen miles were

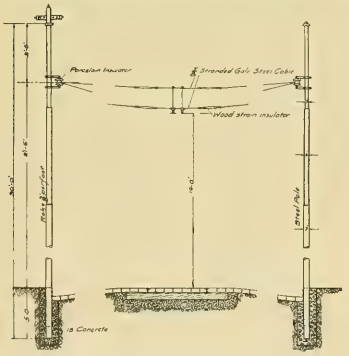



FIG. 4. CROSS SUSPENSION FOR CITY STREETS, BLOOMINGTON, PONTIAC AND JOLIET ELECTRIC RAILWAY.

put into service January, 1905. The trolley pressure is 3,300 volts. The catenary form of suspension is used with one 0.4375-inch steel messenger wire, supported every 100 feet by large flat insulators held on an iron bracket.

Bearing in mind the distinct requirements of the three classes of roads already referred to, the problem of line construction may be discussed under the following heads:

1. Pressure and insulation.
2. Location of conductor.
3. Requirements for safety and stability.

As an entire paper might be devoted to any one of these subjects, there is offered an opportunity for considerable discussion.

The single-phase lines now in operation in this country have 3,300-volt trolleys, and several lines under construction have also decided to use this pressure. From present appearances, therefore, 3,300 volts is to be the standard for interurban lines. It would be well, however, to consider just at this time whether it would not be advisable to use a trolley pressure of 6,000 volts. From an operating standpoint there seems to be no reason why this higher pressure is not just as practicable as a lower one; and to get the full benefit of all the advantages inherent with the high-tension system the higher pressure should be adopted.

Even if a few of the first roads are built with a 3,300-volt trolley, there is no reason why, with the catenary suspension, the insulation provided should not be capable of standing a working test of 6,000 volts, so that when the time comes to double the pressure, the expense of the change will be a minimum.

For steam-railroad conditions, the larger amount of energy required indicates that a pressure of at least 15,000 volts will probably be desirable. Just where to strike a balance between the cost of copper and the cost of insulation for steam-road work is a problem which should be carefully worked out; but there seems to be no reason at this time why pressures of over 10,000 volts should not be considered.

The catenary form of suspension affords so convenient a method of insulation that it should become standard practice for interurban electric lines. When selecting an insulator for this construction mechanical strength should be the first consideration, and a few cents more spent on the insulator will insure an abundance of insulating qualities. As far as insulation is concerned, there is no reason why the catenary construction could not be operated at more than 30,000 volts, if desired. For pull-offs and cross-suspensions to iron poles special porcelain insulators are being designed and used with success.

It has long been admitted that dry wood is one of the best insulators. The convenience with which a wooden rod fitted with suitable terminals can be worked into an overhead construction will commend this form of insulation. Impregnated with an insulating compound, and of sufficient length to withstand high-pressure tests, the long wooden insulator is applicable to the insulation of guy wires, anchors and cross-suspension wires. Its use in actual practice will be watched with interest.

The use of a wooden bracket to hold the insulator for supporting the catenary will probably appeal to some as a step backward. As far as looks are concerned, however, it may be said that a wooden bracket of a section 3.5 by five inches presents an appearance fully as attractive as the ordinary cedar pole to which it is attached; and that a double-track road with a line of center poles equipped with wooden brackets will be much less offensive from an esthetic point of view than a double row of side-suspension poles raked outward in the usual fashion.

The wooden bracket has an element of safety not possessed by an iron support, as the insulating properties of the wooden arm would be useful in the case of the failure of an insulator. Unless the wooden bracket were wet, it would safely hold up a 6,000-volt catenary until the line could be repaired.

For moderate-speed roads, the natural tendency will be to have the trolley wire where it has proved to be so thoroughly satisfactory; that is, over the center of the track, and to continue to use the present trolley-harp and wheel. For speeds not exceeding 40 to 50 miles an hour at trolley pressures up to 3,300 volts, this arrangement will work satisfactorily.

For high-speed electric lines there will be little objection to the conductor wire remaining over the track, provided it is properly suspended; but the danger of the ordinary trolley wheel jumping off the wire at high speeds will, no doubt, suggest the use of some form of collector other than the wheel. The bow, the roller, and the shoe will each find advocates, until more experience has been obtained and the results are reported and discussed.

Special cases will arise, such as the installation of a high-pressure conductor wire over a road already equipped with a direct-current trolley, as was the case with the Ballston (N. Y.) road. In such an event the catenary construction can be very nicely adapted to suspending the wire at the side of the track. This location could be advocated for an entirely new installation on the grounds of cheaper first cost and some additional safety in case the wire should break and fall, but both these arguments lack sufficient weight to establish the wire in the side position as standard practice.

For steam-road conditions considerable objection may be found to locating the conductor wire over the center of the track; the danger to trainmen standing on top of the cars; the fouling of the conductor; the deterioration of the insulation, and the destruction of the wire and supporting cables by the gases of locomotives which may jointly occupy the tracks; the blocking of traffic when it is necessary to repair a broken wire—all these are serious drawbacks to this location of the conductor for heavy-railroad practice. To avoid the deleterious effect of the locomotive gases it would seem to be imperative to place the contact wire at one side and as low as possible consistent with general safety. The advisability of installing an independent and duplicate system of conductors is also to be considered for lines of importance; this can be done only by putting the wires on opposite sides of the track.

The Huber system appears to have been carefully worked out, and at the present time is the best suggestion for a solution of the line problems in connection with the electrification of steam roads. There is one serious objection to the arrangement, but this can be overcome. The contact wire carried from pole top to pole top is liable to break, and some form of support should be devised to prevent the broken ends falling to the ground. A double-catenary suspension system with one wire carried on an insulator at each end of a cross-arm attached to the pole, say, a foot from the top, could be provided, and the contact wire could be supported from the apex of triangular supports attached to the two catenary wires. This method would offer advantages over any system of guard wires or cradles which might be devised to catch the broken wire, as it would require three wires to be broken before any part of the system could fall to the ground.

Whatever method of construction is followed, every precaution should be adopted to prevent accidents to the public or employes from the loose ends of a broken live wire. Suspensions or supports properly installed every 10 to 15 feet will lessen this danger.

With bracket construction having poles about 100 feet apart, there will be no need of a double-catenary suspension for the wire which is to be used with an under-running collector. In such a case, the double suspension would mean twice as many insulators as would be required with the single catenary, thus decreasing the insulation resistance and increasing the chances for trouble. With what is known as the "tower" method of construction—using long spans—the double catenary, spreading at the points of insulated supports and converging together at the center of the span, will be found desirable. The necessity of keeping the wire from swaying will justify the double catenary in this case, and the fact that the number of points of support is reduced by using long spans will more than balance the use of two insulators at each support.

In a hard sleetstorm every attachment connected to the wire will naturally be the cause of additional trouble. The arcs due to a coating of ice between the wire and the collector, will be much more vicious at 6,000 to 15,000 volts than at 500 volts, but there is no occasion to become alarmed at the possible danger from this source. In this country one of the high-pressure lines using a trolley wheel on a 3,300-volt wire has already passed through a hard siege of sleet; and, though the sparking was spectacular, very little damage was done. The frequent trolley supports, however, added considerably to the sparking.

Greased trolley wires are sometimes used to prevent the trouble caused by sleet; it would be interesting to learn the experience of members of the Institute with this device. It is well known that the grease finish of an aluminum wire prevents the collection of sleet upon the wire, and it may be possible that a coating of grease on the high-pressure conductor wire would entirely obviate this trouble. It is evident that with a collector taking the current by means of a contact made on the top of the wire, as in the Huber system, the trouble from sleet would be a minimum. In those kinds of sleetstorms in which icicles are formed and hang from the wire, a top-bearing collector would have every advantage, but when the sleet freezes equally all around the wire, the lighter pressure of the top-bearing contact might put the Huber collector at a disadvantage.

The transmission lines from the power plant to the sub-stations will be at a higher pressure than the trolley pressure, and will therefore require careful treatment. For a road which is to be built economically, a single set of transmission wires serving all of the static-transformer stations in parallel will be sufficient. These transmission wires will ordinarily be carried on the tops of the same poles which support the trolley bracket.

The next refinement would be to have a separate set of transmission lines from the power house to each sub-station, making it possible to put the overload protective devices on the central-station switchboard, and thus eliminate the sub-station attendance. With this multiplicity of wires and consequent higher first cost adopted, it is but one step farther to separate entirely the two systems and to install two pole lines on the same right-of-way; where the electric road is of the high-speed class this should be done.

To be consistent, however, in insuring safety to the public, it would be well to advocate as standard practice the plan of carrying the high-pressure transmission lines entirely around small towns and cities instead of through them. If the transmission lines are too dangerous to be carried on the railroad company's trolley poles, then there is more danger in carrying them along the streets and over the network of telephone wires inside the corporate limits. The problem of the proper regulation for this situation is one that will shortly have to be faced.

The first investment in the transmission line, the cost of maintenance, and the loss by leakage—all these can be cut in half by thoroughly grounding one side of the single-phase transmission line so as to use the earth as one leg of the circuit. An actual

trial of this suggestion to further simplify the distribution system is under contemplation, and no doubt will furnish valuable information as to its effect on telephone and telegraph lines as well as data in connection with the resistance of the earth with alternating currents.

Where the transmission lines pass over other wires, there should be a cradle of grounded wires to prevent a broken transmission line from coming in contact with a foreign wire.

General Conclusions.

1. There are no reasons why the standard pressures of the conductor wire for interurban electric lines should not be at least 6,000 volts; this is suggested as a standard, in order to provide for interchange of equipment.

2. For the electrification of steam roads, a pressure of about 15,000 volts on the conductor wire is desirable.

3. For electric interurban lines, the present tendency is toward the catenary form of suspension, with the trolley over the center of the track. A connection should be made about every 10 feet, between the steel catenary wire and the trolley wire.

4. For steam-railroad conditions a contact wire at the side of the track appears to offer the greatest advantages. Some form of construction should be adopted, however, to prevent the falling of the conductor in case it should break.

5. A successful bow collector for interurban work and a contact arm for steam-road installations similar to that in use by the Huber system would allow the location of the contact wire to be standardized.

6. A trolley wire 20 feet above the center of the track is suggested for interurban roads. For steam-road electrification the height of the contact wire at the side of the track could be made standard at 16 feet.

Discussion (in Abstract.)

President J. W. Lieb: The suggestion in connection with the protection between high-pressure wires and protection by guard wires, referred to in Mr. Damon's paper, reminds me of the danger that is often introduced in undertaking to add a safeguard to a system and introducing an element of prevention which makes the possibility of trouble even more present and gives rise to increased liability of trouble. In one of the earlier installations, which was made in connection with the rotary-converter systems, it was desirable almost absolutely, as near as conditions could be foretold, to prevent the possibility of any high-tension current getting over on to the lower-tension system between the primary and secondary windings of transformers, so that it could be said that the possibility of getting any high-tension current on a low-tension system was absolutely eliminated. To that end, in the earlier transformers that were installed, ground shields were inserted, and in two years' working the only troubles encountered with the system at all were all in the ground shields. So that instead of giving increased protection, the ground shields furnished all the trouble and were an element of danger rather than of protection.

F. N. Waterman, New York city: During the experimentation at Budapest both single and double-catenary suspension was tried, the construction being essentially similar to that used on the Spindersfeld line. The cross-suspension type, however, was adopted; the system of double insulators and double supports, shown in Mr. Damon's paper, being used. A considerable sag is allowed in span wires, and every effort made to give an elastic and uniform suspension. The insulators as installed are extremely heavy, and certainly do not aid in securing this result.

Dry wood, impregnated as suggested by Mr. Damon, forms an important feature, both of the old and new construction, and a very interesting special type of span-wire construction is also used, particularly where the trolley wires are lowered to pass under bridges. This consists of a catenary type of cross-suspension connected at intervals by suspension wires with an upwardly arched span wire which carries the insulators, thus making a construction which does not sacrifice the substantial elasticity of the line, but holds it accurately in place, permitting a limited rise and fall with the passage of the trolley.

The block-signal system is interconnected directly with the contact conductors, and the entrance of a train onto a section in face of a danger signal disconnects the section. I was unable to learn the details of the system. In addition to this, the conductors within the limits of the stations and for a definite distance on each side are dead at all times save when a train is actually approaching or starting from a station. These sections can only be thrown in by the signal operator. It is customary for express trains to coast over with trolleys down, and it is the usual practice for trains moving at full speed to lower the trolleys at all switches, except such trains as are off from schedule and are making up time.

The Valtellina system seems to have been free from trouble with the overhead construction to a remarkable extent, notwithstanding the fact that two overhead wires are required, and this fact emphasizes the importance of using a trolley contact device which cannot get off from the wire and thus cause a broad insulation or pull down the [illegible]

A. H. Armstrong, Schenectady, N. Y.: Mr. Damon has suggested the use of operating [illegible] as being an improvement over a trunk line [illegible] line feeding all stations in multiple. [illegible] experience in transmission [illegible] believe that the trouble with that is proportionate to the number of miles of wire strung. With separate lines each side of the station the total mileage must be greatly increased over that in use by the trunk line, and while it gives a certain concentration of labor in the generating station it opens up a deceptive idea of elimination of sub-station attendants.

Without branching too far off the subject of the paper, I want to suggest that perhaps it may be found advisable in the further operation of the road to place an attendant in each of the transformer substations, even though they contain no moving machinery. While this attendant may not have his full time occupied, yet I think it would be advisable to have a man there within call of some telltale device should the occasion arise to throw in or out a switch, or to cut in or out a duplicate transformer.

Mr. Babcock: On the west coast the conditions are such that the first and third classes of construction mentioned in Mr. Damon's paper will probably be the ones that we will encounter first, namely, comparatively inexpensive lines over a country not very well settled with people between points where there is a large movement of freight and over which the freight traffic must form the large proportion of the earnings. Then there will come the steam-road work, for which we have hopes. But it is safe to say that any man who attempts an innovation in steam-railroad practice, has a very large contract on his hands. Steam-railroad men by their past life and their experience are exceedingly conservative; they look at a question from all sides and turn it over and inside out before they will go into it, and many of their objections are well founded in their minds because they have learned by hard knocks that certain things must be done.

The question of line pressure and insulation is one that is very vital to us, especially along the ocean front. We find that we can operate transmission lines of very high frequency in the interior and in the southern portion of the state with comparatively little insulation, but when we get to the coast, where the coast fogs come in and we have them to reckon with, the conditions are entirely different. Perhaps some of you have seen an illustration of a fog box. We have them there. We have to have them.

Another point: I cannot help feeling that porcelain is the wrong stuff to be put up for overhead construction. Those of us who have experience in the old porcelain overhead work turned out 10 or 12 years ago know that it did not last. It seems to me that possibly wood construction will offer a better solution.

As to the location of the trolley wire, speaking from the position of a steam-railroad man, I think you are going to have great difficulty in coming without the limits that are allowed in steam-railroad practice for the hauling of large loads. The matter of clearance in steam-railroad practice is very jealously guarded. I merely mention it as one of the points which must be worked out separately before the steam-railroad man is going to consider the thing in tunnels, and in the snowsheds in our country, and in the overhead bridges.

With reference to safety to the public, in Mr. Damon's paper he mentions that it may be necessary to run these high-tension lines outside or around cities. It is our practice to run 60,000-volt lines directly through cities. We had a line come down on the sidewalk and it made a very pretty street of what looked like glass. Fortunately there was nobody underneath it at the time.

The point of grounding the single line is one that has concerned some of us. I remember in handling a 40,000-volt three-phase grounded neutral when one fuse would blow you could hold your triangle up with the grounded neutral as long as there was not much load, but at night, when there was a good load, the current did not seem to be equal to the extra load, and even the very small potentials were not very easily carried, and the result was that some of the lines went in series.

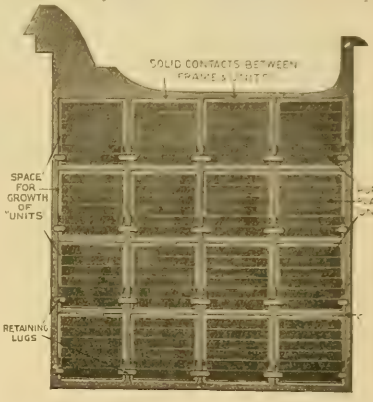
C. O. Mailloux, New York city (written discussion): I endorse strongly Mr. Damon's view in favor of higher line-contact potentials for alternating-current railway motor cars; and, as between 3,300 volts and 6,000 volts I am inclined to favor 6,000 volts as the standard which should be adopted for interurban lines. I also agree fully with Mr. Damon that for steam-railroad conditions a line-contact pressure of at least 15,000 volts is desirable.

The fact that the sparking increases with the frequency of the trolley supports in the cases observed by Mr. Damon proves conclusively, it seems to me, that ordinary trolley-line construction, using a trolley wheel for the contact, is wholly unsuitable for high-potential contact lines. With the catenary suspension, even in the case of a trolley wheel, the [illegible] distributing purposes.

## Non-buckling Accumulator Plates.

In the [illegible] volume, due to the deposition of an extra amount of material on the plate, resulting often in the buckling of the latter and in consequent short-circuits within the cell. It is difficult to prevent this growth, which often results in such distortion of the plates as to necessitate their removal from the cell.

The National Battery Company of Buffalo, N. Y., in the design of its Unit accumulator, has taken particular pains to obviate this difficulty with satisfactory results. The Unit accumulator is specially




NON-BUCKLING ACCUMULATOR PLATES.

designed for high-charge and discharge rates, combining long life and high efficiency, and is constructed in such a way that the units are firmly attached to a rigid frame, making them practically a part of the frame, and in this way insuring full contact between the two during the entire life of the plate. Both sides of the accumulator are uniform, and in addition its mechanical structure is strong, holding the active material closely to it. The accompanying illustration shows one of the plates.

In the accumulator sufficient space has been left on all sides of the unit to allow for the natural growth of the plate. This does away with buckling. In the construction of the positive plate no attempt has been made to prevent the natural growth of the active material portions. The units, or active portions, are hung in a rigid lead frame, with ample space at the bottom and at the two sides of each unit to allow for expansion, without straining or distorting the supporting frame.

The pasted type of negative has been adopted and a grid developed in which the natural molecular shrinkage of the active material has been provided for and taken advantage of, so that the contact is maintained as the shrinkage progresses, owing to the fact that the active material enclosed in the contact portions is drawn more tightly around the grid projections or pins. A negative plate which loses its contact by shrinkage will cease to give its full capacity as this physical change takes place.

## Large Electric Gantry Crane.

A new crane gantry of massive proportions is nearing completion at Harland & Wolff's shipbuilding yard, Belfast, Ireland. The structure is between 180 feet and 190 feet in height, 650 feet in length, 18 feet at the base and weighs nearly 6,000 tons. At the summit is a rapid-running cantilever crane 230 feet in length. The crane and gantry cover two slips. The cranes on either side of the cantilever run on a projecting railway, and each of these is capable of lifting 10 tons when at full out-outreach, or 20 tons when extended 70 feet. By means of the new gantry the firm will be able to put all the shafting and auxiliary machinery on board the vessels prior to launching. The power for working the crane is supplied by 12 electric motors, with a total capacity of over 400-horsepower, three-phase current for this purpose being supplied from the firm's new generating station in Queen's Road, now nearly ready for operation. The cost of the structure was nearly $400,000, of which $60,000 was expended on the foundations alone, a large amount of piling and some thousands of tons of concrete being necessary for this portion of the work.

## Williams Electromagnetic Clutch.

A new and interesting electromagnetic clutch for machine-tool drive is shown by the accompanying illustrations. The principle of the design is that of the friction disk, the disk being clamped by magnetic action induced by the energizing coil shown concentric with the shaft in Fig. 1. The magnet coil is energized through the contact slip rings and is enclosed in an oil and waterproof case, so that the clutches can be run in oil if required. In any case they should be lubricated occasionally.

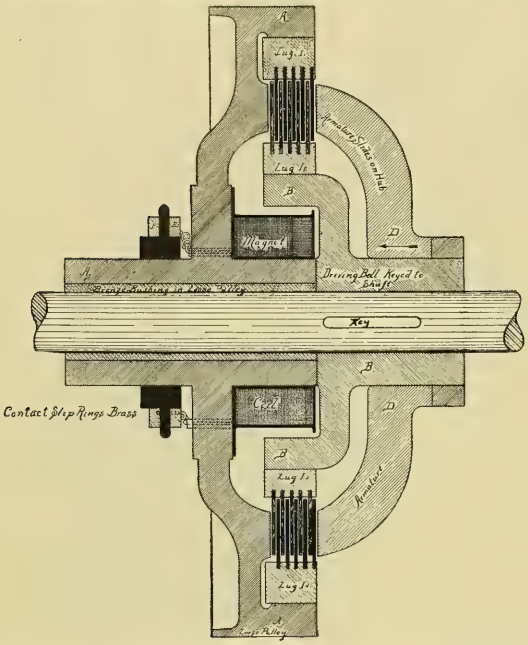



Fig. 1. Sectional View.

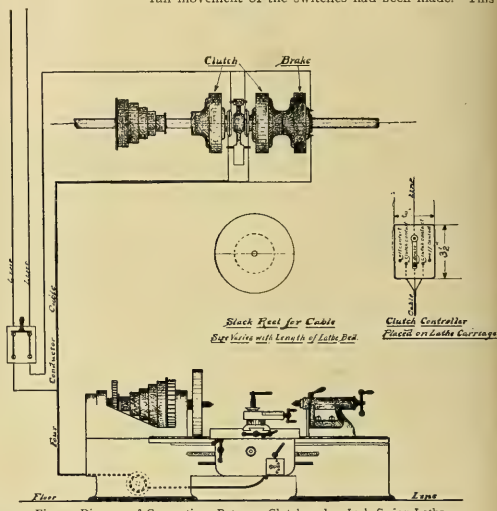



Fig. 2. Diagram of Connections Between Clutch and 24-Inch Swing Lathe.

WILLIAMS ELECTROMAGNETIC CLUTCH.

Interleaved driving disks are mounted through their respective key lugs—one-half on the driving member (B) and one-half on the driven member (A). As the driving disks are loosely fitted to these key lugs, the armature (D) when it is magnetized by the action of the coil slides on the hub (B) and presses against the driving disks and brings their surfaces into intimate contact. This action also reduces the reluctance of the magnetic circuit and automatically increases the disk-clamping effect, which in its turn increases the transmitting power of the clutch.

The multiple interleaved disks introduce into the magnetic circuit a number of minute air gaps in series. On cutting off the current from the energizing coil the release of the clamping effect on the disks causes these air gaps to open, and the rotative action of the disks on the driving member accentuating this condition, the objectionable residual effect is entirely overcome. The special material of the plates also tends to this desirable result, and the outcome is a clutch that lets go its grip in a most prompt and satisfactory manner when the current is turned off.

The holding or gripping property of the clutch may be practically increased to any point desired by simply decreasing the resistance in series with the magnet coil and thereby allowing more current to flow through it. As a low saturation of the magnetic circuit is used in the design of these clutches, a small increase of the magnetizing current has a great increasing effect on the grip. This increase in grip is practically proportional to the increase in magnetizing current. The saturation curve is almost a straight line up to the limit of current allowed to pass by the inherent resistance of the magnet coil. For instance, if a clutch using one-half ampere of current is gripping sufficiently to transmit 10 horsepower, then an increase to one ampere will give sufficient grip to transmit 20 horsepower at the same speed.

The amount of current needed to energize the magnet coil is so small as to be negligible; a 15-horsepower clutch at 300 revolutions a minute consumes one-half of an ampere at 110 volts, or, in other words, considerably less than is used by an ordinary 16-candlepower incandescent lamp.

Fig. 2 shows a connection diagram of a 24-inch swing engine lathe equipped with a set of clutches and electric brake. The controlling switch is located on the lathe carriage convenient to the hand of the operator. The dimensions in inches of the controller are shown in the cut. On account of the small amount of current handled this controller can be made even smaller in case of necessity than shown in this cut.

To the contact points of the controlling switch a four-wire cable connects the clutches, brake and line. In the controller shown, no starting resistance is used in connection with the clutch coils and controller, as it is unnecessary except in cases where a very slow start is desired, but such resistance is furnished when needed and a controller with additional contact points to allow its introduction into the circuit. The connection cable is flexible rubber-insulated and covered with a braided protection.

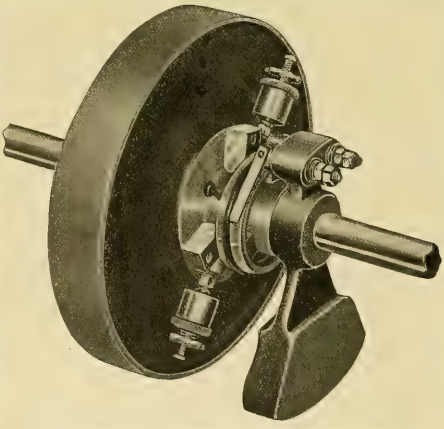


FIG. 3. WILLIAMS ELECTROMAGNETIC CLUTCH COMPLETE.

Fig. 3 shows a single clutch complete. The clutches are manufactured by the Williams Electric Machine Company of Akron, Ohio. It is pointed out that in many cases where it is impossible to use a motor it will be quite feasible to employ the electric clutch, and that a step forward in the electrical equipment has been accomplished.

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A new electric railway is to be constructed in the city of Saragossa, Spain.

## Historical Data of Interlocking.[1]

The first all-electric interlocking machine was installed at College Hill Junction, Ohio, a junction point of the Cincinnati, Hamilton and Dayton railroad, and was placed in service in the summer of 1888. The design and construction of this installation was covered by a patent of Joseph Ramsey, Jr., and F. C. Weir, both of Cincinnati. The principle of the operation is practically the same as that of the present all-electric interlocking; the switches were operated by motors located on the head blocks of the switches, and the signals were operated by motors in a casing located on the signal mast, signals being set to normal position by force of gravity.

Track boxes were placed at all the switches and the signal circuits were run through these boxes so that the signals could not be cleared until the full movement of the switches had been made. This original all-electric machine did not have mechanical locking, but relied entirely upon the locking of divergent routes by the breaking and closing of circuits, through circuit controllers on the signal poles, and on the controller magnets of the machine itself, the dependent switch circuits being opened when the controller magnets were demagnetized, or when the signal was placed normal. The first source of power for generating the current was a hot-air engine direct connected to a small dynamo, which, however, did not prove a success. This was afterward supplanted by an Otto gas engine and a storage battery was installed in addition to the dynamo. There were no detector bars used on this installation, and no track-circuit control. A description of the form of switch movement used here was somewhat as follows: An electric motor operating through a worm gear, a pair of disks each with similar cam grooves cut therein, these grooves carrying a pin which imparted movement to the switch through a rocking-arm. The circuit was established by a lever in the operating case in the tower; the lever was held in contact by a magnet in series with it until circuit was momentarily broken in the switchbox upon completion of the throw of the switch by a circuit breaker operated by one of the disks; the pin having reached that part of the cam groove which was concentric to the circumference of the disk, the circuit was immediately re-established in the switchbox, but the momentary break demagnetized the magnet in the tower, which caused the operating lever to fall and break circuit there. The peculiarity of this plant was the fact that it was operated in the daytime only, while at night the signals were tied down in the "proceed" position.

This installation was much improved upon and the second installation was put in service in 1891 at Storr's Station on the Big Four railway, immediately outside of Cincinnati. This latter installation was much improved in switch mechanism and signal mechanism, as designed and patented by C. Morris Wilder, at that time engineer of the Ramsey-Weir Company.

The Baltimore and Ohio railroad was the third to install an all-electric interlocking system. This was installed at East Norwood, Ohio, in October, 1893, under the Taylor patent, it being the first installation of the Taylor interlocking. The fundamental idea of the operation of this plant was the same as that of the plants installed under the Ramsey-Weir patents, i. e., the operation of switches and signals by

1. Abstract of supplementary committee report on signaling and interlocking presented at the convention of the American Railway Engineering and Maintenance of Way Association, Chicago, March 22, 1905.

electric-motor, a storage battery, charged by a generator, being the source of power. The design of the switch and signal-operating mechanism was very similar to the present design of the Taylor all-electric, and had mechanical locking of the switches in conjunction with the electric locking.

The first all-electric interlocking introduced in Europe was at the station of Prerau, on the Northern railway of Austria, in 1893. This installation was put in according to the Siemens & Halske system, and consisted of an installation of 25 switches, 15 signals and 22 indicators. This system is known as the four-wire type in contradistinction to the two-wire type—the Taylor type. In this four-wire type the indications of the movement of the switches and signals are operated by a 25-volt storage battery located in the central station or tower.

The most recent installation of the all-electric

FIG. 1. GENERAL VIEW OF GENERATOR ROOM OF DAN RIVER POWER AND MANUFACTURING COMPANY.

system in Europe is at the Antwerp Station of the Belgian State railway. The installation corresponds in number of movements to that of a 204-lever mechanical machine. The track circuit is used for operating tower indicators and locking the routes, and a treadle alongside of the rail is used for setting the signals normal as the train passes the signal.

The first installation of the all-electric interlocking in England was at Crewe Station on the London and Northwestern railway, and consisted of five interlocking towers containing 60, 152, 95, 75 and 57 levers, respectively.

The first experiments in operating switches and signals by electricity were made at the suggestion of the management of the French Northern railway. They date back to 1887-88, a period at which many of the stations of that railway already had electric-light installations. Two types of apparatus were tried. The first, based on the use of two solenoids operated alternately by currents in opposite directions, was worked out by Marcel Deprez and completed by a bolt devised by Mr. Singre, engineer for the company on the transmission of power by electricity.

The second was worked out by E. Sartiaux, engineer and superintendent of the electrical department, on lines proposed by A. Sartiaux, the chief traffic engineer of the French Northern railway. It consisted of a rotary motor operating the switch points by means of screws of decreasing pitch and oval followers. When the points were closed they were locked by stops and electric contacts transmitted a return current which made it possible to complete the movement of the levers and to unlock the interlocked signals.

The first all-pneumatic interlocking plant, as designed and patented by J. W. Thomas, Jr., was put in service at Clinton and Park Streets, Nashville, Tenn., on March 18, 1897. The fundamental feature of this all-pneumatic interlocking, as differing from other forms of interlocking, was the manipulation of the valves admitting air to and exhausting it from the working cylinders of the railway switches and signals by means of an equalizing type of piston, the piston being actuated by a sudden increase or decrease of air.

The switch and lock movement of this method is similar to the form of switch and lock movement in use on mechanical interlocking. The back and front indications were given through indication pipes which ran from the switches and signals to the machine in the tower, this being the principal difference between all-pneumatic and the electro-pneumatic system. In the all-pneumatic system the air is used for operation of switches entirely and also for giving the indications on signal and switch levers, the control of the inlet and outlet, as stated, being accomplished by equalizing valves. On the electropneumatic the indication is given electrically and the control of the air is governed by a valve actuated electrically.

The all-pneumatic machine had mechanical tappet locking in the machine proper. The substitution of a two-arm signal would make the layout conform to the committee's recommendations. Two 9½-inch Westinghouse pumps were used for compressing air at this plant.

## An Interesting Lightning-arrester Installation at Danville, Va.

Electric stations differ in the size and shape of the building, in the apparatus installed, in the method of installing the apparatus and in the number, voltage and current capacity of the feeders, all of which affect the installation of protective apparatus. Unfortunately, lightning arresters are not always considered when making the preliminary plans for a station, and generally when it comes to installing these devices but little space is available and they must be located where convenient or possible. The Westinghouse Electric and Manufacturing Company has made a careful investigation of a great many installations, among which is that described below, as erected in the power station of the Dan River Power and Manufacturing Company, Danville, Va. The three accompanying views show the lightning arresters, the choke coils under the switchboard gallery and a general view of the station.

There are two 750-kilowatt and one 500-kilowatt, 6,000-volt, three-phase, 3,000-alteration generators (Fig. 1) supplying one three-phase transmission line of three No. 0000 B. & S. solid conductors. Lightning arresters are installed at each end of this line. Those in the power station (Fig. 2) are placed on the wall and are well located for inspection, discharges being visible from the floor of the power station, while the condition of the cylinders can be inspected without difficulty. They are located immediately at the entrance of the wires to the building. Three single-conductor cables would be more secure than the three-conductor cable shown. This cable is subjected to static strains as it is connected outside of the choke coils.

The choke coils as shown by Fig. 3 are under the switchboard gallery. There is a set of choke coils for each generator which gives the best protection of the generators from static strains caused by disconnecting the machines from the bus, one coil being permanently connected in each generator switchboard lead. The coils have large areas, thus providing large cooling surfaces so that deterioration of the insulation from heating is negligible. The design also allows of the maximum amount of insulation between the ends of the coils where the voltages set up by discharges are greatest. Supports and insulators are strong and rigid. Trouble might be experienced from the heat given off by the field rheostats if the underside of the switchboard gallery had been enclosed, though, as it is, the ventilation is good and no trouble should ensue from this cause.

## Annual Report of the American Telephone and Telegraph Company.

The annual report of the American Telephone and Telegraph Company for the year ending December 31, 1904, has been made public. [illegible] been made during [illegible]

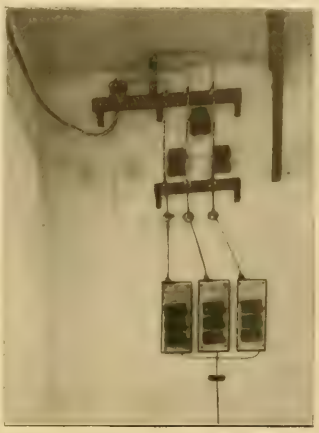


FIG. 2. LIGHTNING ARRESTERS MOUNTED ON WALL IN DAN RIVER POWER STATION.

is dated at New York, March 28, 1905, and is as follows:

The results of the business for the year 1904, as shown by the treasurer's statement, were:

| | |
|---|---|
| Gross revenue | $[illegible] |
| Expenses, including interest and taxes | [illegible] |
| Net revenue | [illegible] |
| Dividends paid | [illegible] |
| Carried to reserve | [illegible] |
| Carried to surplus | 890,435.05 |

The following were the corresponding figures for the year 1903:

| | |
|---|---|
| Gross revenue | $[illegible] |
| Expenses, including interest and taxes | [illegible] |
| Net revenue | 10,564,968.04 |
| Dividends paid | 8,619,140.75 |
| Carried to reserve | 728,130.97 |
| Carried to surplus | 1,217,674.32 |

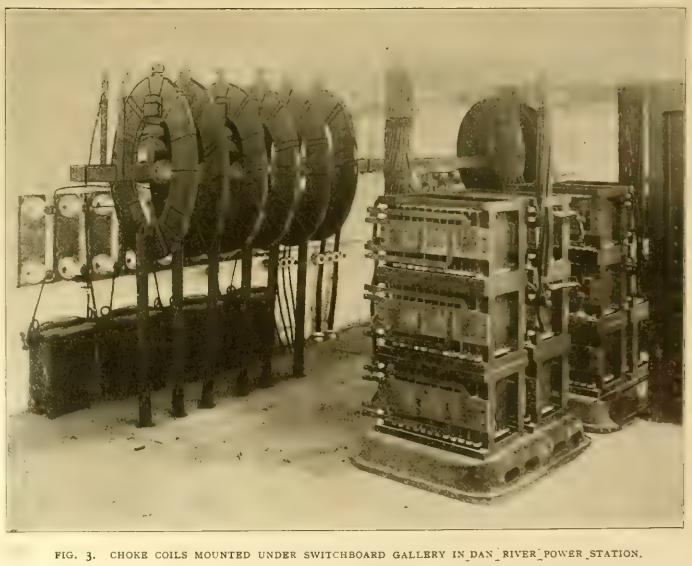


FIG. 3. CHOKE COILS MOUNTED UNDER SWITCHBOARD GALLERY IN DAN RIVER POWER STATION.

The net output of telephones during the year 1904 was 701,047, making the total number in the hands of the operating companies 4,480,564.

The number of exchange stations at the end of the year operated by the companies which constitute our system was 1,799,633, an increase of 274,466. In addition to this number there were 167,213 exchange and toll stations operated by companies or associations under sub-license contracts and making use of our telephones. Adding also telephones employed for private-line purposes, our companies have a total of 2,003,213 stations.

The total mileage of wire for exchange and toll service was 4,671,038 miles, of which 712,147 miles were added during the year.

Including the traffic over the long-distance lines the daily average of toll connections was about 301,000, and of exchange connections about 11,149,000, as against corresponding figures in 1903 of 258,000 and 9,876,000; the total daily average for 1904 of connections, both toll and exchange, reaching 11,450,000, or at the rate of about 3,687,000,000 per year.

The total amount added to construction and real estate by all the companies constituting our system in the United States during the year 1904 was:

| | |
|---|---|
| For exchanges | $22,673,200 |
| For toll lines | 8,243,500 |
| For land and buildings | 2,520,000 |
| | $33,436,700 |

The amount added in 1900 was $31,619,100; in 1901, $31,005,400; in 1902, $37,336,500, and in 1903, $35,368,700, making the grand total of expenditure upon these properties during the five years, $168,766,400.

The amount expended by this company in 1904 for the construction, equipment and supplies required for its long-distance lines was $4,012,905, making the total investment in long-distance lines and equipment up to the close of the year $30,889,710.

The development of the business during the last year exceeds that of any preceding year, and this applies not only to the increase of the number of subscribers in established exchanges, but to the toll-line development and the extension of lines and service into the more sparsely peopled sections of the different states. Present indications point to even a larger growth of the business for the year 1905.

The efficiency of the operating companies is constantly improving. The work of construction, maintenance and operating is done better and with more economy each year as improved equipment and more intelligent methods of construction, maintenance and operation are devised and introduced into use. A spirit of loyalty and of devotion to the work pervades our entire organization throughout the country.

Every year it becomes more clear that the prosperity of the company is and always must be based primarily upon its ability to give such service, both in extent and quality, as is required to meet the reasonable demands of the public.

Every extension of the service brings in new subscribers and, what is of greater moment, increases the value of the service to those already connected. The demand for telephonic connection has spread throughout the entire country, so that today not only the smaller householders and business men, but even the isolated farmers in all parts of the country are coming to regard the telephone as a necessity. Its use on railroads, in factories, on steamships and in other special environments is growing rapidly, and there is an enormous increase in the number of private-branch exchanges in hotels, apartment houses and other large establishments where, by the use of the private-branch exchange, the same telephones can be employed for intercommunication between the rooms or offices as well as to talk out upon the lines of the general system.

The experience of the Bell operating companies in meeting the greatly increased demand for telephone service which has characterized the last few years, and the trend of the business as a whole, afford definite assurance that the investment required for the extensions which must necessarily be made, in the interest of the company and of the public, will bring an adequate financial return.

It is gratifying to note that the service throughout the country is constantly improving, notwithstanding the enormously greater difficulty in carrying on the business on its present large scale. This is due in part to improvements in physical plant and to the adoption of better operating and maintenance methods, but even more to the more definite recognition that a high standard of service must be attained and to the more intelligent and careful supervision of the plant and of the operating which has come with experience and with a higher aspiration for good service.

Involved in the extension of the business, both from the point of view of the companies and of the public, is the establishment of such schemes of rates as will result in an adequate return to the operating companies and at the same time will make it possible to graduate the cost of the service to the varying requirements of the respective subscribers, and therefore be alike fair to the large and small user. In no other business that serves the public are the difficulties of dealing with rates greater than in the telephone business, particularly in view of the facts that in no two localities is the investment or the cost of operating per station the same, and that, as communities increase in size, conditions arise which largely increase these costs.

The Bell companies are dealing with this question intelligently and on sound lines. By the adoption of measured service in places where it is applicable, and of different grades of service which can be supplied at varying prices to meet the requirements of different classes of telephone users, they are promoting the necessary extension of the service on a basis that is safe, and satisfactory both to the companies and to the public. As a fundamental principle, the large user should pay to some extent in proportion to his use, while the smaller user should be offered a service adapted to his needs at a lower price.

The number of subscribers to the Bell system is now practically 100 per cent. greater than was the case three years ago. In almost every part of the country each subscriber is able to talk to twice as many stations, and through those stations to a very much larager number of people. Thus the value of the service to the user is constantly increasing, and its cost to the subscribers, in relation to its value, is constantly reduced.

Moreover, the telephone users on the average pay a substantially less amount for the service they receive, irrespective of its increased value, than was the case three years ago. Not only are the standard rates reduced from time to time, wherever the conditions justify such a reduction, but a constantly increasing proportion of the telephones installed is furnished at the lower scale of rates adapted to the needs of those whose requirements are adequately met by the classes of service offered at such lower rates.

Concurrently with this reduction of the average rate, and as a consequence of the continued application of sound methods of engineering and of operation, and of the extension of the business into fields where relatively expensive construction and high cost of operation are not required in order to render adequate service, there is a constant decrease in the average investment and cost of operation per station, of the Bell system as a whole. This is not true of every locality, and the extent of this reduction, if any, in any given place, depends upon the local conditions; as, for example, the size of the community and the density of its population, the proportion of the investment that is required in any special place for real estate, expensive underground construction, intercommunicating trunk lines or elaborate exchange equipment, and the character and extent of service that is demanded.

As a general principle, it seems perfectly certain that it will always be the case that the larger and more densely populated the community, the higher must be the standard of rates for the comprehensive service required for that community. Not only the investment and the cost of operation, but the general difficulty of doing the business which can only be overcome by enlarged expenditure, increase in passing from the smaller towns and cities to the larger.

All these difficulties and expenses culminate in cities of the first rank. In those cities there is extensive underground construction, laid and maintained under unfavorable conditions and at great cost, the real-estate expense is necessarily very high, the central office equipment is complicated and expensive out of all proportion to the number of subscribers served, there has to be a network of trunk lines connecting the different exchanges one with another, and there are many other conditions involving great expense that are not present to a proportionate degree in smaller communities. Moreover, the business is on such a large scale and the element of time so much more important as to require the maintenance of a much higher standard of promptness and efficiency in the service furnished than is necessary in a smaller community, and this higher grade of service can only be attained at a disproportionate increase in cost. In fact, the conditions in those cities are such that only engineering skill of the highest order, and the courage to embody the result of that engineering skill in permanent construction and to practice the most sensitive methods of operating regardless of cost, even at times when there was a fair question as to whether the great expense involved was justifiable, have enabled our companies to bring the situation into such shape as to be able to render the amount and character of service that is now required of them. Today there is no question as to their foresight, and it is certain that the telephone problem in the large cities, complicated and difficult as it is, can be worked out satisfactorily, whatever may be the demands for service.

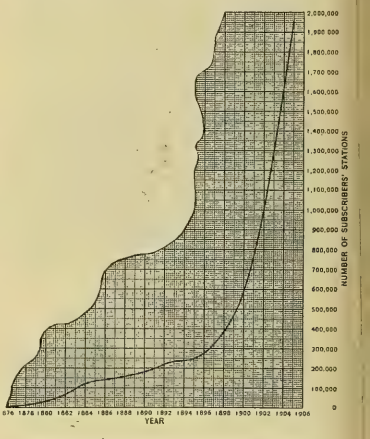
Even in the largest cities, however, not only the average rate per station, but the standard rates of the individual subscriber, have been reduced from time to time as the conditions warranted; and this policy will be continued as circumstances permit.

In some places in the country, particularly where there has been the demoralizing effect of unintelligent competition, the rates are at the present time too low. The service rendered is worth substantially more than the users pay for it, and the net return to the operating companies in those particular localities is inadequate. In many such places the rates have already been raised to the point of reasonable return, with the good-will and hearty co-operation of the community. There is no doubt that this process of readjustment will continue as the public becomes satisfied that it is the intention of our operating companies to increase rates only where it is necessary, and to reduce them as and when the conditions of the business justify it. That such is the policy of our companies will, it is believed, be recognized more clearly from year to year.

But little need be added to what has been said in former reports with reference to the effect of the operation of the so-called Independent telephone companies upon the interests of the Bell companies. The developments of the year 1904 have served only to confirm the view heretofore expressed, that their presence in the field in certain portions of the country is not a matter of substantial disadvantage to the interests of the Bell companies as a whole. In some cases their competition, particularly in view of the rates at which they undertook to supply service, and which they themselves, to a large extent, now publicly acknowledge to have been entirely inadequate, has undoubtedly operated as an embarrassment to the logical progress of the business and to that extent has interfered with its sound development, to the disadvantage, temporarily at least, of our interests, and clearly to the disadvantage of the public. It becomes more clear, however, every year that to enable the Bell companies to meet successfully such competition as may from time to time exist, it is only necessary for them to prosecute their affairs intelligently and with due regard to the public interest. The situation, as a whole, so far as this phase of the business is concerned, seems even more satisfactory than in former years.

It is to be observed that in many instances even aggressive competition has not substantially affected the sound application and development of the rates from time to time established by our companies as fair to them and to the public.

The fact that your company and its allied companies constitute a national system, extending




CURVE ILLUSTRATING GROWTH OF BELL SYSTEM.

throughout the country, is each year more definitely recognized as entitling the Bell system as a public utility to a position which cannot be attained by rival organizations that are, relatively speaking, largely local in character.

The number of telephone companies organized to operate independently of the Bell companies in rural districts and relatively small centers of population, and for the most part in places not at the time having the Bell service, which have concluded that it is for their interest to become a part of the Bell system, is constantly increasing, and their course in entering into contracts with the Bell companies, whereby they take our telephones and connect with toll lines of our system, is significant, as showing the growing appreciation of the value of the Bell service. Such contracts are clearly for mutual advantage, as well as for the advantage of the community served, and are to be encouraged in the interest of sound telephone development, wherever, by reason of the establishment of such relations, it becomes unnecessary for our companies to duplicate an existing plant.

On December 31, 1902, as appears from the admirable and complete bulletin of the Census Department relating to the telephone and telegraph industry of the United States, there were of the telephones classified as operated by Independent companies, so-called, 84,021, which were in fact Bell telephones used under contract with the Bell companies and as part of the Bell system. This number has grown so that on January 31, 1905, there were, as above stated, 167,213 telephone stations of this class. There is every reason to believe that this sub-license business of the Bell companies will increase from year to year to the advantage of all concerned.

The money required by the company for the extension of its long lines, and for investment in its operating companies for the year 1904, was obtained by the sale, on favorable terms, of $20,000,000 five per cent. coupon notes, due May 1, 1907, and secured by its four per cent. collateral trust bonds to the amount of $25,000,000.

The money required for like purposes for the year 1905 is provided by the sale, just consummated, of $25,000,000 four per cent. collateral trust bonds.

Appended to Mr. Fish's report are several tables from which the following figures are taken:

| | |
|---|---|
| Instruments in the hands of Bell licensees, under rental, on December 31, 1904 | [illegible] |
| Increase of such instruments for the year 1904 | [illegible] |
| Similar increase for the year 1903 | [illegible] |
| Miles of pole lines (toll lines of all Bell companies) on January 1, 1905 | [illegible] |
| Miles of wire (toll lines of all Bell companies) on January 1, 1905 | [illegible] |
| Average daily number of toll connections | [illegible] |
| Number of Bell exchanges on January 1, 1905 | [illegible] |
| Of which the branch offices numbered | [illegible] |
| Total miles of wire of Bell companies on January 1, 1905 | [illegible] |
| Of which there was under ground (in miles) | [illegible] |
| Total circuits on January 1, 1905 | [illegible] |
| Total number of employes, same date | [illegible] |
| Total number of stations, same date | [illegible] |
| Total estimated number of exchange connections daily in the United States, made up from actual count in most of the exchanges | [illegible] |
| The total number of daily calls per station varies in different exchanges, the average throughout the United States being | 6.2 |

The ledger balance—debtors and creditors—on December 31, 1904, was $273,810,673. Items in this balance include: Capital stock, $158,661,800; bonds, $28,000,000; bonds (collateral), $25,000,000; notes, $20,000,000.

The accompanying curve illustrates graphically the growth of the Bell system of telephones.

## Ohio Telephone Notes.

The Citizens' Telephone Company of Columbus has received a carload of automatic telephone instruments and will begin installing them at once. They will be connected with the old board until the new exchange is cut in, which will be about June 1st. This will be one of the finest telephone exchanges in the country when it is completed.

Ground has been purchased in South Lorain by the Black River Telephone Company, on which a central exchange will be erected.

A franchise has been applied for in Worthington, a village north of Columbus, by the Bell people. The town already has a flourishing Independent exchange.

The Colebrook Telephone Company of Colebrook has been incorporated with a capital stock of $5,000 by V. G. Bedell, C. H. Turner and others.

Telephone bonds have been selling well on the Cleveland Stock Exchange for the last few days. In every way they have been stronger than for some time past and investors seem anxious to get them. Cuyahoga 5's have sold right along at 77, and the supply has hardly been equal to the demand.

The Hamilton Telephone Company of Hamilton, which recently increased its capital stock from $200,000 to $300,000, will use the money secured from the sale to extend its lines over the country.

It is said that a plan is on foot at Custar to organize a farmers' mutual telephone company, which will be maintained by a monthly assessment. A membership fee will provide money to equip an exchange, and each member will furnish his own telephone box.

The Bell Telephone Company is endeavoring to get franchises in Burton and Middlefield. The company already has a franchise in Chardon and several pay stations in Geauga County. The idea is to get a better foothold in the county.

President Dickson of the Cuyahoga Telephone Company has expressed confidence that the company will have 20,000 telephones in operation by the end of the year. On March 12th the number actually installed was 15,720, a gain of 5,501 since the same date last year.

Officers have been elected as follows by the directors of the United States Telephone Company: President, F. S. Dickson; vice-president, H. A. Everett; secretary, James B. Hoge; treasurer, R. W. Judd. Mr. Everett succeeds Mr. Moore as vice-president, and this is the only change from last year. The gross earnings of the company for 1904 were $418,308, compared with $379,235 in 1903. The net earnings for the year were $152,168 and the surplus, after paying $11,178 for dividends and deducting other charges, was $40,905. C.

## Indiana Telephone Items.

The Osgood Telephone Company has filed articles of incorporation, the capital stock being $5,000. The company proposes to construct and operate a telephone system in Ripley County, with the principal exchange in the town of Osgood. W. C. Leslie, George Ashman, Orlando Jenkins, T. R. Hartley and R. A. Cregmyle are the directors.

The Home Telephone Company of Wabash announces that it will establish an exchange at Lagro on a franchise granted there three years ago.

According to the report of General Manager Dale of the Rushville Co-operative Telephone Company, the company now has 800 telephones in use. In the last four years 500 telephones have been installed.

Ten years ago a telephone was scarcely known in Gibson County. Now it is the boast of the community that there are 18 exchanges and 5,400 telephones in use.

Every citizen of Johnson County can be reached by telephone by allowing only one mile in extreme cases for messenger service. There are 2,182 Independent telephones in use in the county, and the number is being rapidly increased. The Bell company has 500 subscribers on its line and is only waiting for a proper time to secure a franchise in Franklin, when [illegible] tions are proposed.

## Telephone News from the Northwest.

The Brainerd Telephone Company of [illegible] Minn., has been incorporated with [illegible] stock. The incorporators are C. A. Walker, W. Hemstead, F. H. Gruenhagen, H. P. [illegible] M. Mahlum and H. D. Treglawny, all of Brainerd.

The Eden Valley Telephone Company, Eden Valley, Minn., declared a dividend of 21 per cent. at its annual meeting recently. The line is to be extended in the spring.

The Rice County Rural Telephone Company has bought a building in Faribault, Minn., for its office and central exchange.

The Tri-state Telephone Company seeks a franchise in Montevideo, Minn., and proposes to build a toll line to Ortonville from Minneapolis.

The Farmers and Citizens' Mutual Telephone Company of Springfield, Minn., has declared a dividend of seven per cent. on its first year's business, about five months' actual business.

The Northwestern Telephone Exchange Company did some quick work in replacing its switchboard at the Mankato (Minn.) office, which was burned out recently. At 11 o'clock the morning after the fire a switchboard had been received from Minneapolis and at noon all toll lines were connected up and ready for business. On the second day a force of men was put to work on a new board sent from Chicago.

The Mankato (Minn.) Citizens' Telephone Company during 1904 gained 214 subscribers, making a total of 1,171.

The city of Fargo, N. D., has receded from its stand and will permit the Tri-state Telephone Company to build its line through the city under certain conditions.

The Western Electric Telephone Company has incorporated at Des Moines, Iowa, with a capital of $1,000,000. T. A. Way is president and B. C. Way secretary. It is proposed to unite the majority of the small Independent companies of Iowa and furnish them with long-distance connections with other systems.

The United States Telephone and Telegraph Company's stock is to be sold at auction in accordance with the order of the Federal District Court at Dubuque, Iowa. It is planned to form a new company and bid in the stock in order to establish a modern system at Waterloo, where the system is located.

Judge Williston of Red Wing, Minn., held in a late decision that a telephone company placing its pole in front of a man's property is a trespasser unless it obtains the owner's permission. The company can compel the owner to acquiesce by condemnation proceedings. The judge holds that it is taking private property, and must therefore be paid for. The telephone companies have hitherto gone on the assumption that the property owners consent was unnecessary when the law gave them permission to occupy the highways.

The interior telephone exchange of the West Hotel, Minneapolis, is to have an attachment in each room whereby a general fire alarm may be sounded from the switchboard desk by the operator.

The New State Telephone Company, recently incorporated at Sioux City, Iowa, is planning building trunk lines to Omaha, Kansas City, St. Joseph and Chicago, connecting the big packing centers of the country. One of the packing companies is said to have pledged half of its business between these points for the first year. R.

## NEW COMPANIES.

The Bondville Telephone Company, Bondville, Ill., has been incorporated by W. H. Scott, G. A. Keller and O. W. Norton. The capital is $2,500.

The Cedar Run Mutual Telephone Company has been organized at Catlett, Va. F. S. Ensor and others are in the concern. The capital will be $5,000.

The Wilmington and Southport Telephone Company has been chartered at Wilmington, N. C., to operate telephone and telegraph lines, the capital being $5,000. Richard Dosher and W. B. Cooper of Wilmington are in the company.

The Cumberland River Telephone Company of Barboursville, Ky., has been incorporated with a capital stock of $5,000 to build a system of lines from that place to Keely, Tenn. John Woodward is the president of the company and L. R. Benjamin is the secretary.

Among the telephone companies which have recently been incorporated in western states are the following-named: Exline Mutual Telephone Company, Exline, Iowa; Interurban Telephone Company, Dipping Springs, Texas, capital $10,000, R. E. Spaw and others; Cody Southern Telephone Company, Cody, Wyo., capital $10,000, J. F. Young and others; Staplehurst Telephone Company, Staplehurst, Neb., capital, $5,000, E. Jacobs and others; Kearney Telephone Company, Kearney, Neb., capital $100,000, T. H. Tilchrist and others; Turkey Valley Telephone Company, Hennessey, Okla., capital $2,500; Byron Mutual Telephone Company, Byron, Okla., capital $10,000.

## Investigating the Telephone Business in Canada.

[illegible] outside of the cities and principal to[illegible] stead of only 63,192. The report dwells on the overcapitalization of the [illegible] to be responsible for the excessive rates.

Mr. Dagger recommends the ownership by the government and control of long-distance lines and government control of local systems. He also recommends that the telegraph system be acquired as well as the telephone; otherwise the telegraph companies would enter the telephone business and compete with the government system.

## TELEPHONE MEN.

R. H. Nansawen, for 13 years [illegible] local telephone exchange at Hartford, Wis., has resigned and is succeeded by R. C. Blakesley.

Emil J. Frautschi becomes manager of the Wisconsin Telephone Company at Madison, Wis., on April 1st. The company plans extensive improvements in the local system.

Frederick P. Fish, president of the American Telephone and Telegraph Company, is at the head of the list of Boston men who are directors in corporations, according to a recent compilation. He is a director in 42 companies, 36 of them being subsidiary companies of the big telephone company, however.

## GENERAL TELEPHONE NEWS.

The Wabash Valley Telephone Company has changed its location from Marshall to Paris, Ill.

There are 38 telephone circuits in Egypt. Trunk lines connect Alexandria and Cairo, and connections with other larger towns are in contemplation.

The Tri-state Telephone Company of Grand Forks, S. D., began giving service January 27th with its new exchange equipment, furnished by the Stromberg-Carlson company. The company starts out with a good-sized list of subscribers and reports that it is adding to this list rapidly from day to day.

The Western Telephone and Telegraph Company in its third annual report shows gross earnings for 1904 amounting to $1,408,215 compared with $1,238,221 in 1903. The number of exchanges operated by the systems controlled by this company at the end of 1904 was 325. The stations connected with these exchanges numbered 149,431, an increase during the year of 17,094. At the end of the year there were in operation 96,314 miles of toll wire, as compared with 91,847 miles at the close of 1903. The expenditure within the year for extension of the properties of these companies has been $1,739,271.

A State Department of Telephones is proposed in the Francisco bill, introduced in the Assembly at Albany, N. Y., a few days ago. All telephone companies would be required under the bill to take out licenses for every telephone instrument placed by them. A tax of $5 would be exacted of the telephone companies each year for every telephone operated. Half the sum would accrue to the state and half to the town or city where such instruments are in operation. The bill further provides that the companies shall be fined $100 for each telephone unlicensed. A state superintendent of telephones would be installed at a salary of $3,000 a year.

## MANUFACTURERS AND DEALERS.

The American Electric Telephone Company of Chicago has equipped many of the War Department divisions with switchboard and telephone apparatus. A recent shipment to Washington included two 50-line local battery switchboards.

The Cincinnati Enquirer publishes a dispatch from Piqua, Ohio, dated March 25th, which says: "Representatives of the American Machine Telephone Company of Piqua have closed a deal in Chicago by which a company, capitalized at $10,000,000, under the name of the Lorimer Automatic Telephone Company, has purchased the American rights to the invention. The Lorimer system of automatic telephone exchanges has required 12 years to perfect, but is now covered by a blanket patent that fully protects it. It has taken years of litigation in the United States Court to secure this result and cost over $350,000. The original company still retains the foreign rights, and W. G. Lorimer and N. D. Neill will shortly leave for Europe to install a plant."

# CORRESPONDENCE.

## Great Britain.

London, March 15.—The agreement between the National Telephone Company and the postmaster-general for the purchase of the undertaking of the former has, not unnaturally, given rise to a considerable amount of discussion. In addition several questions have been asked in the House of Commons—somewhat prematurely, seeing that the agreement will not come into force for seven years—as to the method with which the company's employes will be dealt when the acquisition of the business is an accomplished fact. On this latter point, of course, the government has wisely refused to bind itself to any definite course of action so long ahead. What was more to the point, however, was a deputation that waited upon the postmaster-general, consisting of representatives of municipalities owning telephone systems. The view held by these local authorities is that the agreement is to be deprecated from many points of view. First, if any purchase is to take place they think it should be put into effect at once, and that, on the other hand, the conduct of the telephone service of the country as a national business is not a necessity. The view was expressed that the postoffice should, when the National company was acquired, administer the system in friendly competition with local authorities and so encourage an extension of municipal exchanges. In reply to the deputation, the postmaster-general said it was his strong view that the whole of the telephones of the country should be in the hands of the government, and in order that this aspect of the question might be further developed, he suggested an adjournment and a conference at a later date.

Now that the position of electric power companies is becoming so important in this country, an agreement which has just been arrived at between the Newcastle-on-Tyne Electric Supply Company (the pioneer electric power company in England) and the County of Durham Electric Power Company, is not without significance. The areas of the two companies adjoin and both are filled with manufacturing centers, but while, on the one hand, the business of the Newcastle company has been rapidly developed, that of the Durham company has not. An agreement has therefore been come to between the two companies practically for an amalgamation, the idea being that the larger the area to be supplied from the generating station of the one company the more satisfactory will be the results. It is stated that the Newcastle company has secured a site upon the River Tyne, which will allow of the erection of a 100,000-horsepower generating station. The agreement was sanctioned by the shareholders of the Newcastle company a few days ago.

While referring to electric-power companies, it may be mentioned that the Newcastle company is largely interested in the mammoth scheme for supplying electrical energy all over London, which will come before Parliament in a day or two. There are, in addition, eight other bills seeking powers to supply electrical energy over specified areas in London, and as all the bills are to come before one committee, the proceedings will be very protracted. In fact, of such an important nature are these bills considered, that the committee will devote the whole of its first sitting to discussing the best method of dealing with the proposals. No doubt an ultimate decision will turn largely on the question of principle, viz., whether, in view of the numerous authorities already supplying electrical energy in London, and the competition now existing, any further competition would be in the public interest.

The possibility of a strike upon the District Railway in consequence of new terms and conditions being imposed upon the employes as a result of the introduction of electric traction has once more brought Mr. Yerkes and his American methods prominently before the public in London. In addition to having only one man on each motor car, it is proposed to compel each workman to work a shorter number of hours, spread over a longer period, than at present, and to reduce the scale of pay. Whatever action the workmen may take—they are now considering their position—the fact that only one man will be in the driver's cabin has set several people thinking of what may happen to the passengers should he become ill or otherwise incapable of fulfilling his duties. The government has been questioned on the matter, but, apparently, acting under information received from the railway company, the reply has been given that it sees no reason to move in the matter, inasmuch as there is an automatic signaling system which will prevent a train going past a signal set against it, and also that each motor car is fitted with what is known here as "the dead man's handle," another safety device.

The largest of the proposed tube railways in London this session, has been rejected on a more or less technical point at a very early stage in its parliamentary career, and is consequently "dead" for this year. But it does not seem likely that the remaining schemes will reap much benefit from this stroke of luck, for the opinion in parliamentary circles prevails very strongly that none of the bills should be allowed to proceed until the Royal Commission on London Traffic has issued its report, which is not expected until June, by which time it would be too late to do anything with the proposed schemes this year. G.

## New York.

New York, March 25.—Vice-president Bryan of the Interborough Rapid Transit Company announced yesterday that more than 98 per cent. of the traffic had been resumed on the readjustment of affairs following the recent strike, and that on that day the motormen on the elevated lines had been restored to the full control of their respective trains. He says that the 17 accidents which have occurred at various times during the last 12 days were not to be attributable to the inefficiency of the new men, but to a tampering of the air brakes by strikers.

Offers appear to be forthcoming from the Interborough and the Metropolitan companies to bid for the franchises of some of the many schemes recently put forth by the rapid-transit commissioners. These offers, it is said, represent, if accepted, an outlay of $225,000,000. These tentative offers have so far not been discussed by the board at a public meeting.

Gossip from Albany says that there will be an increase of between $50,000,000 and $75,000,000 in the franchise-tax assessment for New York city for the ensuing fiscal year. The tax rolls are made up on April 1st.

The plans to establish a lighting plant for the hospital on Blackwell's Island at an estimated cost of $150,000, and to put in four electric elevators at the Kings County Hospital at an estimated cost of $13,500, have both been rejected by the Board of Aldermen. Engineer E. E. McLean of the Public Charities' Department reported that the Blackwell's Island Hospital is at present lit by an unsatisfactory combination of gas and oil lamps, and that to extend the gas service, which is greatly needed, would not be economical. Mr. McLean also reports that the electric elevators would be more economical than the present ones, which are "unreliable and expensive."

An estimate has been prepared calling for the sum of $17,750 for supplies and repairs for the fire-alarm service in Richmond Borough. The chief items are pole lines, $8,000; circuit extensions, $3,000; additional stations, $3,000, and battery material, $800.

Frederick Pearce, electrical manufacturer and contractor, of 18 Rose Street, has incorporated his interests as the Frederick Pearce Company, with a capital of $100,000. Associated with Mr. Pearce are C. F. Pearce and G. H. Tamlyn. This firm in the past has been very successful in obtaining municipal contracts.

J. H. Freese, W. B. Farrell and Bertha Bohn have incorporated the C. C. Bohn Electric Company of this city, with a capital of $5,000.

The Board of Education has arranged for a fresh series of lectures on electrical subjects at various parts of the city. The lecturers are to be Prof. C. L. Harrington, Mr. Theodore I. Jones and Prof. W. Wallace Kerr.

There has been some talk this week about the chartering of a steamship to be equipped with space-telegraph apparatus and intended to proceed to outside the three-mile limit on the Atlantic and there to receive news of races, thus constituting a floating poolroom for the gambling fraternity. For reasons not given, the first trip of the boat has been indefinitely deferred.

Telephone subscribers in Manhattan will receive material reductions in their toll charges after May 1st as the result of action taken at a meeting of the board of directors of the New York Telephone Company on Wednesday. The decision of the directors became known through the Merchants' Association, which received a communication from General Manager U. N. Bethell of the company, giving the business schedule decided upon. The letter of Mr. Bethell's is supplemented by advertisements in the various newspapers giving the new schedule of rates and announcing that other reduced schedules will be announced later. The new schedule gives 600 direct-line messages for $60 instead of $75, and the rate gradually increases as the number of messages increases up to 4,500, on which number the rate is reduced from $228 to $204. D. W. W.

## Dominion of Canada.

Ottawa, Ont., March 25.—It is proposed to establish communication by space telegraphy between Montreal, Ottawa and Toronto. The system is being introduced by the De Forest Wireless Telegraph Company of Montreal. This is the first attempt in Ottawa to establish wireless communication with Montreal and Toronto.

In the Legislature of New Brunswick, Hon. Mr. Tweedie, the provincial premier, stated that the sum of $40,000 had been deposited by the Grand Falls Water Power Company, which proposes to develop the great waterpower at Grand Falls, N. B. One condition of the deposit is that if the company carries out its proposal to complete the work and expends $3,000,000 at Grand Falls within five years, the province will refund the deposit with three per cent. interest. The intention of the company is not only to expend a large sum of money in harnessing the waterpower, the premier said, but to supply electricity to places as far away as the city of St. John, a distance of 200 miles. There is estimated to be a minimum power of 39,000 horsepower at Grand Falls.

As soon as the frost is out of the ground, it is the intention of the Quebec Railway, Light and Power Company to construct what will be one of the highest dams ever built in Canada. This dam will be 90 feet high, 12 feet wide at the top and 65 feet wide at the bottom. It is to be built at the foot of the Natural Steps on the Montmorency River. The construction of this dam will not only have the effect of doubling the power of the company, but will give it an enormous storage reservoir, containing over 50,000,000 cubic feet of water to draw from in periods of drought.

The Quebec-Jacques Cartier Electric Company is also commencing to build another dam, which will have the effect of very largely increasing its power and doing away with the operation of its steam plant, except in cases of emergency. These improvements above stated will cost $250,000. W.

Winnipeg, Man., March 25.—The Port Arthur street-railway cars were operated through Fort William on Sunday last, in spite of the protests of Mayor Rutledge of the latter town against the operation of Sunday cars. The action of Port Arthur is based upon a decision of the Supreme Court, but it is believed that though the council of Fort William threatens to appeal to the courts to stop the service, a majority of the ratepayers of the town are in favor of Sunday cars. A deputation waited on the Ontario government, as representing the Ontario Lord's Day Alliance, and suggested that a bill be passed to prevent the running of Sunday cars on electric railways, other than those which now enjoy such special legislation on the Sabbath Day.

F. Nicholls, president of the Niagara, St. Catharines and Toronto electric railway, recently met with the City Council of St. Catharines and stated that his company would commence immediately to survey its road from Hamilton to Toronto, but if its application for an extension of time was refused by Parliament, it would drop the extension altogether, and fall back on the Niagara and Toronto Power Company's right-of-way from Toronto to Niagara Falls, which they intentionally made wide enough to build a railway.

The St. John Electric Street Railway Company is having six new cars built at Ottawa. They are open cars, with the seats running crossways.

Charles D. Haines, who controls the charter of the Hamilton, Ancaster and Brantford electric street railway and also the Hamilton, Galt and Berlin Railway Company, stated to the City Council of Hamilton that if granted entrance into the city it was his intention to build the line to Ancaster and Brantford first, and later on a line to Guelph and Galt, via York Street. He stated that when his plans for the Guelph line were matured he would ask for the right-of-way from Main Street, along Dundern Street, to the high-level bridge. The city has received a letter from Frederick Nicholls of the Toronto and Hamilton Railway Company stating that the company will soon make an application to the council for an entrance into the city, and urging the council not to tie the city up to any agreement with any other company until his company has had an opportunity to make its plans known, and to make an application accordingly. H.

## Ohio.

Cleveland, March 25.—The Scioto Valley Traction Company of Columbus has taken over the roads built under that name by a pool of 32 men. The lines were completed to Lancaster and Circleville by the pool and will soon be in operation to Chillicothe. About $2,000,000 has so far been expended in construction work and equipment. There was thorough harmony among these men throughout the time of construction, and they all became stockholders of the new corporation. The new officers of the company are: President, Frank A. Davis; vice-president, Winfield S. Courtright; secretary and treasurer, Edwin R. Sharp. An issue of $2,000,000 stock will be made. The Union Savings Bank and Trust Company of Cincinnati was made trustee under a mortgage to secure an issue of $2,000,000 bonds. When the Chillicothe extension is completed the company will have 81 miles of road in operation. The distance from Columbus to Lancaster is 31 miles, and from Columbus to Chillicothe, 50 miles.

The Toledo Southern Traction Company has been incorporated by George B. Kerper, Sr., W. F. Robison, Thomas H. Tracey, George B. Kerper, Jr., and Charles F. Chapman, Jr. It is understood that the Toledo, Bowling Green and Southern tracks will be used for a portion of the way from Toledo and a branch will be built to Greenville, close to the Indiana line.

President George B. Kerper of the Toledo, Bowling Green and Southern, with a party, made the trip from Toledo to Findlay, 50 miles, in one hour flat a few days ago. The car was a new one, built by the Cincinnati Car Company, and is equipped with roller bearings, which, it is said, will reduce by 70 per cent. the amount of power necessary for operation. This company has completed its entrance to Toledo and has its power plant at Findlay well under way. When it is finished the road will have an abundance of power, and, as it is well ballasted, will be in good shape for fast time. The company has a portable power station carried on a car, so that current may be furnished temporarily in case of a break in the lines.

The Toledo City Council has appointed a committee to investigate the municipal-lighting proposi-

tion, with a view to building a plant in case the experience of other places shows that it would be a paying investment for the city.

The Lorain and Eastern Railway Company will be formed by owners of the Lake Shore Electric, it is said, to build a line from South Lorain to Avon Beach, a distance of seven miles. There are also rumors that the Lake Shore will build to Oberlin. A portion of the right-of-way has already been secured, and engineers have been looking over the proposed route.

For the purpose of building a line from Dayton to Kenton, the Dayton and Northeastern Railway Company has been incorporated with a capital stock of $100,000. Hugo Cook, W. W. Chambers, John J. Hall, W. W. Shey and L. W. James are the incorporators. Messrs. Cook and Chambers purchased the assets of the Dayton and Kenton road, which some time ago went into the hands of L. W. James as receiver. Should this road be built, it will make one of the longest lines in the state.

The Citizens' Transit Company, which already has one large electric machine in operation in Cleveland, will put on several others, and they will be used for city-touring purposes through the summer. Routes will be laid out and 50 cents a trip will be charged. Special tours to suit passengers will also be made. J. W. Butler, in charge of the touring cars of the Cleveland Electric Railway Company last year, will have charge of this service.

The Electric Speed Meter Company of Cincinnati has been incorporated with a capital stock of $30,000 by William H. Whetstone, Martin J. Hester and others.

The Lima and Toledo Traction Company of Lima has been incorporated with a capital stock of $50,000, to build a line connecting Lima and Toledo. This is a competitor of the Western Ohio and is being promoted by owners of the lighting interests in Lima, headed by J. B. Mayer.

J. B. Hanna of Cleveland and C. E. Bailey of New York were in Indiana a week ago looking over the prospects for the South Bend, South Shore and Chicago Railway Company. Mr. Hanna feels that the prospects for the proposed line are good, and it may be that work will be begun on it within a short time. O. M. C.

## Indiana.

Indianapolis, March 25.—A revival of the talk of gasoline-motor cars as a medium of successful competition by steam roads with electric lines for interurban traffic has been noticeable during the last few weeks. In addition to the Lake Erie and Western (the Indiana road said to be experimenting with the motor car) the Wabash and the Great Central systems are said to be giving serious consideration to the motor car. At Peru word is sent out that, owing to the strong interurban competition along the Wabash steam line from Fort Wayne to Logansport, the Wabash will place motor cars on its line between those points quite soon, with hourly service. A prominent official of the Cleveland, Hamilton and Dayton recently expressed the belief that it was only a question of time until the motor car would be proved practicable, and that when that time came it would be universally adopted for quick and frequent local traffic over steam lines that have to fight electric interurban competition.

A party of Westinghouse officials from Pittsburg and electrical engineers from Chicago made an inspection trip over the Indianapolis and Cincinnati single-phase traction line on March 22d in the company's private car, and said they were well pleased with the operation and condition of the line.

The Muncie, Hartford and Fort Wayne Traction Company, now operating between Muncie and Bluffton, will on April 3d start a freight service to compete with the Fort Wayne branch of the Lake Erie and Western, which it parallels. The Lake Erie will meet the competition by reducing rates below those of the traction line, it is said.

The Indianapolis, Toledo and Newcastle Electric Railway Company, which was granted a 50-year franchise by the Indianapolis Board of Public Works last week, has been ratified by the council, and the company has filed its bond and provided for the payment of $5,000 for its proportionate share of the grade separation in Massachusetts Avenue.

In the trial of the suit of A. J. Smith against the Fort Wayne and Springfield Traction Company, at Portland, Judge Macy held that the benefits to a farm by the construction of a traction line could not be considered in making an award for a right-of-way. If the farmer whose land was penetrated by the electric railway was benefited then it would be only equitable to assess benefits against the man owning a farm just across the highway, whose land was not used for right-of-way, said the judge.

The Evansville and Henderson electric railway has been granted an extension of franchise for one year by the Evansville council. The former franchise expired in February. The suit to force a right-of-way over the Henderson bridge is pending, and this alone stands in the way of the immediate construction of the line.

A meeting was held in Lafayette on the 21st in the interest of the Fountain-Warren traction line, which is proposed to be built between Lafayette and Covington. C. M. McCabe stated that the right-of-way between the two cities, except for a short distance, had been secured and that the company had secured options on some valuable coal land. [illegible] has voted a subsidy of $25,000 to aid of the line and other localities will do equally as well. There is a general desire for the road.

The Citizens' Electric Lighting Company of Muncie, capitalized at $200,000, and composed largely of Muncie business men, has been organized for the purpose of supplying, within 90 days, electric lights to Muncie people at a cost of five cents a kilowatt, instead of 12 cents, which is the charge of the only company now supplying lights for commercial purposes. The directors of the new corporation are C. E. Hinkley, H. J. Keller, W. C. Brann, C. R. Hathaway and W. F. Warner. S. S.

## Michigan.

Detroit, March 24.—The South Bend and Southern Michigan electric railway, which is now operating between Niles and South Bend, has been granted a franchise by the Niles City Council for the extension of the line to the northern limits of the city. This company also proposes to build a line to St. Joseph, about 25 miles north.

The Battle Creek council has voted to submit the question of municipal ownership of gas and electric lighting to the electors at the coming spring election. The city now owns its waterworks and also constructs its own sewers.

Mayor Codd of Detroit and several representative citizens have appeared before the Michigan state Legislature and have urged the enactment of the Greusel municipal-ownership bill. Corporation Counsel Tersney also spoke on the subject, and every effort is being made to pass the bill, which provides for the owning and operating of street railways by cities in Michigan.

The new Grand Rapids and Ionia electric railway will pass through 14 townships, serving a population of 134,500 people. The estimated first cost of this road is $971,000, over $30,000 of which has already been invested. The headquarters and power house of the road, as well as that of the Ionia and Owosso electric line and the Owosso and Pontiac electric line, will be located at Owosso.

The Ionia council has ordered the electric-light and telephone wires about town separated. The recent death of Walter Straub, a telephone employe, who received a fatal shock upon a telephone pole by a cross, it is asserted, with an electric-light wire, is the cause of this action.

It is reported that the Grand Rapids-Kalamazoo Valley electric railway has closed a contract for the construction of the road, which is to be begun at once. C. G. W.

## Northwestern States.

Minneapolis, March 25.—The Twin City Rapid Transit Company is making preparations to begin work on the proposed car line on Lake Street, Minneapolis, which will connect with one to be constructed on Marshall Avenue, St. Paul, forming a third interurban line between the two cities. This company has decided to remove its main car shops from Minneapolis to St. Paul, and it is the intention to remove the entire manufacturing plant to the new location as soon as buildings can be erected.

The contract for grading for the new trolley line from Minneapolis to Lake Minnetonka has been let to Foley Bros. of St. Paul. Work will be commenced at once and pushed to completion.

Negotiations are in progress for the sale of the property and lines owned by the Madison (Wis.) Traction Company to the North American Company.

The Madison River Power Company has incorporated in New Jersey with $600,000 capital for the purpose of building a power plant on the Madison River in Mont, Ill. P. E. Bisland of New York heads the board of directors.

Business men at Spearfish, S. D., are agitating the project of building a trolley line from Belle Fourche through Spearfish to Deadwood and Lead.

The Great Northern Power Company has acquired a site at Fifteenth Avenue W. and Superior Street for the main station, which will be established in Duluth for the distribution of the electric power from the St. Louis River development. The transmission wires will be placed on a private right-of-way.

The Tri-city Railway Company has voted $100,000 to be spent in track improvement this summer at Davenport, Iowa, and Rock Island, Ill.

A new electric-lighting system is to be put in this season at Fort Brady, Mich., at an estimated cost of $50,000.

W. J. Stanton is figuring on a proposition to establish an electric-light plant at Conrad, Iowa. R.

## Rocky Mountain States.

Salt Lake City, March 23.—A vigorous campaign is being waged by local newspapers against the petition of the Utah Light and Railway Company for the extension of its franchise for a period of 50 years. Non-Mormons generally are indignant over what they consider an unwarranted extension, and are urging favorable consideration of the application of Samuel Newhouse, a local millionaire, who offers to establish a plant and give a service at a rate from 20 to 30 per cent. less than that of the present company. The president of the company is Joseph [illegible] shortly inaugurate improvements in its plant and [illegible] $100,000. Contracts for needed equipment and materials have already been awarded.

The mayor and City Council of Ephraim, Utah, [illegible] citizens will [illegible] city for the establishment of an electric power [illegible]

The [illegible] election voted in favor of the granting of a fra[illegible] for an electric street railway to J. R. Wharton, who represents the W. A. Clark syndicate of Butte, Mont. The company will be required to commence work within six months after the granting of the franchise.

Work on the electric railway between Lewiston and Kendall, Mont., a distance of 20 miles, will be commenced in the near future by the Citizens' Electric Company of Lewiston, the estimated cost of the project being $225,000.

The establishment of an electric power plant at a point 10 miles north of Weiser, is contemplated by a company which will shortly be organized and which has already secured water rights for the purpose. The organizers are John R. Piercy of Mount Vernon, Ill., J. H. Morrison, Pitts Ellis and W. H. Adams, all of Weiser.

The Tonopah Mining Company of Tonopah, Nev., has made contracts for an electric power plant, to be established about 20 miles north of the city, for the transmission of electrical energy to its properties.

Officials of the Burlington railroad are looking over the field at Sheridan, Wyo., with a view to constructing electric-railroad lines from that city to the Tongue and Little Goose Valleys, where the establishment of a beet-sugar factory is projected.

W. G. Caffrey of Reno, Nev., is the promoter of an enterprise for the establishment of an electric power plant at Cedarville. The estimated cost is $16,500.

The Utah Independent Telephone Company has petitioned the City Council of Logan, Utah, for a franchise. G.

Reno, Nev., March 25.—The Truckee River General Electric Company has plans ready for the erection of an addition which will double the size of the sub-station at Virginia City, Nev. Transformers, switches, etc., will be placed in the new building. Construction work on the power line will be started within a short time.

The Goldfield Electric Light and Power Company has passed into the hands of the Nevada Power, Mining and Milling Company, of which F. J. Campbell was the president. A reorganization of the company has been effected whereby E. L. McClure of the State Bank and Trust Company was made president and F. L. Brown secretary. It is intended to make improvements in the plant at Goldfield, Nev.

It is reported that the Western Union Telegraph Company contemplates making about $10,000 worth of improvements at Ogden, Utah, within the next few months. The improvements include the installation of several dynamos. In connection with these dynamos a gasoline engine will be installed for use in case of an emergency.

A deal has recently been closed whereby the Prescott Electric Company and the Consolidated Telephone, Telegraph and Electric Company of Tucson, Ariz., have consolidated in Northern Arizona, and all lines north of Maricopa County are to be controlled by the Prescott Electric Company.

The citizens of Ephraim, Utah, are considering the advisability of bonding that city for the erection of a municipal light and power plant. It is proposed to issue bonds in the sum of $20,000 for the purpose. A.

## PERSONAL.

A. Paulson, superintendent of the electric-light plant at Red Wing, Minn., was instantly killed a few days ago by coming in contact with a live wire.

Harry Wagner of Columbus, Ohio, has been appointed manager of the Owatonna (Minn.) Gas, Electric and Heating Company to succeed the late E. G. Porter.

F. E. Merrill of the Detroit, Ypsilanti, Ann Arbor and Jackson electric line has gone on a six-week vacation to Mexico. It is stated that while there upon a pleasure trip, he will also look into the merits of a proposed railroad, 400 miles in length.

Mrs. Florence Cheney, wife of W. W. Cheney, Jr., president of the International Electric Meter Company, Chicago, died on March 21st, the funeral being held from the family residence at 1304 Washington Boulevard, March 23d. Mrs. Cheney before her marriage was Miss Florence Hooker, daughter

of H. M. Hooker of Chicago. The many friends of Mr. Cheney will extend their deepest sympathy to him in his sad loss.

At the last meeting of the American Institute of Electrical Engineers Mr. Frank R. McBerty, assistant chief engineer of the Western Electric Company, Chicago, and Mr. Ernest C. Scott, consulting engineer of Kent, England, were transferred from associate to full membership.

Edgar W. Dennison, who was for 13 years in the employment of the New York and New Jersey Telephone Company in New Jersey, has been made secretary of the Edison Manufacturing Company, Edison Phonograph Works, National Phonograph Company and Bates Manufacturing Company.

Recent deaths of members of the American Institute of Electrical Engineers were those of A. Meuschel, Montreal; George W. Brock, Warsaw, N. Y., and F. A. Baruth, New York city. Mr. Meuschel was superintendent of the power houses of the Lachine Rapids Hydraulic and Land Company. Mr. Brock was formerly of Brooklyn.

W. H. Smith has been appointed general manager of the Vallejo and Napa Valley (Cal.) Electric Railway Company, which is about ready to begin operation. Mr. Smith resides at Pasadena, Cal., and is the son of C. S. Smith, who has at different times been prominently connected with the management of the Central Pacific, Chesapeake and Ohio, and the Atchison, Topeka and Santa Fe steam roads.

C. F. Annett of Chicago, formerly assistant superintendent of telegraph of the Illinois Central Railroad Company, has been appointed superintendent of telegraph, telephones and electric lighting for the Isthmian Canal Zone, Panama, with headquarters at the city of Panama. Thomas J. O'Neil, his assistant, was formerly for several years in the telegraph department of the Illinois Central. They sailed from New York March 14th.

## ELECTRIC LIGHTING.

An electric-light plant to have a capacity of 1,200 16-candlepower lights is contemplated for Ozark, Ark., by C. B. Carter.

The Hamilton (Texas) Light and Ice Company has been incorporated with a capital of $20,000 by A. McSpadden and others.

H. M. Fulwider of Redmon, Ill., has recently been granted a franchise for electric lighting, and he is in the market for apparatus.

The People's Ice and Light Company of Brownsville, Texas, has completed the ice plant and will begin the electric-light plant at once.

The Danville (Ky.) Light, Power and Traction Company has been incorporated with a capital of $50,000, and will operate an electric-light and power plant.

Lang Bros. have purchased the plant of the Athens (Tenn.) Light and Power Company, which they will improve and operate. The company will furnish electric light and power.

At its last meeting the Chicago City Council instructed the committee on state legislation to go to Springfield and ask the committee on municipal corporations of the House to recommend for passage the bills providing for the municipal ownership of gas and electric-light plants and giving to the city the right to regulate the price of gas.

A miniature searchlight for revolvers or other firearms has been invented by Byron C. Riblet of Spokane, Wash., which is somewhat unique. A small incandescent lamp is mounted under the barrel and is connected to a battery in the handle of the revolver. When a button or contact is pressed the lamp is lighted and the weapon may be aimed in a dark room.

A report made by Superintendent C. G. Sundquist of the municipal electric-light plant of Jamestown, N. Y., states that the commercial rates are lower than they should be, made so by the low rate for gas in that city (27 cents per 1,000 feet). According to the usual method of accounting used in municipal bookkeeping the net cost for each street light was shown to be $21.23 a year.

## ELECTRIC RAILWAYS.

The Pacific Traction Company has been incorporated with a capital of $1,000,000 to construct an electric railway between Olympia and Tacoma, Wash.

According to a German paper, the Central South African railway is to change from steam to electric traction. The annual saving thereby is estimated at $250,000.

W. E. Winner of the Kansas City-Topeka electric railway states that work will be begun again within 60 days, and the line will be completed to Bonner Springs this year.

The Chicago General Street Railway Company will use automobile buses to carry its passengers from Wabash Avenue and Twenty-second Street to the west end of the Twenty-second Street Bridge pending the erection of a new bridge at that street. It states that it transports about 3,000 people a day, and it will take a year to build the new bridge.

The Nashville Railway and Light Company is preparing to build a new machine shop and car barn in Nashville, Tenn., the investment to amount to $150,000. The company will build its own cars, employing 100 men.

John F. Turk has been elected president of the Hornellsville (N. Y.), Bath and Lake Keuka Railroad Company—a concern which has been incorporated to carry out his plans. New York capitalists are interested in this scheme.

Engineer van Erlach, in Spietz, Switzerland, has obtained a permit to build an electric railroad from Interlaken to Merligen. Another electric railway is planned for that town, concerning which Regety & Co., Spietz, can give information.

The officers of the Northwestern Elevated Railroad Company and the Chicago, Milwaukee and St. Paul steam road have, it is announced, practically concluded the terms of a lease by which the Northwestern will operate electric trains over the St. Paul tracks from Wilson Avenue, Chicago, into Evanston. The fare will be five cents to the city limits and five cents beyond, making the ride from Evanston 10 cents.

## POWER TRANSMISSION.

The Florida Power Company of Ocala, Fla., recently incorporated with a capital of $300,000, contemplates the construction and operation of a water-power electric plant. W. M. Camp is president of the company.

At a hearing on the bill to amend the charter of the Lockport, Niagara and Ontario Power Company at Albany recently the bill was vigorously denounced by counsel for the New York Citizens' Union, who averred that the underlying object of the bill is to combine electrical companies throughout the state so as to form one vast monopoly, free from the limitations of the existing laws.

## PUBLICATIONS.

The Transactions of the International Electrical Congress will probably be ready for issue to members and subscribers during the present month. An arrangement has been made whereby those who so desire can have the volumes delivered to a firm of binders for binding at 20 cents a volume in cloth or 60 cents a volume in half morocco. Otherwise the volumes will be delivered in paper covers, carriage prepaid, to the address of the member.

T. H. Traylor of Denver, Colo., who has recently received a patent for an electrically operated portable apparatus for use on railroads as a main-line signaling device has issued a pamphlet describing the invention fully and containing pictures of the different parts of the apparatus and the mode of application. It is asserted by the inventor that the system is a reliable preventive of head-on and rear-end collisions and wrecks resulting from wash-outs, undermined bridges, open switches, uncleared cars on sidings, etc.

Catalogue No. 8 of the Locke Insulator Manufacturing Company, Victor, N. Y., is well designed to show the varied line of insulators, pins and brackets which the company manufactures. For testing purposes the company has a well-equipped laboratory which is described in the catalogue. The types of insulators illustrated have been selected as representing the practice best adapted to service in various countries and the aim of the company is to simplify and bring to standard as far as possible insulators for ordinary potentials or transmission. A good feature of the catalogue is a pocket attached to the inside of the back cover in which to place supplementary sheets to be issued later.

Announcement is made in a little pamphlet from the Hunter Fan and Motor Company of Fulton, N. Y., that not only its Tuerk alternating ceiling fans will be placed before the public this year, as usual, but two other kinds of fans also, which are described in the pamphlet. One of these is called the Hunter alternating-current ceiling fan and the other the Fulton alternating-current deflector fan. The latter is a new departure. The motor is of the induction type, equipped with special blades of 14-inch sweep, set at an angle of 28 degrees, and run at two speeds of 1,050 and 800 revolutions a minute, with a maximum current consumption of 125 watts. The air is delivered onto three disks or stationary deflectors which distribute it equally over a large area.

A striking catalogue is that of the W. H. Mullins Company of Salem, Ohio, makers of stamped-steel boats. Not only are its pages well illustrated with the various types of stamped-steel rowboats and power-driven boats manufactured by the company, but they are also overflowing with attractive river and lake scenes, hunting pictures, etc., which make the catalogue a very interesting one to lovers of sports afield. An ingenious contrivance adapted especially to hunting boats where it is important that the person rowing face the bow of the boat, is described in the catalogue. It consists of a set of bow-facing oars which are said to be strong and capable of being quickly attached to any boat and of being shipped and unshipped with ease in rough weather.

One of the bulletins of electric fans which always presage the coming of the warmer months is that of the Sprague Electric Company of New York city. The points of superiority which the company claims for its fans are high efficiency, durability, ease and quietness of running, safety, and appearance. Numerous styles of fans are illustrated in the bulletin, which is carefully prepared.

A useful publication bearing upon the registration of trademarks under the new trademark act, with notes, by Mr. Arthur P. Greeley, has been published by John Byrne & Co., Washington, D. C. Congress has recently passed a new trademark act and in consequence numerous circulars were sent out to registrants urging re-registration, some of these circulars being so worded as to create the impression that reregistration is necessary to the preservation of existing rights and that any delay may jeopard such rights. The purpose of the pamphlet is to correct this misapprehension and make as clear as possible the meaning of the act.

A cursory inspection of the new publication issued by W. H. Schott of Chicago will suffice to show that it is decidedly different from the ordinary every-day catalogue. But a hasty glance will not be found enough, and one must needs stop and go over more carefully the interesting things that are contained in its pages. The pamphlet is entitled "From Necessity to Luxury," and its aim is to show that all modern necessities are the luxuries of a generation ago and have been evolved slowly from the crude make-shifts of a century ago—nothing very new perhaps. But something else the writer wishes to bring out in the pamphlet, and which he does in a clever manner, is that the central-station heating plant is the greatest of all modern luxuries and at the same time "centralization is economy."

## SOCIETIES AND SCHOOLS.

The next meeting of the Engineers' Club of St. Louis will be held Wednesday evening, April 5th, at the club rooms, 3817 Olive Street. Mr. E. G. Helm will deliver a lecture on "The Levee and Drainage Problem of the American Bottoms."

At the next meeting of the Electrical Section, Western Society of Engineers, at Chicago on April 14th, Mr. Charles H. Smoot, an electrical engineer with the Western Electric Company, will present a paper on "A Simple Electrical Method of Determining Flux Distribution and Magnetic Reluctance in Odd-shaped Air-gaps."

Mr. Charles E. Downton of Pittsburg gave an interesting lecture before the engineering students of the University of Minnesota on March 17th, describing the works of the Westinghouse Electric and Manufacturing Company. With the aid of a moving-picture machine he took his audience on a realistic if imaginary trip through the Westinghouse companies' properties.

The Western Passenger Association has named a rate of one fare plus 50 cents for the round trip from all points in its territory to Denver and Colorado Springs for delegates and friends attending the twenty-eighth convention of the National Electric Light Association to be held in the cities named on June 6th to 11th. The rate will apply only where a single fare is $12 or more.

A change has been made in the dates of the remaining lectures to be given by Prof. F. A. C. Perrine at the Brooklyn Polytechnic Institute, also those of Dr. Duncan. Professor Perrine has been giving a series of evening lectures on long-distance electric power transmission, but owing to his absence in Mexico during March in connection with an extensive power-transmission project his dates have been changed to April 6th, 13th, 19th, 27th, May 4th and 18th. Dr. Duncan's remaining dates are April 11th and May 11th and 25th.

## MISCELLANEOUS.

Through an error in the Illustrated Electrical Patent Record of the issue of the Western Electrician for March 25th the cut numbered 780,865 is shown as illustrating the electric train-signaling equipment patented by W. Britton Lane of Evanston, Ill. (No. 780,865), whereas it should represent the electric-elevator control system patented by Nils O. Lindstrom of Jersey City, N. J. (No. 784,869).

T. M. Sinclair & Co., packers, will operate their plant at Cedar Rapids, Iowa, by electric power. The plant will include one 75-kilowatt engine-type generator, one 200-kilowatt belted generator and about 40 motors ranging in size from one to 40 horsepower, to be used for an individual-drive system. The proposed change is brought about by the growing needs of the plant, which already covers nearly 400 acres of ground and gives employment to 1,500 men. Bullock generators and motors will be used.

A peculiar method of starting is employed by a boat running on Lake Geneva, Switzerland. Ordinarily it is driven by a 45-horsepower Diesel engine running at 260 revolutions a minute, but it is started and reversed by electric power. When start-

ing, the engine is disconnected from the propeller shaft and drives only the generator and exciter. The generator furnishes current for a motor connected with the propeller shaft, the torque and speed of which are controlled by regulating the excitation. After attaining full speed the motor is switched off and the engine is directly coupled to the propeller shaft.

## TRADE NEWS.

The offices of the Allis Chalmers Company will be established in Milwaukee, Wis., on May 1st. The Chicago office will be made a district office and will be moved to the new First National Bank Building on May 1st.

The plant and business of the Electrical Appliance Company of Cincinnati, Ohio, pertaining to all its business other than rectifiers, was transferred on March 11th to the Churchet Electric and Manufacturing Company, and the Electrical Appliance Company announces that it will not be responsible for any orders placed or goods undelivered after that date.

The J. L. Schureman Company of Chicago, manufacturer of automatic motor-controlling devices, whose plant at 133-139 South Clinton Street was almost totally destroyed by fire recently, is now fully established in its new and larger quarters at 70-86 West Jackson Boulevard, where increased facilities now enable the company to give customers better service than ever.

The E. E. Naugle Tie Company of Chicago announces the removal of its offices from 159 La Salle Street to the Mallers Building, 226-228 La Salle Street, where it will occupy the entire ninth floor. The officers and employes of the company will be glad to see all of their old and new friends, and will be in position, as heretofore, to make delivery of railway ties, telephone poles and fence posts.

The Navy Department, through the Bureau of Supplies and Accounts, is inviting sealed proposals until April 4th for delivering and installing wireless-telegraph outfits on board the United States ships Pennsylvania and Maryland, at the League Island navy yard and the works of the Newport News Shipbuilding and Dry Dock Company, Newport News, Va., respectively, and delivering two outfits at the New York navy yard. Applications for proposals should refer to schedule [illegible], the proposals being obtainable at the navy pay offices in New York, Philadelphia and Norfolk.

The Tray Plate Battery Company of Binghamton, N. Y., maker of the patent tray plate storage battery for central stations, lighting, power and isolated plants, announces that owing to its constantly increasing business it has found it necessary to open a New York office. This office is in charge of Mr. H. B. Oakman, who has a large acquaintance among electrical men. Mr. Oakman's office is located at 39 Cortlandt Street, New York.

The new trademark which has been adopted by the F. Bissell Company and which is shown herewith may be taken as a symbol of its own activity in pushing the Security specialties and novelty potheads and sleeves which it manufactures, or of its long jumps in the electrical jobbing trade, in which it is very prominent; or it may be a tribute to its home city, Toledo, where frogs were once famous and now are only memories. But, whatever the motive, it is to be widely known as a guaranty of full value.

The General Electric Company brought suits on March 9th against the Jaeger Miniature Lamp Manufacturing Company for infringement of patent to H. J. Jaeger on dental incandescent electric lamps No. 692,294 and against the Kimball Electric Construction Company for selling lamps manufactured by the Germania Electric Lamp Company of Harrison, N. J., in infringement of Branin patent No. 532,760. The Edison Electric Light Company has also commenced suits under date of March 13th against the Elmwood Mills of Providence, R. I., and against the Electric Contract Company for infringement of Edison patent No. 444,530.

## BUSINESS.

The Minneapolis Cedar and Lumber Company of Minneapolis, Minn., which has succeeded to the cedar-pole business of Carney Bros. Company of Chicago, desires to impress upon pole users that it is a producer from its own land, with large stocks of poles at nine yards located in Minnesota and Wisconsin. Pole buyers are invited to submit their [illegible] lengths and ready for prompt shipment. Mr. Reynolds is a capable executive and is energetic in executing the wishes of the patrons of his department.

[illegible] small hanger [illegible]

[illegible] many years has handled, more especially, pine and hemlock lumber, has now engaged in producing white cedar poles, having banked last winter at Laporte, Minn., 50,000 white cedar poles, from 16 to 60 feet long. He takes pride in the soundness and good condition of his stock.

Wing desk fans are of old and tried design and have been standard 20 years. A motor designed especially for use with such fans has been developed by the Rochester Electric Motor Company of Rochester, N. Y. The most important points in the construction of the motors of this type are described in a small circular sent out by the company.

C. A. wood preserver, as described in a pamphlet issued by the C. A. Manufacturing Company of Austin, Texas, is a heavy dark brown oil stain, which impregnates all kinds of wood to a remarkable degree at once, without forming a coating or closing the pores. Its high specific gravity forces it into the capillary tubes of the wood. It is not explosive or inflammable; nor does it evaporate, and it is always ready for immediate use. It is applied with a brush like paint, or the timbers may be immersed. The pamphlet contains many testimonials, a birdseye view of the factory, etc. It may be had upon application to the company.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued (United States Patent Office) March 21, 1905.*

785,076. Printing Telegraph. John C. Barclay, New York, N. Y. Application filed March 1, 1904.

Selecting relays and means for operating them are associated with a restoring circuit and controlling means. Electrically operated carriage-release mechanism comprises a magnet and armature, and a circuit for the magnet is arranged to be completed by the selecting means upon the transmission of a predetermined message. Means actuated by the carriage prevent action of the restoring circuit during motion of the carriage toward its starting point, and comprise a contact operated by the armature and arranged to be broken when the armature is attracted. Another contact in the circuit of the carriage-release magnet is arranged to be broken by the carriage during motion toward its starting point.

785,096. Cable Box. Frank B. Hall, Wheeling, W. Va. Application filed November 11, 1902.

A bracket is mounted on the pole and a non-conducting plate is mounted in the bracket, longitudinal rows of screws extending through the plate. A hook is mounted on each screw, the hooks in one row adapted for connection with the cable wires, and those of an opposite row for connection with the distributing wires. Fuses connect the opposite rows, the fuses being provided with perforations. Strips of carbon are mounted underneath the perforations in the fuses, and ground wires are attached to the carbon strips.

785,103. Telephone Selecting Mechanism. John P. Jackson, Orleans, Ind. Application filed June 30, 1903.

A selecting device includes a constantly operative clock train, an electromagnet and its armature and a circuit closer having operative connection with the armature. A closed circuit is provided in which the electromagnet is arranged and by which the circuit closer is held disengaged from the clock train. Means operable on the breaking of the circuit clutch the circuit closer to the clock train.

785,139. Electrically Driven Hoist or Coal Whip. Johannes Wilhelmi, Hamburg, Germany. Application filed June 16, 1904.

A block comprising a shell is provided with means to connect it to an overhead support and an electric motor to drive a pulley, both contained in the shell.

785,157. Vacuum Lamp. Joseph M. Davey, St. Louis, Mo. Application filed June 27, 1903.

A tube of smaller diameter than the neck of the lamp bulb extends into the bulb, having its outer end flared outwardly. Leading-in wires are secured in position intermediate the flared end of the bulb and the inner end of the tube by a union between the two.

785,167. Process of Separating and Refining Complex Ores. Eric Hedburg, Joplin, Mo., assignor to the American Reduction Company, Chicago, Ill. Application filed January 15, 1904.

After the drying and roasting process the magnetic components of the ore are separated by passing the ore through magnetic fields of progressively increased strength, whereby the strongly magnetic ores are attracted by the lesser energized magnetic field, and the slightly magnetic ores by the highly energized magnetic field.

785,180. Brake-switch Locking Device. Frank C. Newell, Wilkinsburg, Pa., assignor to the Westinghouse Air Brake Company, Pittsburg, Pa. Application filed March 29, 1902.

Combined with a running controller and a brake switch is an electrically actuated locking device for preventing the movement of the brake switch from its running position when the controller is not in its open position.

785,183. Overhead Trolley. Frank J. Prue, Woonsocket, R. I. Application filed November 7, 1904.

A head contains lubricant chambers and has bearings receiving the journals. Bores connect the lubricant chambers and the bearings, and spring-pressed plungers occupy the bores and have ducts for the passage of the lubricant.

785,209. Automatic Beam Scale. Guy Hamilton, Detroit, Mich., assignor to the Caille Bros. Company, Detroit, Mich. Application filed January 11, 1904.

A motor with sprocket wheel and chain moves the counter weight back and forth on the scale beam according to the direction of rotation of the motor. Contacts above and below the scale beam are made and broken as the beam rises or falls. These contacts are the terminals of circuits controlling the motor.

785,221. Automatic Telegraphy. Arthur Korn, Munich, Germany. Application filed November 9, 1903.

Registering telegraphic electrical impulses is done by circulating a high-tension current, for instance Tesla currents, in a receiving circuit, and causing each of the telegraphic electrical impulses coming from the line to insert in the receiving circuit either one or two windowed cathodic tubes according to the impulses being of one or opposite polarity. By the transmission of a radiation through the window of either or each of these tubes an impression is produced on a moving sensitive film.

785,266. Resonator Switch. Harold C. Moyer, Springfield, Ill. Application filed February 8, 1904.

Combined with a number of V-shaped conducting plates, each consisting of three electrically separate members, are a corresponding number of batteries having one terminal connected with a member of the plates respectively. A corresponding number of relays are connected with the other terminal of the batteries. Sounders are connected with the relays and also with one member of the conducting plates.

785,276. System of Wireless Telegraphy with Tuned Microphone Receivers. Adolf Slaby, Charlottenburg, and Georg G. Arco, Berlin, Germany. Application filed September 27, 1901.

A receiving system for space telegraphy comprises an aerial conductor adapted to receive the electrical impulses and connected to the earth. A branch circuit is connected with the aerial conductor, the branch circuit including a microphone and means for so transforming the energy received by the aerial conductor as to decrease the potential and increase the current.

785,293. Electric Tramway. Alfredo Diatto, Turin, Italy. Application filed September 30, 1902.

A magnetized contact bar is carried by the car, superficial contact devices along the road being adapted to be closed by the bar. An electromagnetic circuit-closing device for the motive circuit, and means for sending a weak current from the magnetized bar through the superficial contact devices to operate the electromagnetic devices and close the main circuit, are features of the device.

785,297. Gas Separator for Storage Batteries. Thomas A. Edison, Orange, N. J., assignor to the Edison Storage Battery Company, Orange, N. J. Application filed August 19, 1903.

The mechanical features of an apparatus for separating the gas of storage batteries is described.

785,306. Electrical Fuse Box. Gilbert W. Goodrich, Bridgeport, Conn., assignor to the Bryant Electric Company, Bridgeport, Conn. Application filed June 16, 1904.

A fuse-box is provided with contact plates provided with jaws open toward the open end of the box with a fuse plug adapted to be inserted endwise into the box and provided with contact plates to enter the open jaws of the box-plates by the endwise insertion of the plug. Means latch and lock the plates together by the insertion.

785,315. Electric Railway. Timothy Mahoney, San Francisco, Cal. Application filed December 1, 1903.

Current collectors on the car contact with the trolley rail and a sectional conductor. Uninterrupted electrical connections are provided between each of the sectional conductor collectors and the return. An electromagnetic switch relative to each trolley rail section connects the section to a feed wire. The coils of the electromagnetic switches are not in series with the motor circuit. An actuating circuit connects with the advance switch coil through the car, thence passes to the sectional conductor, thence up through a sectional conductor collector to return.

785,326. Thermostatic Alarm. Charlie C. Palmer, Osceola, Iowa. Application filed April 4, 1904.

A thermostatic bar is connected to the trip lever of a mechanism which operates to close an electric alarm circuit at a given temperature.

785,338. Means for Progressively Establishing and Dissolving Spheres of Magnetic Influence. Guion Thompson and Huntington W. Merchant, New York, N. Y., assignors to the Thompson Safety Appliance Company, Jersey City, N. J. Application filed August 17, 1903.

A multiple electric circuit includes a source of electricity common to each of its branches, the coil of an electromagnet being common to two of the branches. A separate normally open circuit controlling contact is placed in each of the branches, a traveling contact being adapted to close the normally open contact of one of the branches in which the electromagnet is included. Subsequently to leaving and reopening the latter contact the traveling contact closes the normally open contact of the branch in which the electromagnet is not included.

785,366. Vacuum Electrode. Robert Machlett, New York N. Y. Application filed December 1, 1904.

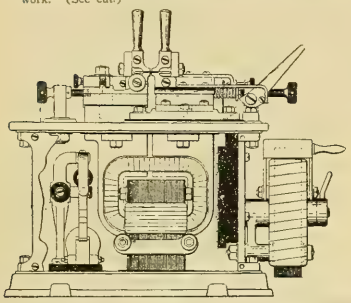
A vacuum electrode has a contact surface adapted to apply an electric current direct to the body of a patient. Means concentrate the passage of the current in the contact surface.

785,372. Trolley Head. Eugene J. Parker and Louis N. Colwell, Providence, R. I. Application filed April 27, 1904.

In a trolley head are combined with a body a trolley arm mounted upon the body and expanding means carried by the body for frictionally engaging the body and pole.

785,379. Electric Welding Machine. Adolph F. Rietzel, Lynn, Mass., assignor to the Thomson Electric Welding Company, Lynn, Mass. Application filed November 16, 1903.

Electric metal-working apparatus comprises a starting device for causing current to flow through the section of work to be heated, an automatic cut-off for stopping the flow of current through the work, and means connected with the work holder for bringing the cut-off into action when, by the softening of the work, the work holder has been permitted to move to a predetermined extent. Other means reset the cut-off device by readjustment of the starting device to position for placing the apparatus in condition in which no current will be supplied to the work. (See cut.)



NO. 785,379.—ELECTRIC WELDING MACHINE.

785,397. Power-operated Switch. Johan M. Andersen, Boston, Mass., assignor of one-half to Albert Anderson, Boston, Mass. Application filed August 29, 1902.

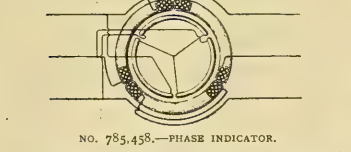
A motor controlled from the switching station operates the switch.

785,403. System for the Rectification of Alternating Currents. Charles F. Burgess, Madison, Wis. Application filed August 15, 1903.

A system for rectifying alternating currents comprises two or more pairs of asymmetric conductors, each pair consisting of two asymmetric conductors arranged in opposition. The outside terminals of each pair are connected to the outside terminals of a corresponding impedance, and the intermediate terminal of each pair are connected to the intermediate terminal of another impedance.

785,405. Electrical Switch. Robert G. Clark, Brooklyn, N. Y., assignor of one-half to U. L. Laughlin, Schenectady, N. Y. Application filed April 16, 1904.

A line terminal, a sliding operating member, a contact member, an operating spring and an interlocking device forming a part of the operating member to prevent the movement of the contact member until the operating member has reached a predetermined point are the essential parts. A stop carried by the operating member limits the movement of the contact member and means set the spring in operative position to move the contact member and close the circuit through the line terminal.



NO. 785,458.—PHASE INDICATOR.

785,407. Self-restoring Heat Coil. Frank B. Cook, Chicago, Ill. Application filed March 9, 1904.

Combined with a resistance body for inclusion in a circuit are an oscillating lever electrically connected with the resistance body, a circuit controlling means adapted to engage the lever and tending to oscillate it and thereby break the circuit and cementing material for holding the lever against oscillation, and means apart from the whole for restoring the lever to its normal operative condition after operation.

785,419. Electric Switch. David E. Gray, New York, N. Y. Application filed June 6, 1904.

An insulating base carries a stationary electric contact. Besides there is a main contact and a switch arm, one of the latter parts having an enlarged head or projection and the other having a correspondingly formed opening. The arm is pivoted on the main contact, movable in a plane parallel to the base and removable after electrical connection is broken with the stationary contact.

785,438. Pressure Gauge. Charles E. Sargent, Chicago, Ill. Application filed September 24, 1904.

The pressure to be measured is transmitted to a column of mercury which, rising in a tube, completes electrical circuits at various heights through contacts entering the tube. The circuits through proper electrical devices indicate the pressures.

785,445. Bridging Circuits for Electric Circuits. Guion Thompson, Duluth, Minn., assignor to the Thompson Safety Appliance Company. Application filed August 2, 1902.

Combined with a nc mally open circuit containing a source of electricity, an electromagnet and a normally open contact is an armature for the magnet adapted when operated to close the contact. A partial circuit comprises a normally closed contact governed by the armature, and normally open contacts including adjoining sections of a railway rail insulated from each other at their opposing ends.

785,446. Electromagnetic Block System. Guion Thompson, Duluth, Minn., assignor to the Thompson Safety Appliance Company. Application filed May 16, 1901.

Associated with a series of normally open electric circuits, each including a source of electricity, is the coil of an electromagnet. A normally open circuit controlling contact is adapted to be closed by the electromagnet when it is energized. A normally closed circuit controlling contact is opened by the magnet when energized.

785,447. Partial Circuits for Electric Currents. Guion Thompson, Duluth, Minn., assignor to the Thompson Safety Appliance Company. Application filed August 2, 1902.

Means carried on the car operate levers which in turn affect the armatures of electromagnets which control the circuits of a signaling system.

785,448. Means for Progressively Establishing and Dissolving Magnetic Spheres of Influence. Guion Thompson, Duluth, Minn., assignor to the Thompson Safety Appliance Company. Application filed August 2, 1902.

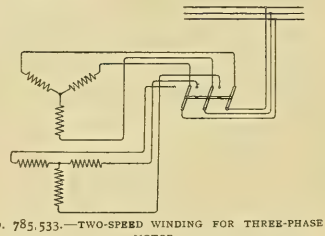
A normally open electric circuit comprises a source of electricity, a normally open circuit controlling contact, the coil of an electromagnet and a distant normally closed contact. An armature for the electromagnet is adapted when operated to close the normally open circuit controlling contact.

785,458. Phase Indicator. Pendleton G. Watmough, Jr., Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 17, 1900.

In an alternating-current instrument are two members mounted so as to be movable relatively to each other without mechanical restraint. Means develop a rotary field in one member and develop in the other member a rotary field having the same direction of rotation as that of the first member. A device for noting the relative movements of the members caused by relative shifting of the fields is also provided. (See cut.)

785,481. Portable Electric Lamp. Henry D. Olier, Jr., Philadelphia, Pa. Application filed September 30, 1904.

Mechanical features of a lamp standard are set forth in the claims.



NO. 785,533.—TWO-SPEED WINDING FOR THREE-PHASE MOTOR.

785,483. Incandescent Lamp Holder. Jonas Feighner, Shelby, Ohio. Application filed September 23, 1904.

A combined globe holder and lamp socket and plug are described.

785,487. Regulator for Alternating Currents. Edward L. Haney, Nashville, Tenn. Application filed September 3, 1904.

Included in the regulator are a transformer provided with primary and secondary windings, a commutator connected with the secondary winding and provided with a movable member for changing the voltage supplied by the secondary winding and clutches provided with movable members. Gearing connects the members together so that the movements of one control the movements of another, while other mechanism connects the clutch members with the revoluble members.

785,499. Electric Generator. William Kaisling, Chicago, Ill., assignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed July 20, 1903.

The features of a small magneto-generator for telephone work are set forth in the patent.

785,516. Electric Arc Lamp. Charles Oliver, Woolwich, England. Application filed February 29, 1904.

The electrodes of this lamp are parallel and point downward, a glass rod being placed rigidly between. As the electrodes are burned away, the rod prevents the free action of the arc. As the electrodes are consumed they are brought down by a weight, which in turn is governed by the movement of the rod.

785,532. Synchronous Motor. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 12, 1904.

In a synchronous motor are an armature structure adapted to receive a distributed winding, and a field structure having projecting poles of a polar pitch unequal to the pitch of the poles produced by the armature winding.

785,533. Two-speed Winding for Three-phase Motors. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 13, 1904.

In the alternating-current motor described there is a three-phase winding and a two-phase winding in the same slots. Means are provided for connecting either winding to the source of three-phase current. (See cut.)

785,535. Electric Furnace. William C. Arsem, Schenectady, N. Y., assignor to the General Electric Company. Application filed August 12, 1904.

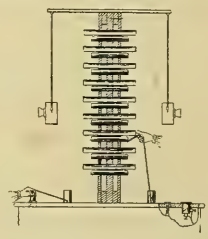
An electric furnace having an air-tight chamber contains a refractory heater and means for supporting material to be heated in close proximity to it and for exhausting the air from the chamber.

785,598. Trolley. Clemens Dillhoff and Joseph Hastreiter, Morgantown, W. Va. Application filed December 13, 1904.

A trolley body has a bifurcated end and a rearwardly extended arm having an aperture at its end, with a trolley harp pivotally mounted in the bifurcated end of the body.

785,624. Telephone Desk Set. Charles T. Mason, Sumter, S. C. Application filed November 29, 1904.

The switching apparatus is supported by a central core surrounded by a tubular casing.



NO. 785,674.—TELEPHONE SYSTEM.

785,626. Socket for Electric Lamps. James A. Mebane, South Boston, Va. Application filed April 30, 1904.

The socket is made in two separate parts having lateral openings which are brought into coincidence when the parts are adjusted together. A spring projects through the openings to lock the two parts together.

785,657. Insulated Step Joint. Bancroft G. Braine, New York, N. Y., assignor to the Continuous Rail Joint Company of America. Application filed February 10, 1904.

Insulating material is interposed between the parts of the rail joint.

785,671. Detonator or Auxiliary Protective Alarm Spark Gap for High-frequency Apparatus. Howard Jackson, Newton, Mass. Application filed July 27, 1904.

A cabinet contains means for impressing on the circuit a high-frequency current. Means mounted on the cabinet in open view give instant visual warning upon the flow of destructive abnormal current, the means being protected from accidental contact.

785,673. Telephone System. Isidor Kitsee, Philadelphia, Pa. Application filed February 24, 1902.

Two or more outlying circuits center in one exchange. An inductorium is placed at the operator's desk for each of the circuits in the charge of the operator, the coils of which are conductively independent. One of the coils of each inductorium is at all times electrically connected to its outlying circuit. A connecting plug also at the desk is supplied for each of the circuits and in inductive relation to the coil.

785,674. Telephone System. Isidor Kitsee, Philadelphia, Pa. Original application filed February 24, 1902. Divided and this application filed August 4, 1902.

A series of jacks for the switchboard consist each of a soft iron core provided with a movable device adapted to connect normally with one part of the circuit to which the jack is connected, and adapted to be moved out of contact with the part through the insertion of the connecting plug. A conductor is connected to a second part of the circuit, the conductor being insulated from the core. (See cut.)

## EXPIRING PATENTS.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on March 27, 1905:

379,944. Commutator for Dynamo-electric Machines. T. A. Edison, Llewellyn Park, N. J.
379,956. Regulator for Dynamo-electric Machines. C. Heisler, St. Louis, Mo.
379,977. Electric Gas Burner. J. Y. Parke, Philadelphia, Pa.
380,010. Electric Annunciator. C. S. Young and G. E. Painter, Baltimore, Md.
380,020. Electrodynamic Machine. G. F. Card, Covington, Ky.
380,053. Machine for Dressing Covered Electrical Conductors. W. H. Bawtree, Providence, R. I.
380,066. Electric Railway. F. M. Speed, San Francisco, Cal.
380,074. Arc Lamp. T. E. Adams, Cleveland, Ohio.
380,084. Galvanic Battery. H. J. Brewer, New York, N. Y.
380,085. Galvanic Battery. H. J. Brewer, New York, N. Y.
380,100. Pyromagnetic Motor. T. A. Edison, Llewellyn Park, N. J.
380,101. System of Electrical Distribution. T. A. Edison, Llewellyn Park, N. J.
380,102. System of Electrical Distribution, T. A. Edison, Llewellyn Park, N. J.
380,103. Conduit for Electric Railways. S. D. Field, Yonkers, N. Y.
380,114. Incandescent Electric Lamp Holder and Cut-out. C. Heisler, St. Louis, Mo.
380,115. Galvanic-current Dynamo-electric Machine. C. Heisler, St. Louis, Mo.
380,138. Induction Coil. E. E. Ries, Baltimore, Md.
380,144. Dynamo-electric Machinery. F. J. Sprague, New York, N. Y.
380,157. Electric Conductor. E. G. Acheson, Pittsburg, Pa.
380,202. Incandescent Electric Lamp Holder and Cut-out. C. Heisler, St. Louis, Mo.
380,241. Fire and Burglar-alarm System. W. A. Barnes, Bridgeport, Conn.
380,261. Electric Vapor Bath. R. F. Jackson and W. R. Pope, Baltimore, Md.
380,271. Electric Arc Lamp. C. W. Adams, Chelsea, Mass.
380,295. Insulated Electrical Conductor. W. A. Phillips, Schenectady, N. Y.
380,301. Electric-light and Globe Protector. W. M. Tompkins, Batavia, N. Y.

# WESTERN ELECTRICIAN

**EVERY SATURDAY**

Vol. XXXVI. CHICAGO, APRIL 8, 1905 No. 14

## The New Horatio N. May Arc-lighting Station of the City of Chicago.

Named in honor of Horatio N. May, who was city comptroller during the term when Hempstead Washburne was mayor of the city, the new power station to supply current for municipal street arc lighting for the city of Chicago represents a distinct engineering advance over the plants previously built. It is placed at Fullerton Avenue and the North Branch of the Chicago River, and is intended to supply current for the street arc lamps on a large portion of the Northwest Side. The plant is designed for an ultimate capacity of 3,000 lamps, while at the present time about 500 lights are in operation. City Electrician E. B. Ellicott has superintended the work of construction generally, and Mr. George W. Le Vin has been the engineer for the city who has had the details of the design and construction work under his immediate charge.

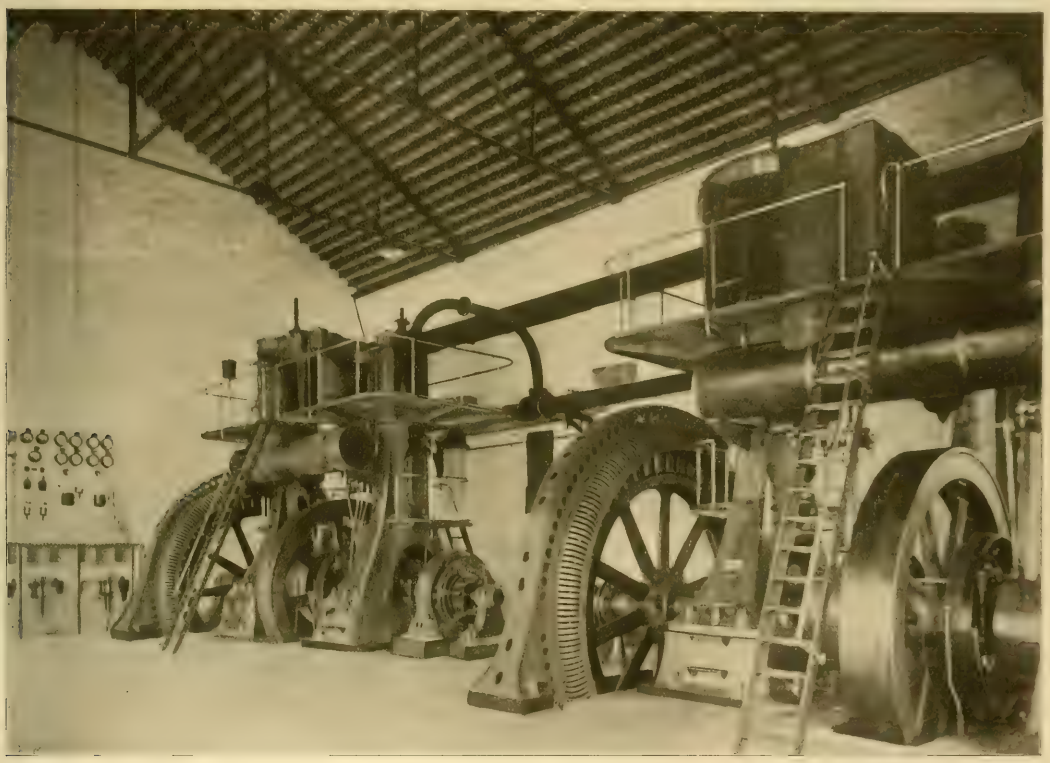


FIG. 1. MAIN GENERATORS AND SWITCHBOARD IN HORATIO N. MAY ARC-LIGHTING STATION IN CHICAGO.

The building is a good brick structure, as shown in Fig. 2, with a tile roof, supported on I beams running lengthwise and carried on steel trusses. It is divided by a brick wall into two parts, a generator room 73 feet long by 53 feet wide and a boiler room 102 feet long and also 53 feet wide, making the total length of the building 175 feet. The walls are 18 inches thick and the interior of the generator room is finished with white enamel brick, giving a handsome and tasteful appearance, as may be judged by a glance at Fig. 5. A 15-ton electrically operated crane serves the various machines.

Taking up first the generating apparatus, as will been seen by Fig. 1, this consists of two units—Buckeye vertical engines direct connected to Bullock alternating-current generators and exciters.

The engines are of standard heavy-duty bored-guide type, cross-compounded and running condensing. The cylinders are 24 and [illegible] inches and the nominal capacity of each engine [illegible] power, but they will operate under [illegible] per cent overload. The exhaust from the low-pressure cylinders is carried into spiral riveted exhaust pipes 24 inches in diameter, which pass straight out from the cylinders and then down to a main exhaust pipe of similar construction beneath the level of the floor, which leads to a Baragwanath siphon condenser. The general construction of this condenser is shown in Fig. 3. The [illegible] 24 inches and the pump [illegible] electrically operated. At the left in Fig. 3 is shown a vertical 30-horsepower motor, which drives a centrifugal pump for lifting the condensing water from a well up to the condenser, which is located above the roof of the building.

The steam enters the condenser through the pipe shown by the dotted lines. At the right is shown the air pump for producing a greater vacuum than could be obtained from the water alone. The water entering the condenser falls in a cone of uniform size, which can be regulated by the hand lever shown, to vary the volume of water. The steam coming in contact with the water cone is condensed and the hot water resulting falls into the hot well below. A peculiar condition arises in the operation of this part of the plant. Since the plant is exclusively for street lighting, the generators are, of course, shut down during the day and are again started at night. As both the air pump and the water pump are driven by motors, which can receive no current until the generators are running, the engines must start non-condensing. In order that they may start, the valve operated by the chain shown in Fig. 3 is provided, which allows the engines to exhaust to the atmosphere until the condenser pumps can be started.

The engines are supplied with governors fitted [illegible] the switchboard, so that in paralleling the generators the speed may be governed to a nicety to secure synchronous operation.

[illegible] ternator developing 65.8 amperes at 6,600 volts. These are three-phase machines with a frequency of 60 cycles at 150 revolutions a minute. The exciters for these generators are mounted on an extension of the main generator shaft. One exciter is plainly shown in Fig. 1 and a similar one is also provided for the unit in the foreground. The exciters are also of the Bullock make and are of 25-kilowatt capacity.

The arrangement of the station is very simple. From the generators the cables first pass under the floor to the switchboard, which is shown at the left in Fig. 1. Here they are first led through the remote-control oil switches, which are mounted in separate brick compartments beneath the switchboard. These compartments or cells may be seen in the picture, as the top marble panel had not yet been put in place when the photograph was taken. The back and partition walls of the cells are of brick four inches thick, the front being made of marble slabs. The oil switches, transformers, regulators and all the apparatus, in fact, which relates to the arc system proper were furnished by the General Incandescent Arc Light Company.

From the oil switches the leads pass to the instrument transformers, and from there to the bus bars.

FIG. 2. EXTERIOR VIEW OF HORATIO N. MAY ARC-LIGHTING STATION.

The front of the switchboard consists of three panels of white marble. The panel to the left is for the exciters and is equipped with two Weston 0-300-ampere ammeters and one 0-150-volt Weston voltmeter. The exciter rheostats are mounted at the back of the board, operable from the front. Two single-throw double-pole switches are also mounted on this panel.

The generator panels are each equipped with three ammeters and a power-factor meter; also synchronizing lamps and handles for operating the field rheostats of the generators. On swing brackets at the end of the board are two voltmeters and a Westing-

The secondaries of the transformers connect to cables which are run in a concrete trench extending around the corner of the room and pass to the regulators installed as shown to the left in Fig. 5. These regulators are placed each in series with one side of one of the lines. Each of these regulators is virtually two combined in one, the two parts being double cross-connected. This practically cuts the electrical strain in two and also provides an increased radiating surface. Furthermore, if one of the halves of a regulator should be put out of service from lightning or other cause, the other half could take care of the regulation temporarily.

From the regulators the circuits pass to a plug switchboard in the opposite corner of the room, not shown in the picture. Here are provided plug switches and an ammeter for each circuit. There are seven panels to this board, of white marble, and the instrument transformers are mounted on the backs of the panels.

A novel switch plug is used, which is a product of the G. I. company, and consists of a combined plug and fuse. The fuse is mounted inside the plug. The shoulder of the plug next to the handle is of conducting material, as is also the tip, the two parts being insulated from each other by a fiber shell, within which is mounted the fuse. When the plug is thrust home connection is made through the fuse between the tip and butt of the plug. When a fuse is blown the plug is withdrawn and another inserted, the fuse being replaced at the convenience of the operator, and with no danger whatever of shock.

Steam-generating equipment has been installed which is entirely adequate to the purposes of the plant. Four Cahall 508-horsepower watertube boilers have been put in. They are the same boilers that did such good service at the Louisiana Purchase Exposition in furnishing steam to the Curtis steam turbine on exhibition, and they are the ones

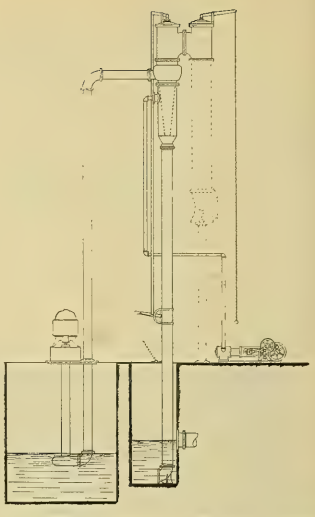


FIG. 3. GENERAL CONSTRUCTION OF SIPHON CONDENSER IN HORATIO N. MAY ARC-LIGHTING STATION.

perintended their erection when they were put in at the World's' Fair plant in St. Louis.

Green chain-grate stokers have been installed, the grate area being 90 square feet to each 500 boiler horse-power. They burn from 40 to 42 pounds of coal per square foot an hour and are self-feeding and

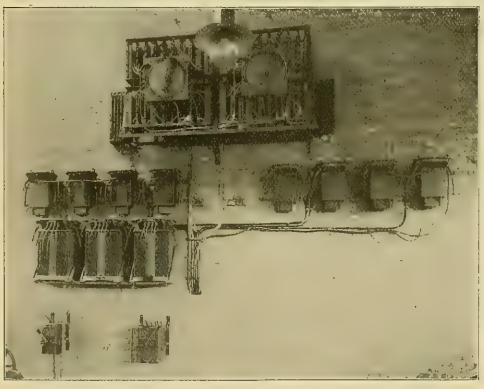


Fig. 4. Field Rheostats and Instrument Transformers Mounted on Wall.

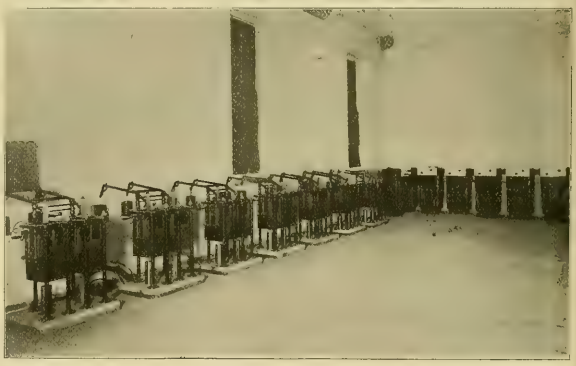


Fig. 5. Regulators and Transformers.

NEW HORATIO N. MAY ARC-LIGHTING STATION OF THE CITY OF CHICAGO.

house synchroscope, to observe in connection with the synchronizing lamps in paralleling the generators.

An interesting point about this part of the installation is the fact that the current transformers, main-generator field rheostats and the auxiliary motor transformers are not mounted in the generator room, but on the wall immediately back of the switchboard and in the boiler room. This apparatus is shown in Fig. 4. At the top of the picture are seen the two generator field rheostats, which are operated from the switchboard platform in the generator room. Of the eight transformers mounted in line just below, the three extreme ones on each side are the instrument transformers, and the two in the center for the synchronizing buses. Below these are seen another set of three transformers which step down the pressure for the motor circuits passing to the two motors operating the condenser apparatus. Last of all are the two compensators for starting these motors.

Going back once more to the circuits at the switchboard, and taking them up as they leave that point, they first are run to the primaries of the seven transformers shown at the rear of the room in Fig. 5. There are seven 80-light circuits now nearly loaded, and these transformers each supply one of the circuits. They take the 6,600-volt current between any two legs of the three-phase generator circuits and transform it up to 7,200 volts, which is the pressure of each arc circuit when fully loaded.

which took the grand prize. The boilers are built for a working pressure of 225 pounds to the square inch, and each is composed of 252 four-inch tubes. The header is of flowed steel, instead of forged steel, the former being a very pliable metal which can be readily bent into any desired curve. The boilers are supplied with low-water alarms, and the steam is collected in two 42-inch drums 24 feet long and one-half inch thick. The boiler installation was under the charge of Mr. Francis Toft, who also su-

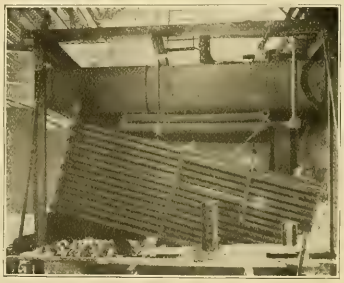


FIG. 6. SUPERHEATER IN HORATIO N. MAY ARC-LIGHTING STATION DURING ERECTION.

self-cleaning. The grates revolve slowly, making one revolution in about two hours, and the parts which are not carrying the fire are therefore always cool before entering again. This part of the installation was superintended by Mr. F. A. Kuehnel.

One point about the plant which marks it as particularly up to date is the installation of superheating apparatus. The boilers are equipped with Foster superheaters designed to superheat the steam 125° Fahrenheit on a pressure of 160 pounds, when the boilers are working at their rated capacity. The superheaters are placed longitudinally, as shown in Fig. 6, a view taken during construction, and occupy the space between the drums and the tubes, receiving the furnace gases just after they make the first pass.

The construction of the superheater consists of cast-steel headers and individual return bends, into which are expanded cold-drawn Shelby tubes. Rings or gills of cast iron are shrunk over these tubes along their entire length. Within the Shelby tube is centered another tube of smaller diameter and having both ends closed, thus causing all the steam to flow through the thin annular space between this inner and outer tube, effecting a quick superheat under all conditions of load. The cast-iron rings make it possible to do away with a flooding device and the extra connections therewith required.

In this superheater the gills not only serve to increase the effectiveness of the heating surface and to preserve the steel tube from injurious action of the gases, but also provide a mass of metal in which

a large amount of heat units become stored up, thus acting as an accumulator against peak loads and changes in the temperature of the furnace gases.

After leaving the boilers and superheating apparatus the steam is carried to the engines through an extra heavy 12-inch steam main with eight-inch bends, to the boilers and engines. The main steam line is carried on iron brackets on the side walls, and is mounted upon rollers on the brackets, to allow of longitudinal expansion.

A good draft for the furnaces is secured by a round brick stack 175 feet high and with an internal diameter of 10 feet. This is connected with the furnaces by a boiler breeching having a cross-section of 48 square feet.

Although not differing much from standard practice, that part of the system outside of the generating station possesses some features of interest.

FIG. 7. STANDARD ARC-LAMP MOUNTING USED IN CITY OF CHICAGO.

Most of the system serves a part of the city which lies across the North Branch of the Chicago River from the power house, and the cables are laid on the bottom of the river. The rest of the system is overhead work, however. The lamps are of the series enclosed type, with 75 volts drop across the arc and carrying 6.5 amperes. They were furnished by the G. I. company. A method of mounting the lamps, which is the standard practice in Chicago, has been employed, as illustrated in Fig. 7. An iron bracket is used, as shown in the cut, and upon this the lamp is mounted rigidly. Thus there is no swinging in the wind, with consequent wearing of the insulation on the wires.

Mr. J. Y. Rahilly, who is in the employment of the Buckeye Engine Company, is at present in charge of the plant, but when all the work has been completed and the plant has been accepted by the city, Mr. H. W. Watts will be the engineer in charge. The wiring work was done principally by Mr. W. C. Robinson.

## Subway Plans in New York City.

The New York city rapid-transit commissioners on Thursday of last week considered revised plans and reports for new subways and elevated lines. The original tentative schemes involving an estimated outlay of $250,000,000 have been reduced to an estimate of $50,000,000 less.

The details of the various schemes are voluminous and complicated. In broad outline the plans provide for four four-track subways from the Battery to the Bronx, with routes laid out to prevent the creation of a monopoly and to attract rival bids. The routes are substantially under First, Third, Seventh and Ninth Avenues and are calculated to serve efficiently the pressing needs of both the East and West Sides of the city. There are also to be cross-town subways either for cars or moving platforms on Fourteenth, Twenty-third, Thirty-fourth and Fifty-ninth Streets, with mutual transfer privileges.

To connect Manhattan and Brooklyn there is a plan for a four-track subway from East New York along the Long Island shore to the Williamsburg Bridge, and then on the Manhattan side, continuing under Delancy Street to the new Manhattan terminal of the Brooklyn Bridge. For Brooklyn also there are outlined subways under Fourth, Gates, Bedford and Lafayette avenues towar dthe suburbs of the borough, and another under the Eastern Parkway. These Brooklyn routes may be regarded as controversial, the interests of Brooklynites being highly diversified. A special line is provided to connect Beekman Street with Montague and Court Streets, Brooklyn, allowing of intercommunication between the new lines and the East River Tunnel.

The government of Hamburg, Germany, by treaty with Prussia has agreed to the construction of a rapid-transit electrical trunk-line railway from Blankenese to Ohldorf.

## Lightning Arresters for Power Circuits.

By R. Scott

Part I.

Notwithstanding numerous apparently conclusive arguments to the contrary, the lightning arrester for power circuits is still in a stage of progressive development. Unfortunately the present and unavoidable ignorance concerning the nature of lightning discharge materially retards this development. However, the number of new devices which are being brought out from time to time shows a marked decrease within the last few years.

Every circuit containing translating or generating devices should be protected by some form of lightning arrester. In the case of generating apparatus these arresters are usually connected near where the external circuit is connected to the switchboard buses. Intermediate between this point and the generator choke coils are placed, which lessen the probability of such a discharge reaching the machine itself.

Aerial lines unprotected by tall trees or other high-conducting mediums form a convenient path for discharging thunder-clouds. When passing through a treeless country, therefore, they should be protected at frequent points along their length by approved lightning arresters.

Lightning subjects electrical apparatus to two forms of injury—grounds and short-circuits. A ground is set up by a disrupting of the insulation of the apparatus by an abnormal potential rise. Such a potential rise must be very considerable, on account of the efficient insulation usually employed on a network. Short-circuits are caused by static disturbances connecting (by the initial arc) adjacent conductors subjected to the full dynamic potential. Abrupt static waves concentrated at local points are the usual cause of such conditions. When such a local wave is prevented from passing out of that part of the circuit, limited by inductive devices, then a heavy strain is put upon the insulation of the system included between these devices.

Conductors having the full or partial potential of the system between them and spaced a short

FIG. 1. DIAGRAM OF STATIC CHARGE.

distance from one another are thus liable to become connected by a static spark resulting from the above condition, which allows the destructive dynamic current to flow by the establishing of an initial arc. It is evident therefore that lightning protection signifies the fulfillment of two conditions—protection against permanent grounds and protection against short-circuits. It is therefore not necessary that an electrical storm be in progress to set up deleterious conditions.

The function of a lightning arrester is primarily to take care of periods when an abnomal static potential with respect to the potential of the earth exists. An arrester therefore must possess two functions—first, that which will assure the prevention of an arc at the spark gaps, and second, that which will prevent a rise in potential. Since these functions are anything but mutual, it is evident that one must be carefully brought out to the exclusion of the other, or both must exist on a similar basis. For these reasons the low-equivalent arrester possesses desirable qualities.

The action of a simple alternating current in charging statically a line wire may be graphically represented by Fig. 1. The line (AD) represents zero static potential, while the varying ordinates within the shaded area represent the changing static conditions which the line undergoes, owing to the impulses of potential received. Such charging and discharging will not result in any harm, providing there is an absence of condenser effect and the coincidence of other static conditions.

Let us assume (Fig. 2) that two static waves (A) and (C) pass along such a line, these waves being displaced in maxima and minima by any given portion of a period. They will set up a resultant wave (B), which imposes much greater stress upon the insulation of the system. This potential may overcome the air gap of a properly designed ar-

[illegible]

FIG. 2. CURVES OF STATIC STRESSES.

choke coil, while a rapid rise [illegible] a high inductive factor. On the other hand, it is not advantageous to introduce into a circuit an excessive inductive resistance; and also choke-coils must not overheat and destroy their insulation when subjected to severe conditions. But a highly inductive choke-coil requires many turns and sets up a great amount of heat. It is thus seen that we have more or less antagonistic requirements. For this reason it is necessary to so surround the choke-coil by heat-radiating arrangements that the generation of heat will not prove injurious to the coil. This may be effected by immersion in a vessel of insulating oil.

A high-static potential may be produced by the opening of a switch or circuit breaker when a short-circuit exists, or by the sudden loading of transformers. Ground protection is best secured by means of lightning arresters, while choke coils or static interrupters prevent short-circuits.

Instruments designed without moving systems should be given preference, except under conditions that warrant frequent inspection. In the horn lightning arresters, which were first introduced by Thomson, an electromagnet is employed to blow out the arc incident on the short-circuiting of the system when a static discharge has passed. Such an arrangement is shown in Fig. 3, and consists of a double electromagnet core (A) provided with two solenoids (H). One end (S) of this double solenoid is connected to the generator or feeder circuit, the other end (N) being connected to the line and also to one of the horns of the instrument. The other horn is connected to ground by means of the conductor (R). These horns are mounted upon insulating pieces (C) so that there will be no possibility of a discharge short-circuiting the magnet coils. The discharge coming from the line

FIG. 3. THOMSON HORN ARRESTER.

passes across the air gap (P) and to ground; this results in the generator sending a current around (H) across the air gap and to ground, thus setting up a short-circuited condition. The magnetism produced by (H) and set up between the magnet poles (A) reacts upon the magnetism set up by the arc across the gaps and blows out or disrupts the latter, thus leaving the arrangement in its normal condition.

A modified form of Thomson's arrester which does not require an electromagnet is shown in Fig. 4. Upon a convenient support (E) the insulators

(D) are mounted; fastened to these insulators are the metal caps (A), to which the horns are rigidly attached, these horns being provided with iron shoes (T), positioned as shown. (G) is connected to ground and (R) to the network or generator to be protected. A discharge passing across the air gap separating the horns sets up magnetism in the shoes, which, reacting upon the magnetism set up by the arc, effectually disrupts the latter. The disadvantage of this instrument is the fact that the horns must be made more massive in construction than is the case with the device already described, due to the fact that they are liable to hold the arc for a longer time than is the case with the electromagnet form. The arc, however, in every case is finally effectively disrupted.

On account of the fact that an arrester is exposed to conditions which do not obtain in other apparatus, it is necessary that very careful installation and insulation be of primary importance. On high-tension circuits good insulation is a very difficult matter, not only on account of the potential of the circuit but also on account of its great arcing distance in conjunction with the static discharge.

The assumption is that every active part of an arrester will at some time in its existence be subject to the full potential of the line. Arresters connected to opposite line wires should be separated by heavy insulation or by a wide air space and should never be mounted upon the same backing.

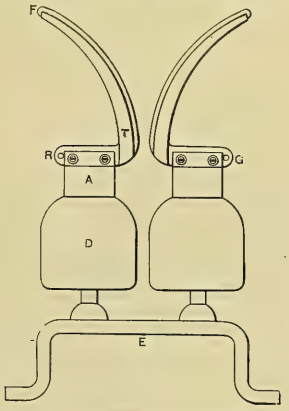



FIG. 4. MODIFIED HORN ARRESTER.

All arrester connections should be as short and as straight to ground as possible. The ground connection should also be very effective in order that no insulation will be maintained on the ground side of the arrester.

When plate arresters are used it is necessary that the jaws be carefully adjusted or separated by means of an insulating template in order that the proper separation may remain unaltered. The plates and their surroundings should be kept perfectly free from dust accumulations in order to prevent unnatural short-circuiting. The arrester should be surrounded by and located upon insulating incombustible material to prevent the possibility of fire resulting from the fusible metal coincident with the arc established during the operation.

Arresters must be provided with a good ground connection, or otherwise they may not give the protection required. The wire passing from the arrester to the grounded plate should not be less than No. 4 B. & S., which should be soldered to a galvanized iron or copper plate one-eighth inch in thickness and having a surface area of 10 square feet. This plate should be sunk in moist ground, preferably where a well or stream is located; if this cannot be accomplished a long iron rod should be driven in the ground, the ground wire being connected to the rod and also to all water or gas pipes that may be convenient.

The usual methods of making a ground connection under favorable natural conditions are generally effective, but when the proper soil is not at hand or where the ground plate cannot be placed within a spring or stream of continuous water a high resistance will usually be interposed. It is an erroneous idea to suppose that wet clay or pure water affords a good ground connection. On account of their high specific resistance and their usual proximity to rock or slate formation, a ground thus effected is not to be recommended. For this reason the ground wire should be connected to a system of pipes or other underground conductors which extend over a considerable area.

On account of the differences existing in the wave form of generators and the varying capacities of lines it is not best to judge the size of the air gap interposed in an arrester by the voltage of the system to which it is connected. For this reason adjustable series spark gaps should be provided so that the sparking conditions may be readily met with. The gap in an arrester must also be so carefully adjusted that it will take care of all rises of potential in a circuit, however great the rapidity of these rises.

The low-equivalent arrester consists essentially of

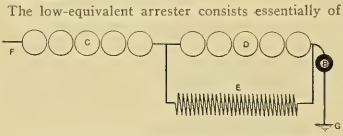



FIG. 5. DIAGRAM OF LOW-EQUIVALENT ARRESTER.

a number of small air gaps connected in series with the line and also connected in series with a second set of air gaps, shunted by a resistance, a low resistance being included in series with the above to limit the dynamic current flowing after operation of the arrester. The arrangement of a low-equivalent arrester for protecting a 7,500-volt circuit, is shown diagrammatically in Fig. 5. The series gaps are shown at (C), the gaps (D) being shunted by a high resistance (E). In series with all of the units is included the resistance (B), the ground connection being at (G). When a discharge passes from the line to (F), and through the arrangement, the series gaps are broken down, as are also the shunted gaps, due to the resistance which the discharge encounters at (E). The shunt resistance removes the arcs occurring at the gaps (D), and also aids to remove the arcs at (C), in conjunction with the resistance (B). The function, therefore, of the shunted resistance is to not only withdraw the arcs from the shunted gaps after a discharge, but also so to reduce the current that the series gaps can also disrupt the arcs.

One of the units used in a low-equivalent arrester system is shown in Fig. 6. This unit consists of five small metal-alloy cylinders (E), held between the porcelain blocks (S) and (O). A small air gap is included between each cylinder, the total air gap in series being four times that between adjacent cylinders. The end cylinders are connected to the rods (A) and (T), which pass through the slate base upon which the arrester is mounted, connections being made to the units at the rear of this board. The non-inductive series resistance is for the purpose of limiting the current set up initially by the discharge, thus saving not only the cylinders, but also preventing a short-circuited condition of the system. The number of series gaps is such as to withstand the normal voltage, with a factor of safety for abnormal conditions, which will exist when one line is grounded or when a low-potential static disturbance is set up. The shunted gaps provide an easy path for the lightning discharge and also a high-resistance path for the dynamic

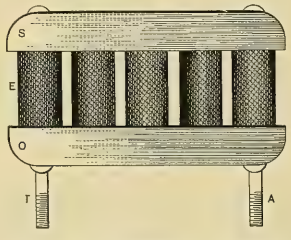



FIG. 6. UNIT OF LOW-EQUIVALENT ARRESTER.

discharge after the arcs have been removed from these gaps.

On high-potential circuits the low-equivalent arrester is provided with an adjustable auxiliary series spark gap. By means of this addition it is possible to adjust very closely the sparking potential of the system.

The purpose of the low-equivalent arrester is to provide a non-arcing arrangement, and also to give the greatest possible protection to a high-voltage alternating-current system. Because of the change in potential which an electrostatic surge undergoes from time to time, it is necessary that the arrester discharge freely, or the protective path afforded by choke coils or other inductive devices will not be utilized, due to the comparative slowness with which the electrostatic potential may rise. It is thus evident that with a lightning arrester which does not freely discharge at all times, when a dangerous potential exists, whatever the other conditions, a dangerous state of affairs will accrue.

In Fig. 7 a Garton arrester is shown in part section and part elevation. The line (on a grounded interurban-railway circuit) is connected at (L), the ground connection being at (V). An inductive discharge will pass from (L) to (V) as follows: (L, H, E, R, D, J, F, V), owing to this being the path of least inductance. The initial arc thus set up at (F) will be followed by a dynamic current; this current will take the path of least resistance, or (L, C, K, H, E, D, V). The reason for this is the fact that the non-metallic resistance rod at (S) has a resistance of approximately 150 ohms; the resistance between (K and (H) being 50 ohms, and between (L) and (K) 100 ohms, and being connected in shunt with (K-L), will be the path selected by a dynamic current on account of its lower resistance; while an oscillatory discharge will more readily pass through (S), on account of the latter being practically non-inductive. When current passes through (C), the iron rod (D), which is connected to the rod (R) and the flexible cable (E), is very

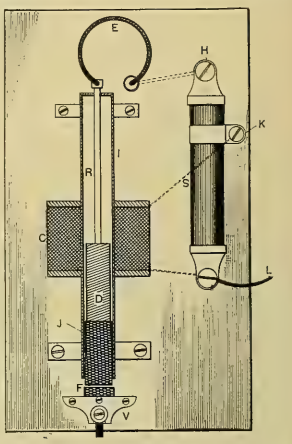



FIG. 7. GARTON ARRESTER.

quickly raised (owing to the absence of any damping or retarding action), and thereby breaks connection with the fixed carbon rod (J). The incident arc is quickly suppressed, due to the inertia of (D) and the fact that the arc is enclosed within an insulating and practically air-tight tube (I). The arc is also very small, owing to the high resistance connected in series, and therefore is quickly smothered. As soon as the circuit is opened, the iron rod returns to its position upon (I), and the apparatus is ready for another operation.

[*To be concluded next week.*]

## Parcel Carrying on English Street Railways.

The Manchester street-railway committee has for some time had under consideration the details of a scheme for carrying parcels on the street cars in that city. Writing from Hull, England, on February 10th, Walter C. Hamm, United States consul, says: "This week the committee met and adopted a scale of charges for parcels, inclusive of the charge for delivery, for two areas, the 'inside' and the 'outside.' The 'inside' area will include the whole of the city of Manchester, the borough of Salford, and the township of Stretford as far as Warwick Road. The 'outside' area will include the suburbs which are around the district thus outlined and within the tramway's circuit. Parcels will be delivered to all parts covered by the scheme at intervals of not more than a quarter of an hour. It is expected that the service will be put into operation next month. The following are the charges for the two areas:

| Weight. Not exceeding— | Inside Service. | Outside Service. |
|---|---|---|
| 14 pounds | 4 cents | 6 cents |
| 28 pounds | 6 cents | 8 cents |
| 56 pounds | 8 cents | 12 cents |
| 112 pounds | 12 cents | 16 cents |

"Manchester, with Salford and Stretford, all included in the 'inside' area, has a population of about 800,000 people. The 'outside' area includes a number of suburban towns and villages. Persons who have been discussing parcel-carrying schemes by trolley cars in American cities will watch this experiment with considerable interest."

## The Zoelly Steam Turbine.

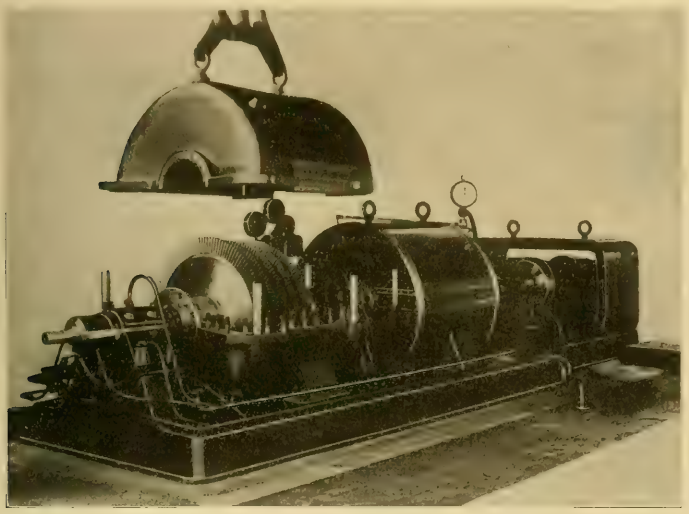
By Franz Koester

A large number of experiments have recently been tried by Escher, Wyss & Co. at Zurich, Switzerland, in the development of the Zoelly steam turbine to a commercial basis. It may therefore be of interest to give here a description of the construction of this turbine.

As will be seen in the accompanying illustration, this turbine consists of a solid bedplate on which are mounted the high and low pressure chambers, with one central and two outboard bearings, the high pressure chamber, of course, being next to the governor. In the large sizes there are two shafts—one for each chamber—connected between two central bearings.

It will be noted that the turbine and generator are mounted on separate bedplates. This is due to the fact that the unit illustrated is an experimental one. In practice it is customary to make provision for the mounting of the generator on the turbine bedplate. The turbine chambers themselves are covered with planished steel plates, horizontally divided so as to facilitate dismemberment.

Steam enters the high pressure chamber through the throttle valve from below, is discharged below and enters the low-pressure chamber, being finally discharged to the condenser, which may be conveniently located under the turbine, which, on account of the light foundation required, may be mounted on a steel structure. The location of the condenser directly beneath the turbine with as short a connection as possible is extensively used on the continent of Europe. As the exhaust steam does not contain any oil, either the jet or surface type of condenser may be used, the former preferably when the cooling water is used as boiler-feed water; the latter when the cooling water is not used as boiler-feed water, but only the condensed steam is so used. Of course, this turbine may be used with any other type of condenser as well as non-condensing.



500-HORSEPOWER ZOELLY STEAM TURBINE, WITH CASING RAISED FOR INSPECTION.

The Zoelly turbine is an impulse turbine, usually of multiple-step design, the steam being expanded in the stages. The steam, after passing the throttle valve, enters the stationary guide buckets, and is deflected into the buckets of the first wheel, thence to the second guide buckets, and buckets of the second wheel, etc., through all the stages of the high-pressure chamber. In each stage the velocity of the steam is decreased, due to expansion and drop of pressure. From here the steam passes through the low-pressure chamber in the same manner. The running wheels are forged of the best Siemens-Martin steel, and each is separately keyed to the shaft. In the circumference is machined an L-shaped slot, in which are alternately placed the buckets or vanes and their distance pieces. A rim is now riveted to the circumference, completing a ⊥-shaped slot, which holds the vanes rigidly in place. All vanes are made of nickel-steel and highly polished, to reduce the friction losses to a minimum. Nickel-steel was chosen on account of its great strength and [illegible] and [illegible] base out, so that in large sizes there is a sufficient factor of safety at the point of [illegible]. With this tapered design it is possible to use longer vanes without increasing the liability of failure. The bending moment [illegible] resisted by the distance pieces, which are made of special shape. This allows a [illegible] section of metal. On account of the [illegible] of the vanes great lateral strength is obtained. The factor of safety of the vanes being taken at from eight to ten and the steam pressure being [illegible] it will be seen that failure in the vanes is very improbable, even at extremely high peripheral speeds. Under these circumstances it will be noticed that on account of the high allowable peripheral speed, few wheels or stages are required, thus making possible a more compact and therefore less expensive turbine. After being built, the wheels are accurately balanced and tested by running at a much higher speed than normal.

Between two consecutive runners are placed partitions, tight in the turbine casing. It is necessary to make these partitions of sufficient strength to withstand the unequal pressure of the steam on the two sides. These disks are made of steel, on the circumference of which are placed the buckets. Outside of these are placed wrought-iron rims which are bolted to the disks, these rims having projections which join the rims of the next disk. The end thrust is transmitted through the successive guide wheels to a projection on the inside of the turbine case. The boss of the runner runs in the boss of the disk, the base of the latter having several grooves turned in it, designed so as to trap the steam and prevent its leakage.

The guide buckets are set in slots in the disks and held in place by wrought-iron rings bolted to the partitions. These partitions being bolted to the cases, which, as previously stated, are divided, it was natural to divide the disks also so that when the top half of the case is removed the upper halves of the disks are also removed, making thorough inspection of the runners easy.

The shafts extend through the turbine casings in combination steam and metal packing, as previously described.

The throttle valve, after the turbine is started, is controlled by a fly-ball governor, which acts as follows: The connection rod between the governor and the throttle valve acts on a relay valve. Two pipes connect an oil (or water) reservoir with either side of the relay valve in such a manner that, if the speed increases, one of these pipes is opened, allowing the oil which is under pressure to flow into a cylinder, partially closing the throttle valve, and thus decreasing the speed. In like manner if the speed decreases oil enters the other side of the cylinder, opening the throttle valve farther, thus increasing the speed. The oil pressure is furnished by a pump operated directly from the turbine shaft [illegible] the vanes.

In order that the turbine may operate successfully [illegible] pently of the main governor. If the speed should increase an abnormal amount (that is, more than [illegible] ating a spring which automatically shuts the throttle valve, thus stopping the turbine.

The clearances between the moving parts and the stationary parts of this turbine may be fairly large without decreasing its efficiency. This reduces the liability of fouling between the runners and the guide wheels, due to unequal expansion. A thrust bearing is provided to prevent any axial movement of the shaft.

The pillow block is divided in a line concentric with the center of the shaft, as will be seen in the accompanying illustration, which materially assists in the alignment of the turbine.

Oil is supplied to the bearings under pressure by means of a pump operated from the main shaft by means of a worm gear. After passing through the bearings the oil runs to a reservoir inside of the bed plate, where it is cooled by contact with coils and again pumped to the bearings. This cycle is continuous, thereby effecting a saving in oil. The shafts of the high-speed turbines are "elastic," the diameter being so chosen that the critical speed is below the normal, while in the low-speed turbines the reverse is true.

Following are the results of experiments performed on the Zoelly turbine by Dr. Stodola in Zurich, in conjunction with Mr. Wagner of the Zurich Electric Works. The turbine used was that shown in the accompanying illustration, with normal rating of 500 brake horsepower, running with 147 pounds gauge pressure at 3,000 revolutions per minute. This turbine had 10 stages and was direct connected to a Siemens-Schuckert three-phase alternator. The latter was separately excited, the input being subtracted from the total output of the generator. The condenser pumps were driven partly by a separate steam engine and partly by an electric motor, and part of the water was drawn from the city mains and part from the works well. The determination of the power thus consumed was very difficult and has not been taken into consideration. This may amount to two or three per cent. of the total input. The pressure and temperature of the steam were measured close to the turbine, in the high and low-pressure chambers and their connecting pipe and in the condenser. Every precaution was taken in order to obtain complete and thorough tests and readings, and notes were made frequently. Tests were made with both saturated and superheated steam, consuming from 20 to 180 minutes. Measurement of the steam consumption could be made only by weighing the condensed steam.

The alternator was run at a constant voltage of 600 and the load kept constant by means of a water rheostat. The voltage and current were measured in each phase. The same care was taken to obtain complete data in regard to the generator as well as the turbine.

Running under full load for 80 minutes with 166 pounds dry saturated steam, a consumption of 13.5 pounds per indicated horsepower was noted. Running under the same load for 70 minutes with 193 pounds and 140° F. superheat the steam consumption was 11.8 pounds per indicated horsepower. The steam consumption per indicated horsepower is given, as this is the usual custom with reciprocating engines. During the extensive tests it was noticed that for each increase of temperature of 9° F., other things being equal, the steam consumption was reduced one per cent. It will be noticed from this that the higher the superheat the lower the steam consumption—a fact which many American engineers who believe in moderate superheat seem to overlook, but which the continent engineers take advantage of and which is probably one of the chief causes of the higher efficiency of European turbines. In the above tests the superheat was comparatively low, as on the continent 300° F. of superheat is frequently used, thus reducing the steam consumption to about nine pounds, as has often been proved.

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## DATES AHEAD.

Iowa Electrical Association (annual meeting), Hotel Julien, Dubuque, Iowa, April 19th and 20th.

American Electrochemical Society (annual meeting), Boston and Cambridge, Mass., April 25th to 27th.

Association of Railway Telegraph Superintendents (annual meeting), Read Hotel, Chattanooga, Tenn., May 17th and 18th.

National Electric Light Association (annual convention), Denver, June 6th, 7th and 8th, and Colorado Springs, June 9th, 10th and 11th.

National-Interstate Telephone Association (first convention of consolidated telephone associations), Chicago, June 21st, 22d and 23d.

Ohio Electric Light Association (annual convention), Hotel Victory, Put-in-Bay, August 16th to 18th.

THE OSMIUM LAMP has not met with the favor which was predicted six years ago, when it was invented by Auer von Welsbach. One of the principal reasons for this is no doubt the fact that osmium, though brittle when cold, is soft when heated, and the lamps must therefore burn in a definite position. Some interesting facts about the development of this form of illuminant were brought out in a paper recently read by Fritz Blau before the Elektrotechnischer Verein in Berlin. Mr. Blau said that when the manufacture of the osmium lamp was taken up by the Deutsche Gasglühlicht Actiengesellschaft the highest voltage that the lamp could stand was 27 volts. After the lamps had been perfected to burn at 37 volts, they were put on the open market. The lamp voltage was soon after brought up to 44 volts, and during the last few months a considerable number of 55 and 73-volt lamps have been sold. Quite recently 110-volt lamps have appeared. Structural changes occur very rapidly when the lamp is run at less than 1½ watts a candlepower. Still, lamps burning only one watt a candlepower have been observed to burn several hundreds of hours without a decrease in light. The osmium lamp is also available for very low voltages, and a large number of two-volt lamps for mines are in use with portable storage batteries. It is not possible to state definitely the life of an osmium lamp, but 5,000 hours has, it is said, been repeatedly exceeded.

THE CHICAGO BRANCH of the American Institute of Electrical Engineers is entitled to a word of praise for the number of good original papers and the character of the discussions that have characterized the meetings of this season. The topics selected for treatment have been of practical, timely interest, diversified to meet the requirements of the different branches of the industry, and the men contributing papers or prepared discussions have been well qualified to speak with knowledge. It is to be remarked, too, that the discussions have attracted a number of out-of-town members and visitors, many of these coming long distances to be present. The character of the work which is being carried out this season may be judged by the following list of titles of papers prepared especially for the Chicago meetings: "Recent Observations of European Lighting and Railway Practice," by James Lyman; "The Metering of Polyphase Currents," by Prof. J. D. Nies; "Use of Cement in Central-station Construction," by E. B. Clark; "Some Notes on the Maintenance of Underground Structures," by John M. Humiston, and "The Use of Small Carbons in Enclosed Arc Lamps," by George N. Eastman. In addition, the paper to be read at the next Chicago meeting will be on the interesting subject, "Effects of Laws of Probability on Telephone Traffic," by M. C. Rorty. This is a good assortment of helpful papers, and those so far given have justified their titles. Credit is due Mr. K. B. Miller, the local chairman, Mr. P. Junkersfeld, the local secretary, and the other gentlemen on the local committee, for their effective work.

PARIS, like New York, has an "electric-lighting situation," as Chicago has its "traction situation." There are six central-station companies in the French capital. The franchises of four will expire in April, 1907, and those of the other two in August, 1908, and December, 1908. The Municipal Council is socialistic in its tendencies, but, although it appears that the existing distributing networks will become the absolute property of the muncipality after the expiration of the companies' franchises or licenses, the council seems to be in doubt just how to proceed. It may, indeed, buy the generating plants, service wires and meters, but the companies appear to insist that the mains must be included in the deal, although it is conceded, as we understand it, that the street mains, by themselves, become automatically the property of the city at the expiration of the franchises. There is the alternative of building, at a cost of something like $20,000,000, an entirely new system.

A technical committee has made a report in which it is stated that the entire plant should be of 80,000 kilowatts capacity, the generators to be of 5,000 kilowatts each, driven by steam turbines and placed in three stations located on the banks of the Seine. Three-phase current at 8,000 to 12,000 volts is recommended for transmission, with direct current at 110 volts for distribution in the central districts and two-phase current in the localities of lesser demand. The latter is chosen by the committee in spite of its greater cost in comparison with a four-wire three-phase system, on account of the greater ease in balancing and the simplicity in the arrangement of the circuits. Motor-generators are given the preference over rotary converters, and the frequency is fixed at 50 cycles a second. The works cost of current, including all charges, is estimated at 6.3 cents a kilowatt-hour. On this basis of cost a differential system of charging is recommended, with a first price for the first 400 hours per annum of 10 cents a kilowatt-hour, after which two cents a kilowatt-hour is to be charged. But these 400 hours are not the first 400 hours of maximum demand, nor are they estimated on the actual consumption of the translating devices installed; they are the first 400 hours' use of the nominal rating of the meter. If the consumer has a two-kilowatt meter, his first 800 units per annum are charged at the higher rate, and the remainder at the lower rate. The plan is a novel one.

Even if the programme of building a new system should be carried out, the plant could not be provided in working order before the expiration of the companies' franchises. Thus, to avoid discontinuity of supply, it would be necessary, for several years, to use the existing material owned by the companies. This gives the companies a further leverage in the negotiations, which, at present, appear to be at a deadlock.

JUDGE DUNNE'S election as mayor of Chicago on a platform demanding the immediate municipal ownership and operation of the street railways of the city is no surprise. On previous occasions the voters of the city have expressed their sentiment in favor of municipalization by an overwhelming preponderance. In the case of many electors, too, it is no doubt true that while they do not love municipal ownership more, they love private ownership, as exemplified by the street railways of Chicago, less. The street-railway companies of this city may, in large degree, thank themselves for the election of a municipal-ownership mayor. There were, of course, other considerations that influenced the voting, such as Mr. Harlan's personality and his previous relations to the political party whose standard he bore; but in a general way it may be assumed that a considerable proportion of the citizens reasoned that municipal operation could not make the street-railway service of Chicago any worse and might possibly make it better.

The straight-out socialist vote was less than half what it was in Chicago last fall at the presidential election, but yet exhibits a substantial increase—from 11,000 to 20,000 votes, in round numbers—over the vote of that party for mayor two years ago. As was expected, the rather obscurely worded "questions of public policy" relating to the granting of street-railway franchises showed a decisive vote against the granting of any franchise to any street-railway company. This vote, however, is merely advisory—not mandatory.

Mayor Dunne, who is undoubtedly an able, conscientious man, honestly believing in the principle of public ownership, has a difficult task before him. The "traction situation" is entangled to the last degree with legal complications, and eminent lawyers employed by the companies will do their utmost to retain for their clients the street-railway business of this great city. The mayor is not all-powerful; the City Council, made up of 70 aldermen, must pass the needed legislation to make municipal ownership effective. Judge Dunne promises to proceed carefully and deliberately, first obtaining the opinion of a commission of experts as to methods of procedure. "And then, acting upon their advice and the advice of the ablest lawyers that I can enlist, we shall proceed to take such steps as will encompass municipalization of these plants at the earliest possible moment."

A municipal-ownership mayor has been elected, but municipal ownership itself is a long way from realization. No one can predict how or when it will be accomplished, if at all. The mayoralty campaign is over, but unless all signs fail there will be a long and bitter fight before the successful candidate sees his pet project realized. The mayor-elect professes to expect to see municipal ownership within the term for which he is elected—two years—but it is likely that he will be doomed to disappointment.

## The Public Lighting Inquiry in New York City.

The committee appointed by the state Legislature to investigate the cost of public lighting in New York city commenced its inquiry on Thursday, March 30th, under the chairmanship of Senator F. C. Stevens. Legal and other representatives attended from the Consolidated Gas Company, the New York Edison Company, the Brooklyn Union Gas Company, the Kings County Electric Company, the Mutual Gas Company and the Empire Subway Company. An enormous mass of documents was brought into court.

Charles E. Hughes, counsel for the committee, first read statutes dating from 1823 relating to gas and lighting and then outlined the history of the various local companies and their subsequent consolidations. He produced contracts and details of capitalization, and in all cases insisted upon citing original documents.

The first witness was Benjamin A. Whiteley, assistant treasurer of the Consolidated Company, the treasurer, Robert A. Carter, being reported ill. Mr. Whiteley is also assistant treasurer of the subsidiary Astoria Light, Heat and Power Company and treasurer of the Brush Electric Illuminating Company. Questioned on the Consolidated capitalization, Mr. Whiteley's counsel objected and asked for certain figures to be given in private, but this was overruled. Subsequently counsel said that the Consolidated had nothing to conceal.

Amid a mass of details on the first day Mr. Hughes came out with an allegation that the $9,200,000 of the original Edison capital had been represented twice over in the consolidation, seeing that the old Edison stock had been previously held by the old New York Gas and Electric Heat and Power Company. In reply to this James A. Bennett testified that the Consolidated company had never received any dividends from the Edison stock.

On Friday, March 31st, questions were asked to ascertain the actual value of the Consolidated company's investments in plants. The amount on the books was about $40,000,000, but evidence showed that the present valuation of the plants was $27,278,576.50. The company had been paying from eight to 10 per cent. on a nominal capital of $80,000,000. The income from holdings last year was nearly $1,000,000, the remaining profit being from the gas business, which last year amounted to 13,170,760,180 cubic feet, realizing $13,167,609.70. The cost of production of gas was $8,513,441.24, which, plus dividends and less taxes, made a net income of $5,737,400. This, with a previous surplus, provided a dividend of 8½ per cent.

Mr. Charles F. Mathewson, counsel for the Consolidated company, explained that whereas the balance sheets showed a plant valuation of nearly $48,000,000, this represented an accumulation of plants for nearly a hundred years. The lower figure showed the taxable value of the plants less real estate.

On Saturday it was testified that the Consolidated company paid among other items the sum of $9,698,451.98 for the property of the United Brush Company and $2,410,000 for the Astoria company. Of the total payments of $33,193,916 for the consolidated plants there was an amount of $5,876,654.36 not accounted for on the balance sheets.

Robert A. Carter appeared on Saturday. He explained that the alleged discrepancies were due to the difference between "worth" and "value." He was accordingly forced to do a sum in arithmetic and admitted that, excluding the valuation of the franchises, last year's dividend was 17 per cent. and not eight per cent. as apparent in the accounts.

## Electrical Exports for February.

Electrical exports from the United States for the month of February amounted to a total value of $1,155,962, as compared with $881,587 for February, 1904. Both classes of goods—electrical machinery and electrical appliances—show a good increase over February, 1904. Comparative figures are as follows: Electrical machinery—February, 1904, $510,707; February, 1905, 637,479. Electrical appliances—February, 1904, $370,880; February, 1905, $418,483.

Arranged in order of importance, the following-named countries were the principal buyers of electrical machinery from the United States in February: Japan, $141,794; Mexico, $135,509; British North America, $88,429; United Kingdom, $77,756; Philippine Islands, $41,451; Argentina, $32,327; Brazil, $27,426; France, $24,471; British East Indies, $13,320; British Australasia, $11,910; Germany, $5,800; Cuba, $2,950; Hungary, $2,1[illegible]; Chinese Empire, $2,712; British Africa, $[illegible].

It will be seen that Japan [illegible] of foreign nations taking electrical [illegible] from the United States. Previous to 1904 Japan was only a moderate buyer of American electrical machinery, but since the beginning of [illegible] numbered among the largest shippers. [illegible] time headed the list, as follows: [illegible] 1904, $119,850; March, 1904, $201,917; November, 1904, $2[illegible]5,001, and February, 1905, $141,794.

## Marconi's Lecture in London.

A lecture on "Recent Advances in Wireless Telegraphy" was delivered before the Royal Institution in London last month by William Marconi, now Chevalier Marconi. Mr. Marconi observed at the outset that the recent improvements in wireless telegraphy included means to prevent interference and secure independence of communication, to increase the distances over which communication was possible, and to obtain greater efficiency and accuracy. He thought the difficulty regarding liability to interference had been exaggerated by the non-technical mind. In some instances—such as a shipwrecked vessel calling for assistance—it was a distinct advantage that the messages should be received by a number of other ships or stations; but as this interference must in some cases be recognized as a drawback, he had advised a method of obviating it. This method consists of the syntonization of the apparatus at the various stations to different periods, by which it is now said to be possible to transmit messages to each one of them without the others being affected; and even five years ago it was possible to send and receive several messages simultaneously without one interfering with another.

The speaker then dealt with receiving apparatus, and exhibited his magnetic detector, which is to supersede the coherer. He stated that the alterations effected in the detector as the result of experience render high speed and automatic transmission attainable. At first the detector had the disadvantage that it could not be made to actuate a recording or writing instrument, the current impulse with which it worked being too rapid to have any appreciable effect on the tongue of a relay, but by altering the circuits and the character of the iron employed in the magnets, the impulse had been slowed down, so that it was possible to operate a relay, and, therefore, a recording instrument. With this arrangement the lecturer stated that a speed of 24 words a minute had recently been maintained over a distance of 152 miles overland. The audience witnessed the transmission of a message, using the magnetic detector, and a Wheatstone receiver rolled out the tape with the words printed in Morse characters.

Dealing with long-distance transmission, the lecturer adhered to his optimistic attitude, expressing confidence that in a short time it would be demonstrated that transmission across the Atlantic was not only practicable, but trustworthy, and the method so economical as to be within the means of the majority. Besides this, he hazarded the assertion that Lord Kelvin's prediction as to wireless communication with the Antipodes might be realized. Referring to the differences in transmission by day and night, Mr. Marconi stated that these were only noticeable over long distances, the range by night being much longer than that by day, as clear sunlight appeared to act as a fog to the Hertzian waves.

## Chicago Elects Municipal-ownership Candidate for Mayor.

At the city election on April 4th the Chicago voters elected Judge Edward F. Dunne as mayor. He received 161,689 votes against 137,628 for his principal opponent, John M. Harlan. Judge Dunne was supported by the advocates of immediate municipal ownership of the surface street-railway lines. The principal issue of the campaign, as is well known, was "municipal ownership." Both Judge Dunne and Mr. Harlan professed to be in favor of the city acquiring the street-railway lines, the principal difference being, apparently, that the former was for "immediate" municipal ownership, while his opponent said a preliminary short-term franchise might be necessary.

Whatever else may have figured in the result, the fact that the people of Chicago believe in the policy of immediate municipal ownership was again demonstrated by the vote on questions of public policy. On the question, Shall the City Council pass the ordinance reported by the local transportation committee on August 24, 1904, granting a franchise to the Chicago City Railway Company? 140,049 voted "No" and only 60,136 "Yes." As to granting any ordinances (extending franchises) to any street-railway company, the vote was still stronger in the negative, being 141,518 to 55,660.

## Costs of Steam and Electric Traction.

[illegible]

says:

[illegible]

a direct return on the capital of 0.27 and 1.14 per cent., respectively."

The table referred to is given herewith. The figures given are in English pence:

[illegible]

| | | [illegible] | [illegible] |
|---|---|---|---|
| A. | Maintenance of [illegible] | [illegible] | [illegible] |
| B. | Locomotive power | [illegible] | [illegible] |
| C. | Repairs of carriages | [illegible] | [illegible] |
| D. | Traffic expenses | [illegible] | [illegible] |
| E. | Interest on [illegible] expenditure [illegible] stock [illegible] | [illegible] | [illegible] |
| F. | Cost of electricity | [illegible] | [illegible] |
| G. | Cost of electric train men | [illegible] | [illegible] |
| H. | Interest on steam stock | [illegible] | [illegible] |
| I. | Interest on electric stock | [illegible] | [illegible] |
| K. | Interest on electric equipment | [illegible] | [illegible] |
| L. | General charges | [illegible] | [illegible] |
| M. | Rents, rates, taxes, etc | [illegible] | [illegible] |
| N. | Law charges, compensation, etc | [illegible] | [illegible] |
| | | [illegible] | [illegible] |
| | Charges for interest | [illegible] | [illegible] |
| | Working expenses | [illegible] | [illegible] |
| | Average receipts per passenger train mile | [illegible] | [illegible] |
| | Actual sum available for interest | [illegible] | [illegible] |

## Indiana Electrical Contractors Meet.

The semi-annual meeting of the Indiana Electrical Contractors' Association was held at the Claypool Hotel, in Indianapolis, on March 28th. About 35 electrical contractors from all parts of the state attended the convention. President C. C. Hatfield of Kokomo presided, and subjects of interest and importance to the members were discussed. The insurance code was talked about, as well as several restrictive ordinances passed by the prnicipal cities in the state concerning methods of installing electrical work. At the close of the afternoon session an informal dinner was given at the Claypool, after which the electrical men attended the performance at the Grand Opera House. The session was ended with a banquet at the Columbia Club, after the show. The association is in first-class condition, both the interest and membership growing. The annual meeting will be held November 1st.

## A Warning.

It has been reported to the Western Electrician that F. B. Kennett, or Kemmett, is in the custody of the sheriff of Shawnee County, Kansas, charged with fraud in connection with the soliciting of subscriptions for various papers. F. B. Kennett having submitted references that seemed to be satisfactory, the Western Electrician gave him a letter authorizing him to act as its subscription agent. In view of the charge alluded to above and the circumstance that the Western Electrician has received complaints from persons who say that they have paid money to Kennett, which money has not been turned over to the Western Electrician, the public is warned that the authority granted to F. B. Kennett or Kemmett by the Western Electrician is hereby revoked.

## Electrical Wine Testing.

German papers report further tests by the well-known chemist, Maneuvrier, at Paris, in the detection of the adulteration of wine with water, other liquids, and with solids by the aid of the telephone. Two glasses, one filled with the wine to be tested and the other with a like quantity of wine known to be pure, are placed upon an apparatus resembling a scale and a telephone connected with both liquids. If both wines are pure no sound is heard in the receiver, but if one contains water a noise is produced until a pointer is moved to a given place on the dial plate whose movement, by controlling resistance, renders the conductivity of the liquids uniform. The gradation on the dial where the pointer stops shows the quantity of extraneous matter in the wine.

## The Western Pole-hole Digger.

Telephone, electric-light and telegraph construction managers are constantly hearing complaints from their linemen of difficulties met with in digging holes for poles. Any tool, therefore, that lightens labor in this direction, facilitates and makes quicker the irksome job of producing these small-diameter holes in the ground, finds a welcome and careful consideration.

The accompanying cuts illustrate the new Western pole-hole digger that has just been placed on the market by the Western Steel Gate Company of Two Rivers, Wis. The manufacturers of this tool for a long time had been beset by demands for some sort of a pole-hole digger that not only would work rapidly in light soil but one that would at the same time handle sticky soil, and further, one that could be emptied of sticky soil and still, too, be adapted for use in gravel—and all this where four or even six-foot holes of small diameter are necessary.

The Western Steel Gate Company did much ex-

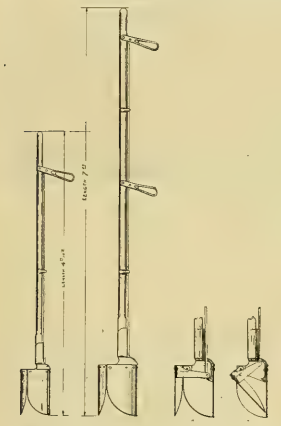


Fig. 1. Fig. 2. Fig. 3. Fig. 4.

THE WESTERN POLE-HOLE DIGGER.—DETAILS OF CONSTRUCTION.

perimental work in bringing this new pole-hole digger to its present state of simplicity. The more important objects sought by the company were that the tool should be simple and very strong in construction and yet comparatively light and easy to handle.

A slight study of the accompanying cuts will reveal the simple construction of the Western digger and its method of operation:

The detail construction of the digger will be easily understood from Figs. 1 to 4, inclusive. Fig. 1 is the regular type of digger for ordinary service; it is four feet 10 inches long and will dig a five-foot hole without making it larger than is required for the pole. Fig. 2 is the special telephone type; it is seven feet long and with it may be dug seven and eight-foot holes without increasing their diameter. These two diggers are alike except that the tele-

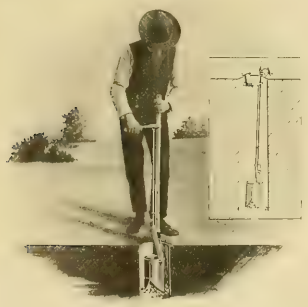


FIG. 5. WESTERN POLE-HOLE DIGGER IN OPERATION.

phone type has a longer handle and is fitted with two hand levers, as shown in the cut, instead of one. Fig. 3 is a section through the tool proper showing the two half-cylindrical blades in position ready to be plunged into the ground. Fig. 4 is also a section, but it shows the hinged blade or scoop after it has been pulled inward by the elevation of the hand lever so as to grasp or clamp, so to speak, a tool-full of earth. Fig. 5 gives an excellent idea of the general operation of the tool in digging a hole when the hole is shallow and also when it is deep. The tool as shown in this picture has just been plunged down into the ground. Pulling up with both hands—one on the lever and one on the tool handle—causes the tool to take a "mouthful."

It will be seen, therefore, that the digger works to some extent automatically. With its sharp blades held open in the cylindrical position, as shown by

FIG. 6. DISCHARGING SOIL FROM WESTERN POLE-HOLE DIGGER.

the cut, the digger is plunged forcibly into the hole, its sharp blades of hard steel going into the soil. The mere act of withdrawing the digger with one hand pulling the handle upward, forces the scoop-like shovel blades of the tool toward each other automatically and the soil is pinched or caught and closed in between the two halves of the cylindrical bucket and brought to the surface. Pushing down the handle at the top forces apart the blades and discharges the soil, as is clearly illustrated in Fig. 6.

## Morse Telegrams Automatically Printed in Conventional Language.

A novel receiving telegraph instrument recently developed prints Morse messages in English or other conventional characters on a strip of tape, in a similar manner to that of the familiar "stock ticker." This instrument, however, is unlike any other machine on the market, inasmuch that no special apparatus is required for sending the messages, other

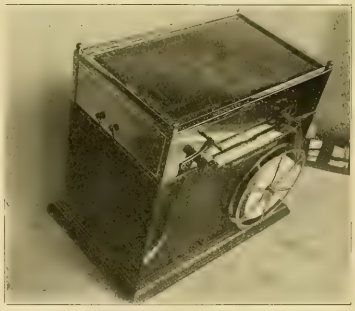


FIG. 2. LATEST TYPE OF APPARATUS FOR AUTOMATICALLY PRINTING MORSE TELEGRAMS.

than the regular Morse key, in the hands of an ordinarily skilled Morse operator.

Receiving printing-telegraph instruments heretofore devised have depended largely upon some synchronizing device to keep the sending and receiving instruments in unison, with the exception of that class of apparatus which depends upon variable strengths and direction of current in the line. In the instrument here described, however, there are no vibrating reeds or other highly sensitive parts, and the mechanism is comparatively simple.

The instrument operates on the principle of analysis and synthesis, the analytical portion measuring the length of the impulses, as well as their respective positions in the character being sent over the line, and the synthetic portion turning the typewheel to the position corresponding to the value of the combination of impulses representing that character. Should one character be missent, it will have no influence over the following character, as the entire mechanism starts from zero for each character.

A remarkable feature of the invention is that it may be almost instantly attached to any Morse telegraph line, and the messages will then be printed in English on the tape, instead of being recorded in the form of dots and dashes, or being received by ear and translated by the operator, and at the same time the regular Morse instruments will operate as usual, since the line conditions have not been disturbed.

The instrument shown in Fig. 1, when connected in the local circuit of a space-telegraph outfit, recorded the wireless messages in printed English, a feat never before accomplished. The instrument in Fig. 2 is a more recent type than that shown in Fig. 1, and is also much more rapid in operation. This machine has given excellent results when connected on a line with a well-known Morse transmitting typewriter.

It is expected that this machine will go a great way toward solving the problem of rapid and accurate commercial telegraphy, as the change may be made gradually from manual to automatic transmission without changing the line or office equipment.

As an example, it has been possible for an ordinarily skilled typewriter to send Morse messages

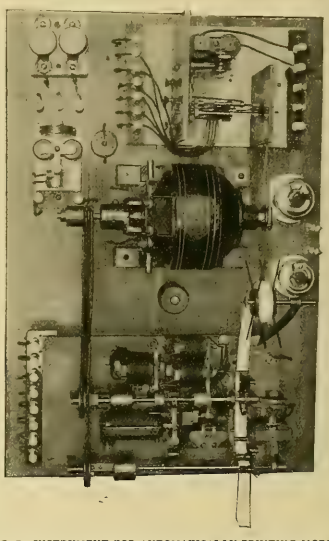


FIG. 1. INSTRUMENT FOR AUTOMATICALLY PRINTING MORSE TELEGRAMS ADAPTED FOR SPACE-TELEGRAPH PURPOSES.

with a Morse transmitting typewriter, the message being legible to a skilled Morse operator at the other end of the line. By the introduction of this new receiving instrument the skilled operator can send messages to the typewriter, the translating instrument automatically receiving and translating the Morse characters, and printing their corresponding English characters on tape or page. Therefore, it would be possible for a person wholly unfamiliar with the Morse code, to communicate with a skilled Morse operator, the only modification of line or office equipment being in the improved instruments used by the person not familiar with the Morse code.

There are many other uses to which the principle of this invention may be applied, notably for selective signaling, etc. The inventor is Mr. Charles R. Underhill of New York city.

## Employes' Insurance at Ampere, N. J.

The shop employes of the Crocker-Wheeler Company at Ampere, N. J., have organized a beneficial association which has a number of interesting features. Every employe who pays 10 cents a week to the association will be entitled to $10 a week for 20 weeks during incapacity through illness. If he dies, his family will receive $100. The payment of 20, 30 or 40 cents a week entitles him to $15, $20 or $25, respectively, with death benefits of $150, $200 or $250. The plan went into effect on April 3d. The company has offered to contribute an amount equal to the dues paid to the association. Thus, if $6,000 is paid yearly in dues the income of the association will be $12,000. The company does not require representation in the association, which will be run entirely by the employes. The president of the Crocker-Wheeler Beneficial Association is James Moore, who has charge of one of the big planers in the main bay of the shops. The other officers are Charles H. Brittain, vice-president; George T. Owen, financial secretary; Frederick Maines, recording secretary, and William Lennox, treasurer.

## Electrically Operated Refrigerating Machines.

By Fred M. Kimball

One of the most recent and interesting applications of electric motor drive is in connection with automatic artificial refrigeration. For many years inventors have endeavored to produce self-contained refrigerating machines of small and medium capacities so thoroughly automatic in their operation as to be available for service in private residences, restaurants, hotels, cafes, hospitals, etc. A large number of patents have been granted on complete systems and on contributary features, and at least half a dozen companies have from time to time undertaken the manufacture and sale of small automatic plants. Up to the present time, however, none of the experimentally built machines have met the requirements of the above mentioned uses, either in operation or cost of maintenance, well enough to enable the industry to assume any commercial importance.

It is well known that all practical methods of artificial refrigeration are based on the thermodynamic cycle through which an easily liquefied gas, employed as the cooling agent, may be passed. The first stage of the process is to compress the gas, which may be ammonia, sulphur dioxide, carbon dioxide, etc., to the point at which the gas liquefies upon abstraction of the heat of compression. The second stage is to conduct the liquefied gas to the refrigerating chest or other space which it is desired to cool artificially, where, in resuming its original gaseous form in an expansion coil of relatively large surface, it absorbs heat from its surroundings, thereby effecting the refrigeration sought. From the expansion coil in the refrigerating box the gas is conducted back to the compressor ready for another cycle.

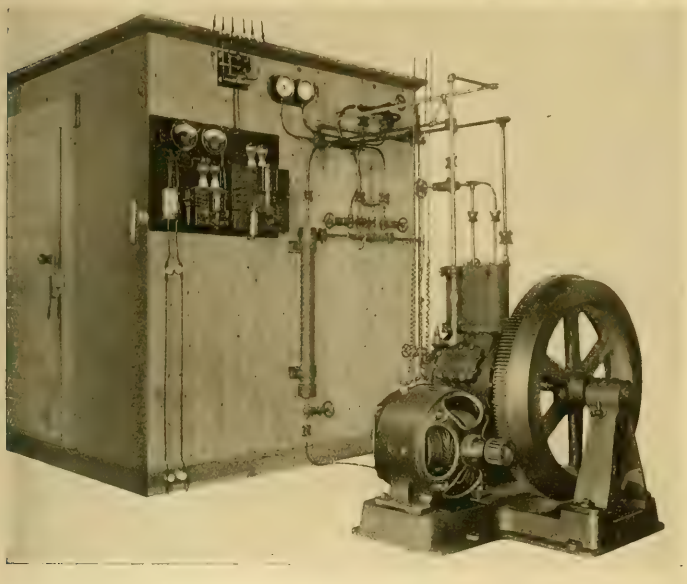


FIG. 1. ELECTRICALLY OPERATED REFRIGERATING MACHINE.

The two principal difficulties encountered in the development of small refrigerating outfits have been:

First.—To provide a reliable, compact source of power in small units which should not necessitate a considerable amount of attendance.

Second.—To ensure the high degree of automatic regulation necessitated by variations in local temperature and in local refrigerating-service requirements. The essential features of control are the feeding of the liquefied ammonia gas to the expansion coil in exact proportion to the varying refrigerating requirements, and the supply of an adequate quantity of cooling water to the condenser sufficient to extract from the varying stream of liquefying ammonia gas as much of its heat of compression as possible without undue waste.

The Automatic Refrigerating Company, first organized as the Federal Automatic Refrigerating Company, of New York city, has been endeavoring to perfect a satisfactory line of small refrigerating plants for the last three years. It has investigated very many systems and has acquired a large number of valuable patents. In this development, as in so many other instances, electricity has co-operated to an important degree. The widespread extension of electric service, by rendering the electric motor nearly everywhere available, has solved the question of motive power, while recent ingenious inventions in electrical governing mechanisms have largely [illegible]

The [illegible] for the last [illegible] Company has had [illegible] electrically controlled and electric motor-driven machines which [illegible] of meeting all the conditions arising in ordinary practice. The electrical equipment [illegible] attendance required by the [illegible] be operated by non-experts. The [illegible] comprises a specially constructed thermostat, placed within the space to be refrigerated, which sets in motion and primarily governs all of the mechanism necessary to stop and start the motor automatically at the proper times, regulate the supply both of ammonia and cooling water and shut down the whole plant in case of failure of current supply, abnormal pressure in the pipe system, or damage to any part of the apparatus. The Automatic company has recently made an agreement to standardize and purchase General Electric motors for use with its machines, and a description of the latter should therefore be of interest.

Fig. 1 is a general view of an apparatus having a "duty" equivalent to that obtainable from 3,000 pounds of melting ice. A compressor of special construction driven by a three-horsepower General Electric motor compresses the ammonia gas and forces it into the water-cooled condenser which is mounted on the rear wall of the refrigerating chest as shown in Fig. 2. The liquefied gas passes from the condenser to the receiver and thence to the ammonia expansion valve, which is usually located in the refrigerating chest and which controls the quantity of liquid ammonia supplied to the expansion coils. The valve shown in Fig. 3 is the simplest form used by the company and is entirely mechanical in its construction. An electrically controlled valve is used, however, to meet the severe requirements encountered in complex service and is perhaps the most important part of the whole regulating apparatus. The characteristics of ammonia gas and the peculiar phenomena which are encountered in regulating its flow are such that the construction of a reliable valve capable of sufficiently close variation of adjustment to the needs of the apparatus has usually been the "stumbling block" in producing successful machines. If the work required in any refrigerator is absolutely constant it is a comparatively easy matter to regulate the flow of ammonia gas by a manually operated valve, so that satisfactory results will ensue, but such constant demand is very rarely met with in the class of service under consideration.

On the side wall of the refrigerating chest (Fig. 1) are the double-throw main switch through which power is supplied, and a "controlling panel" containing a hand-operated circuit switch, a voltmeter, an ammeter, and the instruments for the automatic regulation of the apparatus. The latter instruments include a circuit breaker and an automatic starting rheostat with time-element device which are actuated by the special thermostat placed within the refrigerating box and are designed to automatically govern the plant, thus doing away with the constant supervision that machinery of this sort has hitherto required. The controlling devices regulate [illegible]

FIG. 2. CONDENSER FOR LIQUEFYING AMMONIA GAS USED IN REFRIGERATING.

apparatus indefinitely. Ordinarily the hand-operated switch on the controlling panel is left closed and the control of the motor is effected by the circuit breaker, which is actuated by the thermostat in the refrigerating chest. When the temperature in the chest has risen above a predetermined point the thermostat completes a back contact, closing the circuit breaker and throwing the current on to the automatic starter, which in turn starts the motor. During the period that the compressor is in operation the control of the circulating ammonia is thrown on to the automatic expansion valve. This valve is so arranged that it not only directly governs the supply of liquid ammonia to the expansion coils within the chest, but indirectly governs the load on the motor so that only a sufficient amount of current is drawn to provide for the work being done in the compressor from minute to minute. When the temperature in the chest falls to the minimum for which the special thermostat is adjusted the latter completes its front contact, tripping the circuit breaker and bringing the machinery to rest until the temperature in the chest has risen to a point where it is necessary for the compressor to be started again. The governing

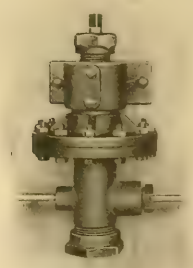


FIG. 3. AUTOMATIC EXPANSION VALVE USED IN REFRIGERATING MACHINE.

system is so arranged that the work done by the motor is at all times proportional to the service required, and practically no power is wasted at any time. In practice the special thermostat is usually so adjusted that an elevation of the temperature in the refrigerating chest of 1½ or two degrees above normal will put the apparatus in operation, while a diminution of temperature of 1½ or two degrees below the normal will bring it to rest.

The above features of control, actuated by the refrigerating chest thermostat, ensure a feed of liquid ammonia into the expansion coil just adequate for the maintenance of a predetermined low tem-

perature at all times. The thermostat also indirectly governs the amount of cooling water supplied to the condenser, through an automatic valve, shown at the left in Fig. 2, which permits just the proper flow of water at all times in accordance with the varying feed of ammonia. In short, the thermostat sets in motion and primarily governs all the mechanism necessary to regulate the supply of ammonia and cooling water, starts and stops the compressor motor at the proper time, while other automatic devices shut down the whole plant in case of any damage to the system.

This apparatus has been examined by many engineers and other interested parties, and without exception has received the highest encomiums. At present the Automatic Refrigerating company is prepared to furnish outfits in several sizes from a capacity equivalent to the melting of 800 pounds of ice per day up to a capacity equivalent to the melting of 12,000 pounds of ice. In the future it expects to put on the market very much smaller sets adapted to the requirements of domestic use.

It may be pointed out that in the rating of mechanically operated refrigerating machines the duty is given in the equivalent of melting ice. In other words, a given machine will produce refrigeration equivalent to substantially twice its capacity for making block ice.

## Ohio Independent Telephone Association.

The Ohio Independent Telephone Association, in annual session at the Hotel Hartman, Columbus, on March 30th, took action to unite the various interests of the state in a bond that will strengthen the position of the Independents in such a manner as to be able to cope with the opposition as well, perhaps, as if they were united under one management, like their competitors. The attendance was over 300, and this was considered the best meeting ever held in the state. The constitution was changed so that a state organizer, who will receive a salary of $3,600 a year and expenses, will be in charge of the work of getting all companies into line. Another change provides that members may be assessed as high as four cents a unit, in addition to the regular annual fees, to provide for the expenses of organization work. A unit is considered one telephone in active use or one circuit-mile of toll line. It is the intention of the executive committee to secure an expert for the position of organizer—an expert in both the financial and operating branches of the business, so that he may be able both to organize and perform the duties of a consulting specialist. There is a field for much effort in organizing. Out of 335 Independent companies operating in the state, 110 are members of the association. Those which do not belong are for the most part smaller companies, but it is to the interests of the association that all be gotten in, and it is believed that within three or four months at least 90 per cent. of them may be enrolled.

The meeting opened at 10 a. m. and was presided over by President Frank L. Beam of Columbus. After a few words of a congratulatory nature, he introduced Mayor Robert H. Jeffrey, who welcomed the visitors to the city and invited them to come again. President Frederick S. Dickson of the Cuyahoga and Federal Telephone companies responded to the mayor's address in a witty manner. While the Independent interests have a good start, he said, the Bell people are still alive, and it will take the best there is to compete with them successfully. They have no fixed rates in some places, but pursue a settled policy of charging all they can get.

### President's Address.

Following Colonel Dickson, President Beam presented his annual report, which is in part as follows:

To consider briefly the benefits accruing from a closer association we need only to look backward a decade. In 1895 there were less than a dozen Independent exchanges in the state and the opposition numbered less than 50,000 telephones. The purpose of the original organization was to encourage the spirit of independence, promote the building of exchanges and toll lines and to foster a concentrated movement along general lines of development. You all know the signal success of this first union. In three short years the Independents outnumbered the opposition in point of exchanges and telephones in operation, changed the sentiment of the public and made it hot for monopoly. After several years of hard work upon the part of the active members of the organization, interest began to lag as the purpose of a closer affiliation had been accomplished beyond the fondest dreams of the most optimistic. Many, too, of the most active workers had been called to other fields beyond Ohio, notably the late Judge J. M. Thomas, than whom Independent telephony had no more stanch advocate, a man big in his ideals, broad in his purposes, and masterful in execution. His services to the common cause in the early days cannot be estimated and history alone will give him the full measure of credit. Another pioneer of the dark days, when it was fight, and fight hard, for every foot of ground gained, was H. D. Critchfield of Chicago, whose assistance in many of the executive and legal details was invaluable.

In June, 1904, a call was issued for a meeting of Independent telephone operators and stockholders to revive the old organization and carry still farther its projects. The idea of the rejuvenated association was a much more compact union based upon nine districts in the state, each with a vice-president and secretary, with an executive committee composed of a representative from each county. This district body meets at regular intervals or upon call, and it has brought about the close affiliation of telephone interests desired. The district takes care of itself in all matters unless assistance is needed from the central body. It has been to my pleasure and profit to attend these district meetings, and I cannot tell you how much good has already come from the "Ohio Scheme" of amalgamation or organization after only a few months' trial. I think you all realize what this plan means to us in the future. It means a body militant, ever ready to advance its own interests and to protect its members; alert and watchful, vigorous and resourceful.

This "Ohio scheme" is being made the basis of the national organization, which is spreading like wildfire, taking in state after state, until the Independents in every village, every city, county and state will present a solid front to the opposition. To bring about the result every Independent company in the state must join this association, not only join but become active and loyal members. The opposition is canvassing the state, soliciting the various companies to sub-license with them under almost any terms. Beware of honeyed words and prolific promises. So far it has availed them nothing.

Today we have over 300 incorporated companies operating over 600 exchanges, over 1,300 toll stations and over 200,000 telephones, and every list is increasing daily without solicitation, faster almost than the growth can be handled. This success is apparent to all, especially the opposition, which is playing a final card in its interest plan of going into a community and interesting local people in proposed telephone development at rates they know cannot be maintained definitely, as they are far below the costs of operation, to say nothing of maintenance and the giving of free toll and local service.

In closing, I want to impress you with the fundamental fact that the opposition is not your friend and cannot be from the very nature of things. In the beginning it was intimidation and coercion. The spirit of your manhood fought that to a successful conclusion. The opposition beaten, but not crushed, tried other tactics. A friendly spirit is now manifested. They go into a district developed by you and offer you many good things. They want to give you long-distance service to points not now reached and try to sub-license. Looks harmless, but stop to think. Are they actuated by any idea as to your welfare? No. United, they know they cannot defeat you. Singly, they can.

### Reports of Secretary and Treasurer.

The report of Secretary E. E. Knox consisted of statistics, comparing the number of telephones in use, the number of exchanges and the number of toll stations by districts, with those of the Bell company. It is as follows:

District No. 1—Counties of Trumbull, Lake, Geuga, Medina, Lorain, Erie, Huron, Cuyahoga and Ashtabula.—Independent telephones, 37,606; Bell, 23,174; Independent exchanges, 79; Bell, 42; Independent toll stations, 168; Bell, 107; Independent stockholders, 2,890; Bell, none in state.

District No. 2—Counties of Columbiana, Carroll, Harrison, Jefferson, Mahoning, Portage, Summit, Stark and Tuscarawas.—Independent, telephones, 22,769; Bell, 10,870; Independent exchanges, 101; Bell, 34; Independent toll stations, 183; Bell, 34; Independent stockholders, 1,430.

District No. 3—Counties of Coshocton, Belmont, Athens, Guernsey, Gallia, Monroe, Mayan, Meigs, Noble, Perry, Washington and Muskingum.—Independent telephones, 19,770; Bell, 7,464; Independent exchanges, 103; Bell, 14; Independent toll stations, 236; Bell, 84; Independent stockholders, 4,666.

District No. 4—Counties of Pickaway, Fayette, Vinton, Jackson, Scioto, Lawrence, Pike, Adams, Highland, Clinton and Ross.—Independent telephones, 12,214; Bell, 4,389; Independent exchanges, 44; Bell, 20; Independent toll stations, 174; Bell, 80; Independent stockholders, 500.

District No. 5—Counties of Butler, Clermont, Preble and Warren.—Independent telephones, 6,904; Bell, 2,338; Independent exchanges, 33; Bell, 7; Independent toll stations, 91; Bell, 41; Independent stockholders, 417.

District No. 6—Counties of Green, Montgomery, Clark, Champaign, Logan, Shelby, Darke, Miama and Madison.—Independent telephones, 24,020; Bell, 11,381; Independent exchanges, 63; Bell, 15; Independent toll stations, 174; Bell, 112; Independent stockholders, 1,488.

District No. 7—Counties of Marion, Wyandotte, Hancock, Putnam, Paulding, Van Wert, Mercer, Allen, Auglaize and Harding.—Independent telephones, 20,081; Bell, 6,139; Independent exchanges, 69; Bell, 8; Independent toll stations, 86; Bell, 76; Independent stockholders, 2,024.

District No. 8—Counties of Defiance, Fulton, Lucas, Henry, Ottawa, Sandusky, Seneca, Wood and Williams.—Independent telephones, 23,114; Bell, 6,085; Independent exchanges, 69; Bell, 21; Independent toll stations, 176; Bell, 21; Independent stockholders, 2,130.

District No. 9—Counties of Ashland, Crawford, Delaware, Franklin, Fairfield, Hocking, Holmes, Knox, Licking, Richland, Union, Wayne and Morrow.—Independent telephones, 30,739; Bell, 12,599; Independent exchanges, 109; Bell, 15; Independent toll stations, 164; Bell, 15; Independent stockholders, 1,464.

Totals.—Independent telephones, 196,937; Bell, 104,318; Independent exchanges, 668; Bell, 159; Independent toll stations, 1,452; Bell, 743; Independent stockholders, 17,029.

Treasurer Ralph Reamer reported receipts of $717.50; expenses to date, not including this meeting, $624.88; balance, $92.86. Aside from this, the supply companies had contributed $1,285. A vote of thanks was tendered the companies for their liberal donations, and President Beam urged that, inasmuch as the supply people were thus interested in the welfare of the organization, greater effort should be made to perfect it and make it a strong factor in the business.

### Committees.

At this point the following committees were appointed:

Credentials—Charles D. Duncan, Chillicothe; C. L. Norton, Cleveland; F. B. Miller, Alliance; A. W. McKee, Cumberland; J. C. Rhodes, Zanesville; H. C. Devin, Mount Vernon; E. E. Williams, R. D. Funkhouser, Dayton; David Clark.

Constitution and by-laws—C. W. Cary, Jr., Cleveland; Cyrus Huling, Columbus; G. P. Thorpe, Wilmington.

Auditing—George Carter, Delaware; M. M. Herron, Millersburg; W. R. Fee, Milford.

### Reading and Discussion of Papers.

O. F. French of Cleveland read a paper on "Standardization of Equipment." He divided the topic into local equipment, subscribers' equipment and long-distance equipment, and then discussed each in a technical way. A competent engineer, he said, should always be consulted in regard to the size of switchboard to be installed and the kind of equipment to be used, no matter what the size of the plant is to be. Mr. French discussed the farmer lines and the kind of equipment that should be used in them, as well as the small exchanges, in order that they may work in harmony with the larger plants and the toll lines. Pay stations and all the various parts that go into the system received careful attention.

B. H. Brooks of Columbus read a paper on the same subject, and also read a paper prepared by M. H. Clapp of St. Louis, who could not be present. Mr. Clapp's paper dwelt at some length upon toll lines and the number that can successfully be handled by one operator. A number of other points were taken up at some length and dealt with in a technical manner. Mr. Brooks discussed the purchase of instruments for subscribers' stations, transmitters and receivers, material, cords, etc., that go to make up the instruments. Both papers were of exceptional interest to the practical telephone man.

In his paper on "Practical Operating and Maintenance of Exchanges," C. E. Stinson of Toledo dwelt on the organization of the operating force, the requisites for good managers, promotion of employes, keeping exchanges and toll lines in perfect order, and the harmonious working of all departments through the adoption of as nearly a perfect system as possible. He said a manager should make no useless rules, but when one is made it should be rigidly enforced. Promotions should be made only in accordance with the perfect fitness of the person to hold the higher place. Discord among the heads of various departments is a death blow to a successful operation of a telephone plant, he said. Mr. Stinson argued that only the best men for the various positions should be employed, and that all portions of the plant and all departments of accounting be kept abreast of the times.

Dwight E. Sapp of Mount Vernon made an address on "Development of New Territory and Importance of Placing Properties on a Dividend-paying Basis." Mr. Sapp has the record of paying dividends every 90 days on all the property which he manages, and the association was, therefore, anxious to know his methods. The size or unit of territory is not accurately defined, he said, but he had found it satisfactory to be conservative in the matter. A small territory well developed is better than a larger area only partially covered. Better satisfaction to subscribers results. His plan is to make the county seat the basis of operations and develop from that point as far and as rapidly as the people demand. While the bounds of the territory is largely determined by the demand, yet it is sometimes well to anticipate the demand and get in on the ground floor. But a company cannot develop territory on wind. There must be money. He said that unless there is a market for securities, there is difficulty in getting money for development. The better plan is to take a good portion of the profits for dividends to stockholders, paid regularly and at a fixed rate. By this method a demand is created at home for the stock, and when it comes to extension and further development it is better to sell stock than use the profits for that purpose. With a company paying fair dividends, the matter of selling stock is not a difficult one; they had created a market at home for their securities, he said. In cities this may be different, as there are investors who are willing to wait for future developments for dividends. The stockholder in the smaller places wants dividends from the start, even if he invest them at once in additional stock. The membership in a company should not be limited to too small a number. Let others share the good things. By the method suggested he believed that interest enough can be created at home to take care of the development. Independent companies should not fight each other over territory. If people have money to invest and cannot secure territory at home, it is better to develop some other place where it is needed.

James Brailey, Jr., followed with a discussion in which he agreed with Mr. Sapp upon almost every point. He said small properties may be made to pay dividends almost from the start, but the larger ones are a different proposition if they are not handled in the right manner. Fair dividends

should be paid at all times, if possible, but there is danger of creating dissatisfaction among patrons, if they are too high. If a plant makes extraordinarily large profits, it is better to pay fair returns and allow the remainder to go to the maintenance fund, where it will be needed.

Quite a discussion followed as to what to do when companies work up to each other in developing territory and what to do with the persons on the line. But the consensus of opinion was that it is better to lay the matter before them and let them choose for themselves. If possible, a working agreement should be formed among companies thus situated, although there is a difficulty in this, because of a difference in rates.

"Operating Rules and a Standard Method of Accounting" had been referred to a committee consisting of C. Y. McVey of Cleveland, S. E. Ward of Mansfield, George H. Matheany of Lima, J. P. Boylan of Cleveland, C. E. Stinson of Toledo and M. B. Overly of Cleveland. Mr. Ward read the report on the latter portion of the topic. It consisted of a plan of accounting something like that used by certain eastern companies. It was ordered printed. J. P. Boylan of Cleveland read the report on operating rules. This paper will also be printed for the use of the companies.

M. B. Overly, manager of the United States Telephone Company, spoke on "How to Increase Long-distance Business." In a physical way he said that keeping the lines and instruments in the best of order was one way to cause an increase of business. Some detail plans were suggested for making repairs, making connections and other work that comes in this line. Poor maintenance, he said, would cause people to patronize other lines quicker than anything else. Some practical examples were given for the cause of dissatisfaction. Instruments should be inspected frequently, especially those which are used often for long-distance work. Lack of system in the service has been the worst thing his lines have had to contend with. To remedy this he suggested that careful attention be given to the book of rules sent out some time ago. Signs are also of service in attracting business. They should be on every office and every booth.

W. F. Laubach of Akron discussed "Protection of Independent Interests by Manufacturers." His idea is that the companies should develop territory so thoroughly and well that there will be no excuse for opposition companies for the manufacturers to supply, but at the same time he said it was impossible to do everything, and do it at once, and in the meantime something should be done by the manufacturers to protect them in their work. In other words, since they are getting the greater part of their business from the Independents, no goods should be sold to opposition companies. In the discussion that followed it came out that several mutuals, opposing the Independents, have been equipped by companies that look to the Independents for business. One at Leipsic has an entrance to 22 towns, and is still building, a direct competitor of the Independents. An endeavor was made to secure the names of the concerns selling to these companies, and the executive committee will probably make an investigation along these lines.

Mr. Byers made a report for the committee on insurance, appointed some time ago. His plan, which is that of the New England factory mutuals, was to form a company which would take their business at the regular stock-company rates and at the end of the year pay dividends from the balance after all losses and expenses were taken care of. Mr. Byers said the actual cost of insurance was only 35 or 40 per cent. of what is now paid for it. The convention adopted the plan. If taken up, such a company will probably follow closely in the footsteps of the Electric mutuals, which are now in course of organization.

H. P. Folsom of Circleville spoke on the importance of the association appointing a man to give his entire time to its interests. Mr. Folsom's idea was adopted, and pressure is being brought to bear on Frank L. Beam, president of the association and manager of the Columbus Citizens' Telephone Company, to accept the place.

"National-Interstate Telephone Association" was the topic assigned to J. B. Hoge of Cleveland. He gave a review of what the association is doing and referred to his visits to other state associations. Virginia, West Virginia and Maryland have promised to unite with the national organization, and it is probable that the Dakotas, Minnesota and the Pacific Coast states will come in. There will be at least 200 delegates at the meeting in June. Mr. Hoge said that New York and Michigan had organized by districts, the same as in Ohio, and that the Ohio plan is being carried out in other states also.

### Officers and Delegates.

The committee on nominations made the following report, which was adopted by the association unanimously:

President—Frank L. Beam of Columbus (re-elected).

Secretary-treasurer—Ralph Reamer of Columbus.

Vice-presidents—District No. 1, E. G. Miller of Warren; District No. 2, W. F. Laubach of Akron; District No. 3, J. B. Rhoades of Zanesville; District No. 4, G. P. Thorpe of Wilmington; District No. 5, W. G. Thompson of Hamilton; District No. 6, I. H. Thedieck of Sidney; District No. 7, G. H. Metheany of Lima; District No. 8, [illegible] of Toledo; District No. 9, D. E. Sapp of Mount Vernon.

District delegates to national convention, elected in order as above:—C. M. Crane of [illegible], D. A. Sauer of Massillon, J. B. Rhoades of Zanesville, G. P. Thorpe of Wilmington, W. G. Thompson of Hamilton, H. P. Miller of Dayton, G. M. Salzgaber of Van Wert, R. F. Hamblin of Toledo, E. J. Grosscup of Ashland.

Delegates at large to national convention—Frederick S. Dickson of Cleveland, James B. Hoge of Cleveland, Dwight E. Sapp of Mount Vernon, Cyrus Huling of Columbus, C. Y. McVey of Cleveland, I. H. Thedieck of Sidney, W. F. Laubach of Akron, Ed. L. Barber of Toledo, Judge Elam Fisher of Eaton, E. E. Knox of Portsmouth, E. E. Kibler of Newark and Frank L. Beam of Columbus.

Alternates—M. B. Overly of Cleveland, H. C. Devin of Mount Vernon, George Adams of Millersburg, Judge L. D. Hagerty of Columbus, E. L. Coen of Vermilion, W. W. Fisher of Bellefontaine, Morriss Taylor of East Rochester, D. A. Yoder of Toledo, W. R. Fee of Milford, C. Burr Forrest of Gallipolis, William M. Haseltine of Dalaware and O. M. Bake of Hamilton.

As a formality a motion was made that this association become a member of the National-Interstate Telephone Association, which was carried. Frank L. Beam was then chosen as a member of the advisory committee of the national body.

### The Banquet.

The banquet took place at eight o'clock in the evening at the Hotel Hartman. Col. Frederick S. Dickson acted as toastmaster. Dwight E. Sapp of Mt. Vernon responded to "The Future" in a way to inspire confidence in the business. President Henry A. Lanman of the Columbus Citizens' Telephone Company spoke on "Some Observations," in which he declared that few things now are not in the hands of combines or organization. Hugh Dougherty spoke on the "Stockholders and the Telephone." "The Past Decade" was reviewed by J. B. Ware of Grand Rapids, Mich. He gave a sketch of the development of the telephone business and alluded to the affect the Independent movement had had on the Bell companies as money-makers. President W. O. Thompson of the Ohio State University responded to "The Telephone as an Educator." He said that the telephone had at least taught him patience. Then he enumerated the ways in which the system has been an educator and the work it is doing. "Weather by Telephone" was the subject of the address of J. Warren Smith, who discussed the plan inaugurated some time ago of sending the reports to the rural districts by telephone to be distributed to subscribers. President Dickson started the system and since that time it has had quite a growth.

### Exhibitors.

F. W. Pardee represented Frank B. Cook of Chicago with a line of protective apparatus.

The Swedish American Telephone Company had a display of goods on hand and attracted considerable attention.

The F. Bissell Company of Toledo had a nice display of the various goods manufactured for the telephone trade.

The American Electric Fuse Company, Erner-Hopkins Company and the O'Kane-Hull Company each had displays of supplies.

P. J. Eubanks and H. A. Nuttall represented the American Electric Telephone Company of Chicago. The display consisted of boxes, receivers, extensions and sets of various kinds.

George H. Foster, Columbus, Ohio, representative of the Stromberg-Carlson Telephone Manufacturing Company, had headquarters at the Hartman and showed the line tnat he uses in his work here.

R. S. Mueller, manager of the Cleveland office of the Kellogg Switchboard and Supply Company, showed the new steel residence telephones, new desk sets, and four-party apparatus.

President G. H. Miller of the Miller Anchor Company, Norwalk, Ohio, had a number of anchors of various sizes and designs and the managers took quite an interest in the good qualities presented.

The Sterling Electric Company showed a number of styles of private branch exchanges, boxes, switchboard terminals and protective devices. W. Doolittle, C. R. Brown and G. W. Metcalf represented the company.

Magneto and central-energy equipment were shown by the Dean Electric Company through its energetic representatives, A. E. Barker, general manager, A. B. Kratz and A. R. Pollock. Quite a display was made and it attracted considerable attention.

C. L. Fisher and J. F. Crook were on the ground for the Automatic Electric Company of Chicago. This company is now installing a new switchboard for the Columbus Citizens' Telephone Company, which is the best sample of its product that could be had.

The North Electric Company showed switchboard parts, both magneto and common-battery, magneto and common-battery telephones, new solid-back [illegible]

## Simple Intercommunicating Telephone.

[illegible] installation with any standard dry cells. Enough [illegible] watch can be heard over the line.

[illegible]

SIMPLE INTERCOMMUNICATING TELEPHONE.

speaker talks past it. It reproduces the voice in a clear tone. One of its advantages is that it has no moving parts and consequently nothing to get out of order. When a push-button and bell are installed all that is required is to connect with the bell wires, and a talking line is established. The instruments are solid nickel finished. The manufacturers' agents for this new device are Anderson & Nachman of 1504 Schiller Building, Chicago.

## NEW COMPANIES.

A charter has been issued to the Lucas Telephone Company of Albemarle, N. C., with J. E. Love as principal stockholder. The capital stock will be $10,-coo.

The Redondo Home Telephone Company has been incorporated at Los Angeles, Cal., with a capital stock of $40,000 by C. L. Zahn, D. F. Boyce and others of Los Angeles.

Citizens of Bear Valley, Cal., have organized a mutual telephone company, with O. I. Butterfield president and A. T. Hain secretary. The line will extend from Willow Creek to San Benito. The Board of Supervisors of San Benito County, Cal., has granted the company a franchise to erect poles along the country roads.

The Bear River Telephone Company has been organized at Wheatland, Cal., with E. T. Manwell as president and A. C. Stagner secretary. The company has a barbed-wire telephone system in the southern part of Yuba and Sutter counties and now propcses to complete smooth-wire lines between Sacramento and Marysville, Cal.

The following-named telephone companies are among those which have recently been organized: New Hottland Telephone Company, McPherson, Kan.; Plano Mutual Telephone Company, St. John, Kan.; Bronson Telephone Company, Bronson, Kan.; Citizens' Telephone Company, Louisburg, Kan.; Central Co-operative Telephone Company, Broken Bow, Neb.; Spring Creek Farmers' Mutual Telephone Company, Callaway, Neb.; Alvo Telephone Company, Alvo, Neb.; Union Telephone Company, Ingersoll, Okla.; Buchanan County Mutual Telephone Company, DeKalb, Mo.; Northwestern Telephone Company, Primrose, Iowa; Lawn Ridge Telephone Company, Lawn Ridge, Ill.; Farmers' and Merchants' Telephone Company, Newark, Ill.

## Telephone News from the Northwest.

The Hannaford (N. D.) Telephone Company has been incorporated with $1,000 capital. J. G. Mills is president and A. O. Anderson secretary.

The Northwestern Telephone Exchange Company will put in an exchange at Foxhome, Minn.

The LaMoure County Telephone Company will build a line from Marion, N. D., to LaMoure via Dickey.

The Bradford Township Farmers' Telephone Company will build a rural line out from Campbell, Minn.

The Chicago, Milwaukee and St. Paul railway will install telephones at its stations at Millville, Hammond and Zumbro Falls, Minn., where no operators are now installed. This will give connection with the nearest telegraph station and enable patrons to get information as to the movement of trains.

The Farmers' Mutual Telephone Company will build an exchange at Bottineau, N. D.

The Hager Telephone Company will build a line from Hager, Wis., to Diamond Bluff and down the Trimbelle Valley.

The telephone system of the Beardsley Electric Company of Beardsley, Minn., has been transferred to the Gopher State Telephone Company of Beardsley.

The Sioux City (Iowa) Telephone Company has placed a block of $100,000 worth of stock on the market for local investors at that place.

The federal government will lay a telephone cable this summer which will connect Beaver Island in Lake Michigan with the mainland at Charlevoix, Mich.

The Henry County Telephone Company of New London, Iowa, will increase its capital from $15,000 to $30,000.

The proposed Independent telephone franchise was voted at Council Bluffs, Iowa, by 800 majority. The Iowa Telephone Company is planning the expenditure of $1,300,000 in improvements on its lines in Iowa during the next two years. Of this amount the building to be done this season will amount to about $750,000.

L. C. Erbes has sold the telephone exchange at Oakville, Iowa, to Charles Avery of North Branch, Minn., and P. E. Newcomb of Hutchinson, Minn.

The Marshfield (Wis.) Telephone Company has made arrangements with the Bell system for long-distance service and will have its exchange equipped with Bell instruments.

The Marietta (Minn.) Telephone Company has been incorporated with $10,000 capital stock by C. J. Orton and others.

The New Ulm (Minn.) Rural Telephone Company has been formed and will expend $50,000 in the construction of a system. It proposes to buy the local system or build a second one.

The Fairmont Telephone Company will install a local exchange at Ceylon, Minn.

The local exchange at Benson, Minn., has been reorganized, the Swift County Telephone Company being formed. The company will make improvements and extensions to the system.

Mayor I. M. Olson and others are talking of organizing an Independent telephone company at Sleepy Eye, Minn.

The Minnesota Central Telephone Company has appropriated $10,000 to be used in improving its system at Redwood Falls, Minn.

L. E. Ketcham and his associates, who will build several rural telephone lines this season, have purchased the local system at Montrose, S. D.

F. S. Meyers, manager of the St. Cloud (Minn.) system of the Northwestern Telephone Exchange Company, has been transferred to a similar position at Sioux City, Iowa.

The Northwest Mutual Telephone Company has been organized at Ipswich, S. D. R.

## Michigan Telephone Matters.

Managers of the Independent telephone companies of Michigan, 50 in number, met at Lansing a few days ago and formed an organization which may be incorporated. The managers state that there is no intention of consolidating the various properties, but that the organization is purely for association purposes framed along the lines of the National Interstate Telephone Association. It is the intention of the Michigan managers to join the National association at its next meeting, which will be held in Chicago on June 21st to 23d. All meetings of the association were held with closed doors, but it was given out that the following-named officers were elected: President, E. B. Fisher, Grand Rapids; secretary, J. B. Ware, Grand Rapids; treasurer, William Robinson, Jackson. W. O. Hunt of Adrian, N. F. Wing of Jackson and G. F. Root of Hart, together with the president and secretary, constitute the board of directors. The state will be divided into six districts and each district will be presided over by a district president, who is also a vice-president of the state association. These vice-presidents are R. B. McPherson, Howell; R. C. Smith, Homer; A. C. Himebaugh, Burr Oak; J. H. Fildew, St. Johns; C. W. Waverly, Kalkaska, and H. A. Price, Saginaw.

It is probable that the Michigan State Telephone Company will not raise the rates in Mt. Clemens for at least three months. It is expected that an Independent company may be organized and it is understood that the Michigan State Telephone Company (Bell) is holding off making an increase in rates to see whether or not an Independent company will be organized.

The Everybody's Telephone Company of Litchfield, Mich., has been incorporated with a capital of $25,000. W.

## Southeastern Telephone Developments.

The Cedar Run Mutual Telephone Company of Catlett, Va., has been chartered by the state corporation commission with a capital of $5,000. F. S. Ensor, J. L. Carroll, J. B. Powers, L. W. Trenis, B. F. Colvin, all of Catlett, are directors and stockholders.

The Southside Telephone Company of Youngsville, N. C., is chartered by the secretary of state with a capital of $10,000 authorized and $500 paid in. G. T. Sykes, C. E. Timberlake, J. F. Mitchell and A. V. Bobitt are the incorporators.

The Southern Bell Telephone Company has bought the Adams telephone lines in the section about Columbus, Ga., and Alabama, and will at once start a line to Omaha, Ga., the headquarters of the Adams system.

It is rumored that the High Point (N. C.) Telephone Company has bought a controlling interest in the plant of one of the near-by towns and the concern bought out will dissolve.

The Opequon Telephone Company of Opequon, Va., is chartered with $1,000 capital. C. W. Snapp is president and E. J. Snapp secretary.

The new $30,000 exchange of the Southern Bell Telephone Company at Huntsville, Ala., has been put into service. A common-battery system has been installed.

J. F. Hayden of Thomasville, N. C., has bought a controlling interest in the Lexington (N. C.) telephone system and will make improvements. L.

## Indiana Telephone Items.

The Summitville Telephone Company has filed articles of incorporation with a capital stock of $5,000. The company will build an exchange and telephone system in Summitville. R. W. Ingels, A. A. Ingels and T. E. Carlwright are the directors.

The consolidation of the Farmers' Mutual Telephone Company of Wabash County and the Home Telephone Company of Whitley County has been effected. The Farmers' will increase its capital stock, make improvements and expand its business.

The Citizens' Telephone Company of Cambridge City has reduced the rate to county subscribers to $1 a month when paid quarterly in advance. This is the same rate given resident patrons in the town of Cambridge City, Melton, Dublin and Germantown. This is a valuable concession to country patrons, since the cost of erecting the lines that reach their homes is much greater than in towns, owing to the distance traversed. This service reaches over 1,000 homes in Wayne, Henry and Fayette counties. It connects directly with all Independent telephone systems in this and adjoining states.

The City Council of Richmond has passed an ordinance requiring the Board of Public Works to make and keep up maps showing the system of wiring in the city, including electric-light, power and telephone wires. S.

## Ohio Telephone Notes.

Announcement has been made that the Bell interests have gained control of all the Independent plants in Jackson County. The properties include exchanges at Jackson, Hamden, Coalton, Oak Hill and Wellston. They have in use about 1,800 telephones. This action will change these systems to the Bell long-distance lines in case the companies do not find that they have a contract with the United States Telephone Company, which has been giving them a good service.

The Edgerton Telephone Company, Edgerton, has been incorporated by Jacob Zeeb, Claude E. Hoover and others, with a capital stock of $30,000.

The new stock of the Cincinnati and Suburban Bell Telephone, Cincinnati, has mostly been taken by the present stockholders. There are a few in England who have not been heard from and the books may be kept open a little longer for them.

The Attica Bell Telephone Company, Attica, has been incorporated with a capital stock of $10,000 by F. C. Myers, S. F. Kaufman and others.

An increase of capital stock from $20,000 to $50,000 has been made by the Ohio Bell Telephone Company, which was incorporated a few weeks ago. Construction work has been started in Knox and Delaware counties. C.

## New England Telephone News.

Nearly $10,000,000 of the $25,000,000 bond issue of the American Telephone and Telegraph Company was taken abroad. The issue was heavily oversubscribed.

The New England Telephone and Telegraph Company has purchased a good-sized tract of land in Malden, whereon it is proposed to erect a large new brick building for the Malden telephone exchange and headquarters.

Stockholders of the Heath Telephone Company of Shelburne Falls, Mass., have voted to apply for authority to increase the capital stock from $30,000 to $50,000, and extensions in Shelburne, Conway, Ashfield, Charlemont, Colrain and Whitingham are planned. B.

## GENERAL TELEPHONE NEWS.

The McLaurine Telephone Company of Oak Grove, Mo., will install an exchange in Grain Valley, Mo.

The city of Mineral, Kan., has closed a deal for the purchase of the local telephone plant from G. A. Walbourne.

The Independent plant of Augusta, Ga., has been sold at auction, the purchaser being a representative of the bondholders. It is asserted that the Southern Bell company was interested in the deal and that the plant will be dismantled.

The Chicago Telephone Company reports 1,919 new subscribers during the month of March. In the city 1,449 instruments were installed and in the country 470. The company reports that it now has a total of 123,284 telephones. Since January 1 it has installed 5,391 instruments.

The Stanford Telephone Company of Stanford, Ill., recently suffered the complete loss of its central office by fire. Sufficient cable was secured for changing the heavy leads to the new location of the central office and a self-restoring drop switchboard and complete central-office apparatus was installed and the exchange put in operation within three days.

At the annual meeting of the American Telephone and Telegraph Company in Jersey City the retiring directors were all re-elected. Resolutions were passed authorizing the transfer of certain lines owned in Georgia and Alabama to the subsidiary companies actually operating them in accordance with the legal requirements of those states. The by-laws of the company were amended in accordance with suggestions of President Fish, made in order to facilitate the company's business.

Hastings, Neb., is to have an entirely new telephone plant and central-office equipment is to be installed in a new building, for which the contract has just been let. The Automatic Electric Company will install in this building a telephone switchboard with an ultimate capacity of 5,000 subscribers and with an immediate equipment for 600 subscribers. The power plant will have duplicate American storage batteries. Two ringing machines will be installed with busy and howler attachments. One machine is to be operated on the commercial-power circuit and one on the storage-battery circuit. Two charging machines will be installed; one will be a motor generator to operate on the commercial-power circuit and the other will consist of a gasoline engine connected direct to a small direct-current generator, so that the plant will be entirely independent of any outside source of power.

## MANUFACTURERS AND DEALERS.

The International Telephone Manufacturing Company, Chicago, reports a heavy demand for its telephones equipped with long-distance transmitter containing special hard-polished granular carbon made under its supervision by a new process from a special hard coal.

The Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., reports having closed contracts for switchboards for McDonough, Ga.; Atwood, Kan.; Orleans, Neb.; Ivesdale, Ill.; Quinter, Kan.; Hendley, Neb.; Waynesville, N. C.; Herald, Ill.; Hayes, Iowa, and Areadia, Fla.

The American Electric Telephone Company of Chicago has just shipped an additional increase of capacity consisting of one section of multiple switchboard for the Independent exchange at Springfield, Mo. This is the second increase made by the Springfield company since this original installation. The Springfield company reports a brisk demand for telephones.

The Dean Electric Company of Elyria, Ohio, calls especial attention to its Compact Type telephone, which can be furnished for all kinds of regular and special local-battery magneto service. Each telephone is equipped with the new Dean talking and signaling apparatus. In a folder devoted to this apparatus are described series, non-interfering, divided-circuit, four-party selective and central-checking telephones.

The Automatic Electric Company will install at Wausau, Wis., a board with an ultimate capacity of 5,000 lines and an immediate equipment of 700. In addition to the board it will furnish the entire central-office equipment. The power plant will consist of duplicate storage batteries. Two charging machines will be furnished and the customary power board equipped with ammeter and voltmeter, overload and underload circuit breaker, etc. The main distributing frame will be F. B. Cook's make, equipped with self-soldering heat coils. The Automatic company is also to furnish new telephones,

## Use of Superheated Steam in the United States.

The advantages to be gained by the use of superheated steam are probably as well recognized in this country as they are by European engineers, but the fact remains that these advantages are not utilized to as great an extent here as they are on the Continent. The subject is one of interest to engineers in general, and information regarding it is always to be read with attention. An address was recently given before the Robert Fulton Association in Chicago by Arthur L. Rice, editor of the Engineer, upon "The Use of Superheated Steam in the United States," which was interesting and instructive. The following is an abstract of the address:

Economy from the use of superheated steam is due to prevention of cylinder condensation loss and lessened leakage. Steam as it comes from the engine cylinder is at a low temperature and cools off the cylinder. When fresh steam is admitted it is at a high temperature and the cylinder walls must again be heated, which can only be done by condensing some of the incoming steam, and this steam which is condensed is of no value in doing work in the engine. The difference in temperature between outgoing and incoming steam is about 125 degrees.

Steam as ordinarily made by a boiler contains a considerable percentage of moisture in suspension, and this moist steam readily gives its heat to the cylinder walls and also absorbs heat readily when leaving the exhaust. In superheated steam this moisture is entirely evaporated and the temperature of the steam is raised so that it becomes more nearly like hot gas and exchanges heat with the cylinder much less easily, the result being a considerable reduction in the amount of steam condensed.

If it were not for this condensation loss better results could be obtained by using the extra heat in making steam of higher boiler pressure and consequently higher temperature than in raising the temperature by superheating, keeping the pressure constant. This involves, however, the building of stronger boilers, stronger piping and heavier engines to use the higher pressure, so that the expense of machinery is increased. The condensation loss is about 20 per cent. of all steam used in an engine, and the use of superheated steam will effect the saving of 12 per cent. The superheated steam is also lighter, that is, a cubic foot will weigh less than for ordinary or saturated steam; hence it takes less weight of steam to fill an engine cylinder, and this gives another advantage. Also there is less friction of the steam in the pipes, so that for a given amount of loss of pressure between boiler and engine the pipes can be made smaller, which will make a plant less expensive. There is also the advantage that water will never be carried into the engine cylinder, and as this water is often a cause of wrecking an engine this feature is of value.

The useful limit of superheat lies at the point where steam will just reach the exhaust of the engine with none of it condensed. A greater amount than this will cause waste of heat, since there is no advantage in having the steam superheated as it goes into the exhaust pipe. For compound engines, in which the steam is expanded in two cylinders in succession, it is found advantageous to superheat the steam between the two cylinders so as to prevent condensation loss in the second cylinder as well as in the first.

It has been found that superheat is lost in traveling through long pipes at the rate of one-third to one degree F. per foot of pipe at a velocity of 40 feet a second. For four-inch pipe the loss is one-half degree; for eight-inch, one-quarter degree; for 12-inch, 0.2 degree, and for 16-inch, 0.13 degree. Allowance must be made for this in deciding on the amount of superheating needed.

In the construction of superheaters it is found that bronze and brass are the poorest possible materials; that cast iron or steel is better. Cast iron is somewhat unreliable in its character, but carries a more even heating than steel. Points of construction to be looked after are that all joints must be kept away from the fire, since the steam has not the ability to cool off tubes that the water has in the ordinary steam boiler. Care must be taken to provide for the expansion of the tubes, as the high temperature makes this much greater than with boilers. So far as economy is concerned the requirements are the same as for boilers, viz., good circulation of the steam and good contact between both hot gases and tubes, and steam and tubes, with plenty of time allowed for transfer of heat from the hot gases to the steam.

Special requirements in a plant using superheated steam are the avoidance of all brass or bronze for piston rods or parts of stuffing boxes; the use of corrugated metal gaskets for making joints in piping, special provision for expansion of piping, provision for flooding the superheater when it is not in use so as to prevent burning out, and special covering of steam pipes to prevent radiation, a covering at least three inches in thickness being advisable.

For most cases the useful limit of superheat is found at 150 degrees above the temperature of saturated steam, or for 150 pounds pressure a total of 525° F., and to give this temperature it is customary to provide [illegible] heating surface equal to [illegible] per cent. of the [illegible] heating surface.

Details were given during the [illegible] of lantern slides of the construction of [illegible] for separate firing and for [illegible] those made by the Babcock & Wilcox [illegible] the Heine Safety Boiler Company, the [illegible] Superheater Company, the Power Specialty Company, the Cahall Boiler Company, and the Providence Engineering Works being described.

## The Iowa Conventions.

The fifth annual convention of the Iowa Electrical Association will be held in the Hotel Julien at Dubuque, Iowa, on April 19th and 20th. In addition to general business there will be these committee reports:

Street Lighting—W. [illegible], Osceola.
Commercial Lighting—[illegible], [illegible] Grove.
Commercial Power—Paul [illegible], Knoxville.
Hot-water Heating—D. F. McGee, Red Oak.
Steam Heating—J. [illegible], Ottumwa.
Meter Data—A. W. [illegible], Davenport.
Facts and Factors—Austin Burt, Waterloo.

Prof. P. B. Spinney of Iowa State College at Ames will read a paper, as he did last year. Other papers on the programme are as follows:

Methods of Obtaining New Business—L. D. Mathes, Dubuque.
Boiler Room Economies—F. H. Lankasher, Davenport.
Methods of Accounting—A. W. Zahm, Mason City.
Steam Turbines—W. E. Boileau, Dubuque.
Association Matters—George S. Carson, Iowa City.

On Thursday afternoon, April 20th, the delegates and others in attendance will visit the new power house of the Union Electric Company of Dubuque. The Iowa Electrical Association has the reputation of holding excellent conventions, of much practical value, and with the above programme there should be a large attendance. W. L. Bowers of Davenport is president of the association and W. S. Porter of Eldora is the secretary. Last year a good-sized delegation went from Chicago, and this year the performance should be repeated or surpassed. The Chicago transportation committee consists of Walter Goll of the Fort Wayne Electric Works, W. H. Colman of the General Electric Company and P. R. Boole of the Electric Appliance Company. This committee has selected as the most convenient train the Chicago-Great Western train No. 1 from Chicago to Dubuque, leaving the Grand Central Station, Harrison Street and Fifth Avenue, at 6:30 p. m., April 18th, and arriving in Dubuque at 11:10 p. m.

The Iowa Street and Interurban Railway Association, which was formed last year at Des Moines during the convention of the Iowa Electrical Association, will hold its second annual convention in the Hotel Julien at Dubuque on April 20th and 21st, thus beginning one day later than the older association and continuing one day longer. The two associations are friendly and in a manner associated, as some electrical operating companies are members of both, and it is convenient that their conventions be held at practically the same time. Nevertheless they are distinct organizations. The programme of the street-railway convention includes the following papers:

Handling Freight by Interurbans and Interchange of Business with Steam Railroads—H. H. Polk, Des Moines.
Accounting as an Aid to the Operating Department—R. A. Leussler, Council Bluffs.
Car Shop Methods—John D. Fish, Davenport.
Rural Railways—F. McDonald, Waterloo.
The Adoption of Gasoline Motors for Street and Interurban Service—(Author's name to be announced later).

On the afternoon of Thursday the association will visit in a body the station of the Union Electric Company of Dubuque. Later it will hold a joint session with the Iowa Electrical Association and listen to the reading of Mr. Boileau's paper on steam turbines. George B. Hippe of Des Moines is president, and L. D. Mathes of Dubuque is secretary and treasurer of the Iowa Street and Interurban Railway Association.

## Attendance of 3,500 Predicted for Denver-Colorado Springs Convention.

Mr. Frank W. Frueauff of Denver, when in New York last week, said that the railroad people had been making an extensive canvass among possible delegates for the Denver-Colorado Springs convention of the National Electric Light Association. They report their belief that there will be an attendance of at least 3,500. This may be a little optimistic, but there is no question that the meeting will break all previous records in point of attendance as well as in point of general attractiveness.

Mr. LaRue Vredenburgh, who so ably handled the subject of advertising in his report presented at the Boston convention of the National Electric Light Association, will this year make a report on the commercial side of sign and decorative lighting, which will be presented at the Denver-Colorado Springs convention to be held June 6th to 11th. This is a subject of great interest to all the members of the association, and Mr. Vredenburgh's skill and experience will enable him to handle it in a most satisfactory and interesting manner.

## OBITUARY.

### E. C. Cockey.

[illegible] accounts of the ord[illegible] in the telegraph service, and though [illegible]

### William Offutt Mundy.

In the death of William [illegible] Mundy, [illegible] occurred at the East End Hospital, Pittsburg, Pa., on Wednesday, March 29th, the street-railway industry suffered a great loss. [illegible] poisoning, developed from an affliction of the ear, which first caused [illegible]

Mr. Mundy was a graduate of the Rose Polytechnic Institute of Terre Haute, Ind., and was still a young man, not yet having reached 30. Until a year ago he was master mechanic of the St. Louis Traction Company, St. Louis, Mo., and his work there attracted the special attention of railway operators. The new shops of that company, embodying many of the best labor-saving devices, were built under his direction. Mr. Mundy was marked for his keen observation, especially in the lines of his profession, which, coupled with his inventive genius, enabled him to improve shop conditions by the substitution of many labor-saving appliances.

The inventions of Mr. Mundy were not confined, however, to the equipment of railway shops, for he did much toward the improvement of systems of electric train control. He was also the inventor of an air-brake appliance of much merit. Quite recently he invented a street-car window, the construction of which permitted the removal of window sashes to facilitate the repairing and cleaning of the windows.

In April, 1904, Mr. Mundy resigned his position with the St. Louis Traction Company to become a commercial engineer of the Westinghouse Electric and Manufacturing Company at East Pittsburg, Pa. He was a man of great energy and one who was enthusiastic in everything he undertook. He possessed a genial disposition, which won for him a host of friends everywhere. Mr. Mundy was a prominent member of the American Street Railway Association and was third vice-president of the mechanical division last year.

Mr. Mundy was married on January 4th of this year to Miss Kathleen Eddy of Detroit, Mich. His parents reside at Louisville, Ky., where he received his early education.

## Hydro-electric Power for New York Central Parallel Lines.

A dispatch from Troy, N. Y., to the New York Tribune, dated March 22d, says: "The New York Central has closed a contract with the Hudson River Water Power Company of Glens Falls, for 25,000 electrical horsepower for 25 years. The minimum charge for the power will be $125,000, and the cost may run up to $500,000 yearly. The power will be delivered from the Spier Falls and Schoharie Falls plants of the power company and from an auxiliary steam plant at Utica. The power will be used to operate the various electric lines the Central has recently acquired."

## Escanaba Abandons Municipal Lighting.

Escanaba, Mich., March 26.—Municipal lighting has proved a failure in Escanaba, and by unanimous resolution of the Common Council the proposition of selling the city electric and gas plants to the highest bidder will be submitted to the voters at the spring election. The property represents an investment of about $80,000. The plants are antiquated and expensive of operation, so much so that, with the usual allowance for depreciation, interest and taxes lost the past year's business was transacted at a loss, with indications that the annual deficit would steadily grow larger.—New York Tribune.

## X-ray Congress.

An international X-ray Congress will be begun in Berlin, Germany, on April 13th. It will be the first of its kind ever held, and its purpose is to show what progress has been made since the discovery of the rays by Professor Röntgen. Lectures will be delivered and demonstrations made by leading scientific men and physicians of various countries. There will be an exhibition of Röntgen-ray appliances and of the literature on the subject. A statue of Professor Röntgen has been placed on one of the bridges of Berlin.

# CORRESPONDENCE.

## Great Britain.

London, March 22.—The largest electric power company yet promoted in Great Britain is now occupying the attention of Parliament. As I have previously mentioned, the bill affects London in connection with eight other similar bills before the same parliamentary committee. The latter bills, however, are merely extensions of the powers of the existing electric supply companies in London itself, whereas the large bill referred to above proposes to take in the whole of the county of London and large areas around it. The inquiry which is now taking place is unprecedented in the electrical industry in Great Britain, and probably some of the proposals which are being made by the new company are unprecedented in the world.

The promoters of the new bill, for which C. H. Merz of Newcastle-on-Tyne is the engineer, intend, should the powers they ask be granted, to build three large generating stations at various points in their area, each having a capacity of 90,000 kilowatts. Turbines of 10,000-kilowatt capacity each will be employed, as well as boilers having a total evaporative capacity each of 30,000 pounds of water an hour. A main cable will be laid around London. The estimates of the promoters for the cost of the generating station are phenomenally low and work out at £8 4s. per kilowatt capacity. The average selling price is put at 7d. per unit. A strong point in favor of the promoters is that firms of the highest standing have undertaken to carry out the work at the prices upon which these estimates have been based.

Mr. Merz's opinion is that London offers such an exceptional field for the generation and supply of electrical energy, and such an extraordinary demand exists, that it should be supplied at lower terms than any city in the world. He says that the existing concerns supplying electrical energy—and they number 54—have not shown the necessary commercial push to bring before manufacturers the advantages of cheap power, and that by the proper concentration of the generating plant, with generation on a sufficiently large scale, all the existing concerns can be supplied with current at less cost per unit than the price at which they now generate it.

One important part of the organization of the new undertaking will be the "selling department," whose function it will be to continually canvass for business, to advise manufacturers as to the method of dealing with their works, and even to lend them apparatus or capital wherewith to carry this into effect. Up to the present only a small part of the case has been heard, and what the ultimate result will be no one dare prophesy. The inquiry will last several weeks—perhaps months. Meanwhile an enormous sum of money is being expended in lawyers' fees, etc.

As a result of the serious breakdown which occurred a short while ago on the electric-lighting mains of the Bradford corporation, it was decided to engage an independent expert to report upon the general condition of the electricity-supply undertaking in that city. The employment of experts to report upon every piece of work undertaken by the resident electrical engineer is very prevalent in many places, but it is one that is viewed with disfavor on the whole, for if the resident engineer is not to be relied upon for carrying on his own works he can hardly be said to be worth keeping. It is therefore pleasing to be able to report that another attempt made at Bradford to engage an "expert" has failed. The city electrical engineer recently prepared a scheme for the extension of the undertaking and the adoption of the three-phase system. A section of the council sought to appoint an independent engineer to examine this scheme, but its object was defeated.

A return just issued shows that the large deficit on the Postoffice telegraph system, which has been the subject of complaint for many years, appears not to be declining. It now stands at $6,250,000.

Another matter concerning the Postoffice is the desire that has been evinced for so long by various rating authorities to assess the telephone wires belonging to that department. Many requests have been made to the postmaster-general that, in common with other trading concerns, he should agree to this property being rated. The London County Council last week, in conjunction with a large number of other rating authorities, suggested to the postmaster-general that, in lieu of rates, he should make a periodical contribution to the local finances. The reply was, naturally, in the negative, but it was suggested by the postmaster-general that he would be willing to move, in the House of Commons, for the appointment of a select committee to inquire into the whole question of government contributions in lieu of rates.

Since the opening of the electric lines of the Northeastern Railway Company, 28 accidents have occurred, of which four have been fatal. The Board of Trade officials are now giving the matter serious attention, and certain recommendations to insure the lines being better protected against trespassers have been made.

The female operators of the National Telephone Company are the latest to protest against terms of the agreement with the Postoffice, and representations are to be made as to the continuity of the existing terms of employment when the undertaking is acquired by the Postoffice. G.

## New York.

New York, April 1.—The state committee began its investigations in the matter of the alleged excessive charges for public gas and electric lighting on Thursday, and the main points of the hearings are abstracted in another part of this issue. There has also been made public this week voluminous reports on 24 separate plans for new subways, and these also are dealt with elsewhere.

A curious accident occurred on Monday morning at the head of the construction work in the East River Tunnel. At this point the men work under very high air pressure. The force of the air caused the river bed to weaken and a workman was blown into the opening through several feet of mud and into the water above. He came to the surface alive and in less than an hour after the accident was again in the tunnel.

The new franchise-tax valuations were published on Thursday at Albany, but seeing that none of the local corporations has ever paid the tax the utility of the increased valuations is problematical. For the greater city the total assessments have been increased from $251,158,450 to $302,193,550. The figures for the more important companies are: Brooklyn Rapid Transit and allied lines, from $25,552,000 to $29,560,000; Brooklyn City railroad, $1,294,000 to $1,730,000; Manhattan Railway Company, $50,075,000 to $59,650,000; New York City Railway (Metropolitan), $74,860,000 to $79,233,000; New York Edison Company, $590,000 to $1,150,000; Edison Company (Brooklyn), $3,644,000 to $4,900,000; New York Telephone Company, $5,015,000 to $6,610,000; New York and New Jersey Telephone Company, $1,320,000 to $1,700,000. Taxes to the total of over $13,000,000 are outstanding and under litigation.

An appropriation of $200,000 was voted on Monday for the purpose of reconstructing the Manhattan terminal of the Brooklyn Bridge. Two more tracks and extended and widened platforms are included in the scheme.

The employes of the Brooklyn Rapid Transit Company gave their annual entertainment on Tuesday night. The proceeds were for the benefit fund.

Progress is reported in the electrical conversion of the suburban lines of the Long Island railroad. The company expects to have 120 steel motor cars ready for operation in June and about as many more trailers, the trailers being converted cars. About 45 miles of track is effected by the present scheme.

Daniel F. Lewis, formerly president of the Brooklyn City railroad, is said to be interested in a scheme to revive and extend an old project to connect Rockaway Beach with New York by a fast trolley line, which would compete both with the Brooklyn Rapid Transit and the Long Island railroad. The Long Island railroad fought and defeated the original scheme at its inception about four years ago.

A franchise has been granted for a trolley line at Glen Cove, L. I., including a spur to Garvie's Point. There were only two objectors to the grant at the public hearing which was held yesterday.

C. W. Taylor, M. H. Mark and E. J. Ludvig of New York city have incorporated the Fargal Manufacturing Company of Fort Ewen, Ulster County, N. Y., and will deal in electrical apparatus. The capital is given at $100,000.

The Long Island Consolidated Electrical Companies have been incorporated with a capital of $25,000. The directors are D. Clark, W. G. Oakman and J. P. Green. The first two are New Yorkers and the third from Philadelphia.

A small concern under the title of the M. F. Flack Company has been incorporated with a capital of $500 by Edwin Burhorn, M. F. Flack and L. A. Phillips to deal in electrical appliances.

It is reported with seeming show of authority that the city has purchased a site at Long Island City for a generating station for a municipal public-lighting system. The price is not divulged, but a sum of $600,000 was appropriated some weeks ago for this purpose. Another report, not quite so well substantiated as the foregoing, avers that the selected site is on First Avenue and Twenty-eighth Street, Manhattan, where there are at present premises used as a generating station by the United Electric Light and Power Company.

Dr. C. H. Tyndall of Mount Vernon, N. Y., gave an interesting lecture, with apparatus, to expound the principles of space telegraphy at the Miller Business School on Friday. Among other things Dr. Tyndall explained the process of "tuning," the instruments used for communicating on the Atlantic. D. W. W.

## Dominion of Canada.

Winnipeg, Man., April 1.—A contract for the electrical equipment of the Lulu Island railway, Victoria, B. C., has been awarded to the Canadian General Electric Company.

The Thunder Bay Power Company, Fort William, Ont., has applied for incorporation to take over the Kakabeka Falls Land and Electric Company.

In connection with the electric plant about to be installed at Indian Head, N. W. T., it has been decided that the water supply should be taken from springs at the foot of the Squirrel Hills, a distance of seven miles from town, with an elevation of 160 feet.

The firm of J. Y. Griffin & Co. of Louise Bridge, a suburb of Winnipeg, is seeking permission from the council of the Kildonan municipality to obtain powers to supply electric light, power and gas to Louise Bridge district.

The legal department of Toronto, Ont., has issued a writ against the Toronto Electric Light Company to recover the land on the Esplanada on which the company's works now stand and to block the arbitration which the company has instituted to secure a renewal of the lease for 21 years from the city.

Arrangements are being made for the introduction of electric light in Ladner, B. C. The power will likely be transmitted from Stevetson, where the British Columbia Electric Railway has a power house.

The contract for the equipment of the electric-light plant in Hull, Que., has been let to the Canadian General Electric Company, Toronto.

The Town Council of Sussex, N. B., is considering the lighting of the streets with electric light.

Penneyman & McGuire of Providence, R. I., who have been awarded the contract for the construction of the dam across the Rainy River from Fort Francis on the Canadian side to International Falls on the American side, have started work with 250 men.

The Western Power Company has been incorporated to produce electricity at Victoria, B. C., with a capital of $25,000.

A street railway for Regina, N. W. T., to be financed by private capital, is now being arranged. William Anderson of Regina is understood to be the promoter and an application is about to be made to the City Council for a franchise, which will be readily granted, as the residents are anxious for an electric-car service. Mr. Anderson was in Winnipeg recently negotiating with the Winnipeg Street Railway Company for rolling stock.

President Frederic Nicholls of the Toronto-Hamilton electric railway is asking for tenders up to the first of May, next, for the grading, culverts, masonry, bridges and other works required between Toronto and Niagara Falls, Ont. Plans and specifications may be seen and obtained at the company's engineering department, Scott and Front Streets, Toronto, Ont.

The dealings on the Toronto Stock Exchange during the last few days have been attended with considerable excitement. The prominent feature has been the advance of about 20 points in Winnipeg Electric Street Railway. There is practically no stock offering, and the rumor that the company had a standing offer of 200 for the control of the property had a most stimulating effect. The stock sold up to 170.

The Windsor, Lake Shore and Essex Rapid Railway is applying to Parliament for an act to permit it to extend its line from Essex to Tilbury Village, Ont.

An act is being applied for to authorize the Strathroy and Western Counties Railway Company to extend its present line, as authorized, between Strathroy and St. Thomas, Ont., passing through the city of London.

J. M. Cambell, the engineer of the new electric railway at Edmonton, N. W. T., has awarded most of the tenders, and work will be begun soon. A Montreal firm is building the road. It will extend from three to five miles, and it is the intention to develop it so as to include a number of neighboring villages. The cost for rails and ballast will be $15,000 per mile, and the bonding and overhead work will add $2,000 a mile to this amount. For machinery to be purchased for the power house alone, without counting the building, $16,000 will be required. The road will be running by September 1st next.

The Ontario Electrical Development Company, which has just let contracts for a new $500,000 power house at Niagara Falls, has decided on a very extensive scheme of power development for electric traction in Western Ontario, in addition to the power to be delivered in Toronto. Surveying parties will start out immediately to locate routes for power cables to Brantford, Paris, Galt, Preston, Berlin, Ayr, and all places requiring power in those districts, while Stratford, London and places in districts surrounding these cities will all be given an opportunity in the near future of using the power from Niagara. H.

Ottawa, Ont., April 1.—The town of Morrisburg, Ont., has passed by-laws for the development by the town of 1,100 horsepower from a canal and converting it into electrical energy for the purpose of furnishing power to factories and the granting of free power, light and water to J. W. Allison of New York for establishing a tin-plate and sheet industry.

The town of North Sydney, Nova Scotia, is soon to have two electric-light companies. The Town Council has endorsed the move on the part of the Sydney Mines Electric Company to seek a charter to operate in North Sydney. The new company offers to provide electric light at 11 cents per kilowatt-hour as against 15 cents at present charged by the Cape Breton Electric Company in the town.

L. E. Cote, engineer of the Dominion marine de-

partment, Ottawa, is locating three stations along the New Brunswick coast of the Bay of Fundy, off which the Canadian government proposes to sink submarine signal bells.

The bill to give the Maine and New Brunswick Electrical Company an exclusive franchise at Aroostook Falls, N. B., has passed the corporation committee of the New Brunswick Legislature with some amendments. The company must expend $25,000 upon its works in New Brunswick within the year. Electrical power must be furnished to patrons in New Brunswick at any time as cheaply as it is sold to Maine customers, and the company will be required to pay the province an annual rental for the privilege of $250 until such time as gross earnings of the company reach $25,000 per annum, then two per cent. upon the earnings thereafter.

A special meeting of the City Council of Ottawa, Ont., considered the situation created by the passing in the House of Commons of the bill allowing the Ottawa Electric Company to purchase the bonds, stock and debentures of the Consumers' Electric Company. The council unanimously resolved to submit to the property owners of the city a by-law enabling the city to buy out the Consumers' company. The charter of that company contains a clause giving the city the power to buy it out at any time, the price to be fixed by arbitration and no allowance to be made for the unexpired term of the franchise. The city some time ago obtained from the Provincial Legislature the power to borrow $250,000 to set up a municipally owned and operated plant if the ratepayers so desired. This sum would now be available for the purpose of taking over the Consumers' plant.

The Richelieu Light and Power Company, with an authorized capital of $500,000, has been formed by several Montreal financiers and is now seeking incorporation from the government at Ottawa. The company proposes to supply the towns of Farnham, St. Cesaire, Iberville, St. Johns and many other adjacent towns in Quebec Province with electricity for light and power purposes. A plant on the Yamaska has been acquired which it is proposed to enlarge. W.

## New England.

Boston, April 1.—By the recent acquisition of about three acres of additional land adjoining the present General Electric works at Lynn, title to which has recently been made clear through court proceedings, the enlargement of the Saugus River plant is assured. Plans are not formulated so that they can be announced as yet, but the management expects to make additions of a substantial character to the plant.

The offer from the New York, New Haven and Hartford Railroad Company for the Springfield street-railway property is on the basis of $225 cash, or two-thirds in preferred stock of the proposed new company, the balance to be in cash. The stock has been selling a little under $200 on 'change, and has paid eight per cent. dividends for some time.

The Worcester Electric Light Company has ordered of the Stewart Boiler Works, also of Worcester, 12 boilers, to take the place of the present battery of 10. The old ones have been in use 15 years.

Leo McCarthy of Cambridge, a former employe of the Western Union Telegraph Company, was arrested on March 25th, and a thriving business done by him in Malden, Newton and other cities adjacent to Boston, in bogus telegrams, which he was industriously distributing and collecting thereon, was brought to an end.

Despite rumors to the contrary, the New York, New Haven and Hartford railroad will not discontinue its Nantasket Beach electric-railroad service.

United States Senator W. Murray Crane of Dalton is interested in the new power house for that town, for which a contract has just been let. The new building will be 30 by 50 feet, and an electrical service of considerable size will be inaugurated.

The property of the electric-light company at Laconia, N. H., has passed to the control of a company composed of Massachusetts and Rhode Island capitalists. The plant will be enlarged to furnish electric power, and extension of the service to the Weirs at Lake Winnepesaukee is contemplated.

At the annual meeting in New Haven on March 21st, of the Consolidated Railway Company, the holding company for the electric-railway systems owned by the New York, New Haven and Hartford Railroad Company, the directors were all re-elected, Charles S. Mellen, president of the steam road, being again made president of the company. B.

## Southeastern States.

Charlotte, N. C., April 1.—An electric-light plant is being built at the Southern Railway shops at Manchester, Va., to furnish 27 arc lights. The firm of George Paul & Co. is also making arrangements to install a light plant in its ice factory.

The Bluestone Traction Company of Graham, Va., has been chartered with $100,000 capital stock to operate an electric railway. John Walters is president, J. N. Sluss vice-president, and Edwin Mann treasurer, all of Bluefield, W. Va.

The Charlotte Consolidated Construction Company of Charlotte, N. C., will build an extension to the Highland Park cotton mills, one mile from the pres[illegible] northern terminus [illegible] president.

Arrangements are being [illegible] work on the electric railway from [illegible] to Summerville [illegible]

The eight-mile belt line of the Greenville (S. C.) Traction Company [illegible]. The poles have all been [illegible] on.

The promoters of the 21-mile electric railway from Charlotte, N. C., to Casconia have secured a charter and the survey has been completed. [illegible] Wright of Petersburg, Va., W. S. Forbes, M. Martin, J. D. Patton and P. C. H. [illegible], Va., are interested. The line will probably be built to Concord also, a distance of 21 miles north.

The town of Spencer, N. C., has contracted with the Salisbury and Spencer Street Railway Company for a system of electric lights to be put in operation by May 15th. The company was also given the right to operate an electric railway between the towns mentioned and a telephone system if desired.

Commissioner Macfarland of the District of Columbia has secured the passage of legislation for the completion of the work of putting electric wires underground. It was expected that 10 years would be required for the work, which has been nearly finished in five years. The telegraph companies are about the only ones who are behind in the work of getting their wires in conduits.

The Cape Fear Electric Power Company of Fayetteville, N. C., expects to be ready to furnish power soon. Harry Walters of Baltimore has become associated with the promoters and is said to be backing the enterprise, which will start with 4,000 horsepower, to be increased to 8,000. The company is also seeking to get a contract to furnish the town of Fayetteville with current, instead of the city enlarging its municipal plant.

The Durham (N. C.) Traction Company has secured the contract for three years for lighting the city, a small part of the contract, however, going to the local gas company. The contract is worth about $30,000 for the three years.

A decree has been issued for the final distribution of the funds of the Wilmington (N. C.) Street Railway Company, which was sold two years ago for $110,000 in the case of the Morton Trust Company of New York against the street-railway company.

It is rumored that persons interested in the Catawba Power Company of Charlotte, N. C., have secured a controlling interest in the Mountain Island shoals on Catawba River and that a similar plant will be erected to that already built by the company on the Catawba River; also that a third plant will be erected in which the American Tobacco Company stockholders are interested. The combined power of the three plants will be about 80,000 horsepower and will be distributed among the towns of Rock Hill, Clover, Charlotte, Gastonia, Dallas and other points, where many cotton mills are operated.

The Seaboard Traction Company of Portsmouth, Va., has applied to the state for a charter in Portsmouth to operate an electric road to Smithfield and Suffolk and thence to Petersburg and Manchester. Work will be started in six months and is to be finished in two years. L. R. Britt of Norfolk is president of the company and W. H. Robinson, formerly of Pittsburg, Pa., is general manager.

The Florence Light and Power Company will shortly begin furnishing lights to the town of Timmonsville, S. C. It is believed that a trolley line will shortly be established between Florence and Timmonsville. The Florence company will also establish a power plant at Timmonsville.

The town of Williston, S. C., has voted $5,000 for an electric-light system, and work will likely be started in a short time.

The new interurban electric concern, the Carolina Traction Company, will connect Union, Spartanburg, Laurens and other points. J. F. Jacobs of Clinton is one of the promoters. L.

## Texas.

Austin, Texas, March 31.—Richard Burges of the El Paso Valley Water Users' Association has made application to the commissioners of El Paso County for a franchise for an electric railway. The proposed road is to run from Anthony, N. M., to El Paso, a distance of 18 miles, and then down the Rio Grande Valley for a distance of 45 miles below El Paso. Power for the road is to be generated from waterpower in New Mexico. The association has also planned to build a telephone line down the Rio Grande Valley.

W. H. McGrath and W. L. Crawford, who propose to operate a street-railway system in Mineral Wells, will build a line up one of the adjacent mountains to a summer resort.

George Fiegel and F. H. Bruce of Austin have been investigating the situation at Brownsville, with the view of establishing an electric-light and power plant.

The board of county commissioners has granted a franchise to Holloway & Thallman to install an electric-light plant at Hondo.

A. B. Storey of Lockhart and other local business men are interested in the project of building an electric railway from Lockhart to a point on the [illegible]

## Ohio.

[illegible] tion C[illegible] hold[illegible] in this deal.

[illegible] to extend the line of the Columbus, Delaware and Marion northward from Marion either through Bucyrus or Galion, the ultimate terminus being some point on the lake. John G. Webb, president of the Columbus, Delaware and Marion, will be the head of the new company, and it is thought that the first cost of the extension will not be less than $1,000,000. The first of the 2,000-kilowatt turbo-generators will be installed in the power house of this road at Stratford in a short time. The second will be put in place some time during the summer. The plant will be one of the largest and best of the kind in the country when these two generators are in.

A two-per cent. dividend has been declared on the stock of the Toledo Railways and Light Company, one per cent. being payable May 1st. This is said to be the first dividend ever paid on the stock. The directors authorized the reconstruction of 10 miles of track.

A new company is in contemplation which will build a line 40 miles long from Mansfield to Chippawa Lake, connecting the lines of the Ohio Central and the Cleveland and Southwestern. The extension of the Columbus, Delaware and Marion to Galion or Bucyrus would also connect with the Ohio Central, and with the proposed line would form a through route from Columbus to Cleveland.

The Dayton Electric Light Company and the Montgomery County Electric Light Company only recently incorporated, have been merged. The capital stock of the merger will be $2,500,000, and, it is said, a large amount will be spent in new equipment.

A plan has been formulated to lift the receivership of the Sandusky Southwestern. It is said that four of the officers will guarantee to raise $25,000 if the other stockholders will raise $20,000 more to clear away the debts.

Consolidation papers have been filed at Columbus by the Fort Wayne, Van Wert and Lima Traction Company and the Lima, Delphos, Van Wert and Fort Wayne Traction Company under the name of the Fort Wayne, Van Wert and Lima Traction Company. The capital stock will be $2,000,000, of which half will be preferred five-per cent. stock. O. M. C.

## Indiana.

Indianapolis, April 1.—Plans are under consideration by the owners of the Evansville and Princeton Traction Company which contemplate the construction of a system of interurban electric railways that will spread a network of tracks over Gibson, Posey and Vanderburg counties. The principal extension and the beginner of the system will run from Kings Station on the main line to Owensville.

Terre Haute is in a state of excitement over the charge that the local traction company is endeavoring to bar out all other interurban companies. Two other traction companies that have projected interurban lines from Terre Haute south into Greene and Sullivan counties have been forestalled by the apparent willingness of the Board of County Commissioners to aid the local company.

A. W. Brady, president of the Indiana Union Traction Company, has returned from Philadelphia and announced that no change was made in the officials by the board of directors at the annual meeting. He said that considerable new construction was ordered for the summer, including the New Castle, Elwood and Frankton extensions from Anderson.

The first car for the Lagrange-Elkhart electric railway has been delivered at Lagrange, and the people are delighted with the prospect of another means of transportation. The company is experiencing trouble with quicksand along the line, the roadbed having sunk about 10 feet. It is expected, however, to have cars in regular operation in a short time.

Work was begun during the week on a short electric railway between Lebanon and Thornton by the Lebanon and Thorntown Traction Company. The line will be 10 miles long. H. M. Atkinson of Indianapolis is president of the company.

Indianapolis men head a company to build an electric railway from Indianapolis to Celina, Ohio. Articles of incorporation under the name of the Indianapolis, Hartford City and Eastern Traction Company were filed during the week. The principal office will be in Alexandria.

Work has been begun on the Indianapolis, New Castle and Toledo electric railway and the promoters

says care will be run between Indianapolis and New Castle before the year ends. Eli Marven, president of the company, says the third-rail system instead of the trolley will probably be used.

Two handsome Holland chair cars have been delivered to the Indianapolis and Northwestern Traction Company and will be put in regular service in a few days. These cars will make three trips each way every day on a schedule of two hours flat. The rate will be 50 miles an hour and the fare will be higher than on other cars.

The first of a number of subsidy elections to be held to vote aid for the proposed traction line between Logansport and South Bend was held in Marshall County on Monday and resulted in a good majority in favor of the subsidy tax.

H. E. Bucklen of the Elkhart, who is constructing an electric railway from Lagrange to Elkhart, is considering the use of Edison storage batteries as motive power. About 10 miles of rails have been laid, but no trolley poles have been erected.

The Chicago and South Shore Railway Company's interurban road between Laporte and Michigan City, now in a receiver's hands, will be sold by Judge Anderson in Indianapolis next Monday. The sale is to satisfy a claim of the Royal Trust Company, which held bonds to the amount of $382,000. The indications are that there will be a lively bidding for the road. S. S.

## Mexico.

City of Mexico, March 29.—The Dwight Furness Company of Guanajuato has placed engineers in the field to locate the route for the electric railroad which it will build from Guanajuato to Irapuato, with a branch line to the town of Salamanca, where it will connect with the National railroad of Mexico. The proposed road will be about 45 miles long.

Thomas Walsh of the General Electric Company, New York, has been making an examination of copper properties in the Autlan district of the state of Jalisco for that concern. It is stated that Mr. Walsh has made favorable reports on some of these properties and that they will be acquired by the General Electric Company. It is further announced, on apparently trustworthy authority, that the plans of the General Electric Company include the construction at an early date of an electric railroad from Autlan to a connection with the Zapotlan branch of the Mexican Central railroad. A Chicago syndicate which owns the Rosa Amarilla mines, recently secured a concession from the Mexican government for the construction and operation of an electric railway from its mines to the port of Navidad, on the Pacific Coast, and it is planned by this syndicate to extend the road to Autlan if the proper encouragement is received from mine owners and others. J. R. Bickerdike, a prominent member of the Chicago syndicate, who is now in Guadalajara, says, however, that the General Electric Company has no interest in his project.

Marcelo Valentin of the City of Mexico has taken preliminary steps toward establishing a large electric power plant in the state of Guerrero. He has applied to the government for authority to use the waters of the Balsas or Mixcala rivers for the purpose of operating the proposed plant.

An official commission, appointed by the Mexican government, has been sent to the United States to study the telegraph systems of that country. The members of the commission are Joaquin G. Salazar and Antonio Alvarez Sardaneta.

Paul Ginther of Santa Rosalia and Joaquin Cortazar of Chihuahua have made application to the state of Chihuahua for a concession to establish an electric generating plant on the Conchos River above Santa Rosalia near the village of San Francisco. They intend to build transmission lines from the power plant to the cities of Parral and Santa Rosalia.

A new telegraph line has been built by the federal government between Guaymas and Cabo Haro, and another between San Luis Potosi and Queretaro. A line will also be built between San Luis Potosi and Monterey.

A syndicate of Canadian capitalists headed by William Mackenzie of Toronto, Canada, has practically completed negotiations for the purchase of the two street-railway systems in Monterey, including a valuable concession held by Mackin & Dillon of Monterey for the establishment of an electric system of railway upon all of the principal streets of the city not already occupied. It is stated that the two systems will be consolidated and that electric traction will be substituted for the present mule traction as soon as possible. A number of new lines will be built and the combined system made one of the most up to date in Mexico. Monterey has a population of about 80,000 and is the greatest industrial city in Mexico.

An electric-light and power plant will be installed at Tlanguismanalco. The power will be derived from a river near the town.

It is announced that the Jalisco Exploitation Company of Guadalajara, which was recently organized with a capital stock of $6,000,000 gold, will build an electric railway from Guadalajara to the port of Chamela, on the Pacific Coast. M. C. Miller of Guadalajara is president and C. W. Whittemore of the City of Mexico is general manager. An electric power plant will be located 24 miles from Guadalajara, where there is an abundance of waterpower.

A company has been organized for the purpose of acquiring and consolidating the electric-lighting and street-railway systems of Colima. The company has a capital stock of $120,000. Luis Brizuela of Colima is the principal stockholder. It is proposed to convert the street-railway system into electric traction and to make important extensions and other improvements.

The waterfall of Tzirimia, about 20 miles from Espejuelos, has been purchased by a syndicate of Buffalo (N. Y.) capitalists, the price paid being $500,000 gold. The new owners intend to erect a large electric power plant.

An electric-light and power plant is to be installed at Lagos. The town also wants a telephone system.

An electric-light and power plant is to be established at Nuevo Laredo by Octaviano Gonzalez and associates.

An American syndicate is said to have offered $3,000,000 for the Bermejillo street-railway system in Guadalajara. Ramon Alcazar of Guadalajara can give information. W. D.

## Michigan.

Detroit, April 1.—The Muskegon council is considering a franchise for the M. B. Wheeler Company, which expects to supply electric power from dams on the White River. The Wheeler company also asks for a franchise in the city of Grand Rapids, at which town as well as Muskegon power will be furnished.

It is understood that the Lansing and Suburban Traction Company has come to an understanding with W. A. Boland of Jackson and also with the Bird S. Coler interests by which the Lansing company will build an electric railway from Lansing to Jackson. The rails and ties of the Boland road to Grass Lake will be taken up and used in the construction of the new road. Mr. Coler and his associates will finance the project.

The Detroit, Monroe and Toledo electric railway has notified its employes that on April 3d an increase in pay will be given to 22 cents an hour. The employes now receive 20 cents.

Mayor Codd of Detroit has appointed T. H. Hinchman, Jr., as one of the municipal electric-lighting commissioners. This is the first time that the commission has been given a practical man, who is technically equipped to carry on the work. The criticism given the municipal-lighting company by the private-lighting corporations seems to call for more practical services on behalf of the city's lighting plant. The lighting commission's estimate for improvements is over $276,000, and the same has been allowed without a cut. The proposed installation of a 2,000-kilowatt unit will greatly improve the service.

The Detroit, Ypsilanti, Ann Arbor and Jackson electric railway will put on a fast limited service between Detroit and Jackson by which the time between these two cities will be cut to two hours and 30 minutes. Free cartage at Ann Arbor and points along the line will be discontinued on April 1st. This action was brought about by the restoration of freight rates by the Michigan Central railroad between competing points. The officers of the electric road say that the company is earning 40 per cent. more now than it was at this time a year ago. New limited cars will be put on, running from Detroit to Battle Creek.

The Mount Clemens Electric Company will erect a new building for the use of the company and will also appoint a new manager on May 1st—Alexander Jacobi.

At the annual meeting of the Grand Rapids, Grand Haven and Muskegon interurban road held at Grand Rapids this week the old officers were re-elected. J. D. Hawks of Detroit is president and W. K. Morley general manager. It is understood that plans have practically been completed for the building in Grand Rapids of a warehouse and terminal station to cost upward of $25,000.

The Indiana and Southern Michigan Electric Railway Company has secured franchises from the Niles City Council and the officials have gone over the road on an inspection tour. George Townsend of Indianapolis is said to have secured the contract for constructing the line from Niles to St. Joseph for $500,000.

The Homes bill for regulating the speed of automobiles in the state has passed the House and is in a fair way to become a law. It places the speed limit for automobiles at 10 miles an hour in the business portion of towns and cities, 10 miles an hour in the residence portion and 20 miles an hour in the country. C. G. W.

## Northwestern States.

Minneapolis, April 1.—The Madison (Wis.) Traction Company has been reported sold to F. Warren Montgomery of New York for approximately $260,000.

The Cedar Falls and Iowa Interurban Railway Company has decided to build a trolley line from Iowa City to Muscatine. This will form a connecting link in the line from Cedar Rapids and Davenport.

A new trolley line is proposed from Centerville, S. D., to Canton.

There are persistent rumors that an electric railway is to be built shortly connecting the Twin Cities with Winona, Minn., and La Crosse, Wis.

Albert Woolson of Windom, Minn., has been appointed superintendent of the electric-light and waterworks plant at Winnebago City, Minn.

The Peterson Heat, Light and Water Company has been given an option of 30 days on the plant of the Iowa Falls (Iowa) Electric Light and Power Company.

Contracts will be awarded at once by the Interurban Railway Company for the construction of the proposed trolley line from Des Moines, Iowa, to Perry via Woodward.

An electric-light plant is talked of at Ashby, Minn.

A survey is being made by the Minneapolis, St. Paul and Suburban Railway Company for the extension of the Stillwater line to South Stillwater.

The owners of the electric-light plant at Sioux Falls, S. D., are considering a proposition for the purchase of the electric-light plant at Yankton, S. D. The price asked is said to be $12,500.

The Fox River Railway Company has filed articles of incorporation at Manitowoc, Wis., with a capital of $250,000. It is proposed to build a trolley line from Kaukauna to Sheboygan via Manitowoc.

Three million dollars wil be spent by the Minneapolis General Electric Company and its controlling interests in securing for Minneapolis and St. Paul nearly double the present power available for manufacturing and other purposes. The plans are complete and before the first of the year the company will be able to deliver 24,000 additional horsepower to the Twin Cities. The large waterpower rights at Taylors Falls, Minn., have been secured and will be developed to at least 12,000 horsepower at once, and this will be increased as fast as there is a demand for more power. The power will be transmitted at a pressure of 50,000 volts to a sub-station between the two cities. The system will be modern in every detail and will be installed under the direction of G. O. Muhlfeld, superintendent of construction for Stone & Webster of Boston, owners of the General Electric Company. R.

## Rocky Mountain States.

Salt Lake City, March 29.—An eastern company has been awarded a contract by the Barber Lumber Company of Boise, Idaho, for the equipment for its proposed power plant, including three 300-kilowatt alternating-current electric generators. Work on the installation of the plant will be pushed as rapidly as possible.

J. E. Bamberger of Salt Lake and B. Mahler of Cleveland, Ohio, have each filed an application with the City Council of Ogden, Utah, for a franchise for the operation of an electric street-railway system in that city. Mr. Mahler's system, if the franchise is granted, will extend from Salt Lake City to Brigham City, via Ogden. The Bamberger route is from Salt Lake City to Ogden.

David Eccles of Ogden, Utah, is promoter of a plant to extend an electric railway for a number of miles into Ogden Canyon, and has promised to commence immediate work on the system, provided the farmers in the territory to be traversed will raise sugar beets for transportation to the sugar factory. The necessary rails and other equipment for commencing work are already on hand.

The Weiser Electric Light and Power Company of Weiser, Idaho, capitalized at $50,000, has filed articles of incorporation.

The Parma Telephone Company of Parma, Idaho, has filed articles of incorporation. The company is capitalized at $10,000. G.

Helena, Mont., March 30.—The Crystal Lake Power and Irrigation Company has been incorporated at Helena, Mont., with a capital stock of $50,000 by W. J. Owen, Patrick Nihil, J. W. Moore and others, all residents of Rock Creek Bench, near Moore.

The Madison River Power Company, a New Jersey corporation, is to erect a plant on the Madison River for the development of electrical power. The capital stock of the company is $600,000. H. W. Turner of Butte, Mont., is the state agent.

P. Ellis is the chief promoter in a movement to organize a company for the purpose of erecting a large power plant on the Weiser River. Surveys have been completed by Engineer A. E. Fox. The plant is to be erected on the Zumalt Ranch, near Weiser, Ida., and will be equipped with the latest style of machinery. The estimated cost of the plant is about $50,000.

The Shoshone Power Company, capitalized for $5,000,000, has been incorporated in Cassia County, Ida., for the purpose of building a plant on Shoshone Falls to supply points in Utah with power. Francis M. Lyman is president of the company; J. A. Bagley, vice-president; L. R. Martineau, secretary and treasurer, and F. M. Lyman, chief engineer. The building and installation of the power plant and the construction of the transmission lines will cost about $1,000,000. The distributing stations and equipment of subsidiary companies will cost another million. About 70 leading business men of Salt Lake are interested. A.

## Pacific Slope.

San Francisco, March 30.—The Oregon Traction Company has awarded to the Atla Contract and Supply Company of this city the contract for building and equipping its electric road between Portland and Hillsboro, Ore., a distance of 20 miles. The contract amounts to about $750,000, and is subject to the letting of the franchise, which is now being advertised.

The Bourbon Electric Power and Mining Company is to install an electric plant near Murphys, Calaveras County, Cal.

Preparations are being made for the installation of an electric pumping plant on the sugar plantation of the Makee Sugar Company at Kealia, Kauai, T. H., for the purpose of irrigating the plantation. The Pelton Water Wheel Company of San Francisco has designed the plant, which is to supply power for the pump.

Actual work on the Wishon Tule River power plant near Porterville, Cal., has been commenced. H. E. Huntington is behind the project. A power house will be erected at the forks, which will develop 4,000 horsepower. Another power house will be built at Doyle's, developing 2,500 horsepower, and a third in the neighborhood of the clubhouse, to develop 2,500 horsepower.

The Aurora Consolidated Mining Company is about to install a big power plant for the development of the Alamo mine, some 60 miles back from Ensenada, Lower California.

The Pacific Traction Company has been incorporated with $1,000,000 capital by R. R. Streets of Olympia, Wash., E. C. McDonald of Spokane, Wash., and others. An interurban electric railway will be constructed between Olympia and Tacoma along the route surveyed by Frank Ross last summer. The company has applied for a franchise to construct and operate a street railway on Main, Fourth and Columbia Streets at Olympia.

H. W. Warrington, chief engineer of the Kettle Valley line from Republic to Spokane, Wash., states that it is expected to have the survey completed by April 15th. The road will be 140 miles long and will cost $3,500,000. It will follow the San Poil River from Republic to the Columbia, across the Columbia by a steel bridge below Hellgate, and up the river to Spokane.

Fred S. Morris, treasurer of the Oregon Water Power and Railway Company, announces that before the end of the year the company will operate an electric railway from Portland to Fairview and Troutdale, Ore., and will connect with Washougal and La Camas, Wash.

The trustees of Calistoga, Cal., have passed an ordinance granting to G. S. Cutler the right to construct and maintain poles, wires, etc., for the transmission of electricity for light and power purposes along the streets and alleys of Calistoga.

Capt. W. T. Forsman and J. W. Kaerth have filed a petition with the Board of Trustees of Colusa, Cal., asking the town to grant to W. H. Buster a franchise for an electric railroad through the town on Main Street.

The supervisors of Stanislaus County, Cal., are advertising for sealed bids for a franchise to construct poles and string wires along the county roads for the purpose of transmitting electric current, as applied for by the Tuolumne Electric Company.

The California Electrical Works of San Francisco, Pacific Coast agent for the Western Electric Company of Chicago, will erect a new office and factory building in San Francisco near the present location. L. E. Sperry is manager of the company.

A San Francisco representative of the Stanislaus Electric Power Company says that Beach Thomson, who has been in New York for some time, has been successful in securing capital for the construction of an electric-power transmission plant to supply San Francisco with power. The power site is situated about 130 miles from San Francisco. The recent transfer of 1,289 acres of land at the headwaters of the Stanislaus River and water rights to 15,000 inches on the middle fork of the Stanislaus from Beach Thomson to James K. Moffitt of San Francisco was made in the interests of the new company. It is proposed to install a modern three-phase generating plant in a power house with space for a capacity of 30,000 horsepower. It is understood that a beginning has been made on the hydraulic system, which will be extensive, at least 15 miles of ditch and flume being required.

The Chancellow Gold Mining Company has decided to build a large power plant in the Slate Creek mining district, Washington, during the coming summer. H. A. Parker of Chicago and eastern associates will furnish capital.

H. D. Wagnon of Portland, Ore., announces that he expects to establish an electric-light and power plant in Salem, Ore. The project will cost $25,000.

The Portland General Electric Company has filed a petition with the county commissioners of Clackamas County, Oregon, asking for a franchise over county roads between Oregon City and Aurora for the transmission of electricity for light and power. A similar franchise will be asked for over the Marion County roads between Aurora and Salem. An additional generating plant will be erected at Willamette Falls.

Manager Fred S. Simpson of the Ballard Electric Company states that plans are being made for extending the company's lines to all parts of Ballard, Wash. About $20,000 will be [illegible] improvement.

William Brodie and [illegible] of [illegible], Wash., have filed an application [illegible] with the city clerk of Harrington, Wash. [illegible] electric light plant.

## PERSONAL.

Chevalier Marconi and his bride arrived at New York on April 1st on board the steamship Campania from Liverpool. On landing Mr. Marconi spoke modestly but optimistically of his present [illegible].

George B. Damon, who has been manager of the New York office of the Wellman-Seaver-Morgan Company, has been transferred to an important position in connecting with the engineering and sales department of that company at Cleveland, Ohio.

Lord Kelvin underwent a serious surgical operation on March 29th, the outcome of which caused apprehension on account of his advanced age. His condition at latest reports, however, appears to be improving, and it is hoped that he will still be spared to continue the work which has made him famous as one of the foremost exponents of exact scientific research.

L. G. Richardson, president of the Central Union Telephone Company, has been elected president of the Cleveland Telephone Company, to succeed President Fish. It is said that Mr. Richardson will spend much of his time, for several months, in Cleveland and make an aggressive campaign for an increase of business. Mr. Fish's other duties prevented him from giving the company the attention that it needed, and this is given as the reason for the change.

William S. Hine, until lately an esteemed member of the electrical fraternity in Chicago, has resigned his position as selling engineer for the Western Electric Company to engage in the life-insurance business, with an office in the Fisher Building. Mr. Hine has had a wide electrical experience, both East and West, and, in addition, possesses social gifts of a high order. The electrical industry loses and the life-insurance business gains a bright, engaging personality by Mr. Hine's change of occupation.

H. D. Critchfield, general counsel and sales manager for the Automatic Electric Company, Chicago, returned to his desk on March 28th after a long and serious siege of illness. Mr. Critchfield was attacked by appendicitis in January and was operated on at the Chicago Hospital February 1st. While convalescing he was seized with pneumonia, from which he has just recovered. Mr. Critchfield possesses one of the brightest minds of those engaged in promoting the telephone, and his recovery will be hailed with delight by a multitude of friends.

A. C. Bunker and W. C. Appleton, alternating-current engineers, have become associated with the Crocker-Wheeler Company, Ampere, N. J., in the engineering and contract departments, respectively. Since the company took up the manufacture of alternating-current machinery eight months ago its activities in this field have rapidly increased and have necessitated a corresponding development in the engineering force. Mr. Bunker has been connected with the Stanley Electric Manufacturing Company on the Pacific Coast. Mr. Appleton has acted as engineering salesman for the General Electric Company in the Atlanta territory.

The Western Union Telegraph Company has just created the office of manager of local branch offices in St. Louis. W. E. Bellman, formerly employed by the company as a solicitor, was promoted to the position. He will have entire control of the 90 branches in St. Louis. Mr. Bellman began as a telegraph operator 20 years ago, and has been employed in every branch of railway, commercial and newspaper telegraph work. He was appointed chief operator at Cedar Rapids, Iowa, in 1889, and since then has held positions in Kansas City and Chicago. During the World's Fair period in St. Louis he was manager of the Western Union branch on the Exposition grounds.

W. A. Stadelman, for 10 years general eastern agent of the Brown Hoisting Machinery Company, has been appointed general eastern agent of the Wellman-Seaver-Morgan Company of Cleveland, Ohio, with offices at 42 Broadway, New York city. Mr. Stadelman is well known and popular among electrical men. From 1883 to 1891 he was agent at Philadelphia for the Sprague Electric Railway and Motor Company, and chief engineer of the Equitable Electric Railway Construction Company, having direct charge of the selling of Sprague electric-railway apparatus and the construction of electric railways in Pennsylvania, New Jersey, Delaware and Maryland. During this period Mr. Stadelman built some 30 electric railways. Since 1895 he has made his headquarters in New York.

William J. Clark, manager of the General Electric Company's foreign department, has recently been elected to the presidency of the Perforated Music Roll Company. His new connection will in no way alter his present relation with the electric [illegible] electrical world. His [illegible] Postoffice Department of the United States. Through his exceptional ability many postal frauds were revealed, and over 100 criminals were convicted. He began his street-railway career in 1886, [illegible] Company [illegible] connecting Ansonia, Derby and Birmingham, Conn. Later the Vandepoele patents were sold to the Thomson-Houston Company, with which Mr. Clark became connected in 1888. He became manager of the railway department of the General Electric Company in 1892, when this company was formed to consolidate the Thomson-Houston and Edison General Electric companies. Later he became manager of the foreign department. He went to London in the early '90's to effect a reorganization of the British Thomson-Houston Company. Besides these connections, he has found time for matters of national importance. He served under the [illegible] during the evacuation of Cuba by Spanish troops and this duty led to his appointment as expert on Cuban affairs. Subsequently he published the book "Commercial Cuba." His wide acquaintance in commercial, political and financial circles rendered his services valuable to the Republican national committee during the recent presidential campaign. Mr. Clark is a member of several societies and an associate of the American Institute of Electrical Engineers.

WILLIAM J. CLARK.

## ELECTRIC LIGHTING.

The Brady (Texas) Water and Light Company has been incorporated with a capital stock of $20,000.

Poles have arrived for the municipal lighting plant in Lincoln, Neb., and construction work will be pushed rapidly.

The Arlington Electric Light Company, Arlington, Neb., has been incorporated with a capital of $10,000 by G. F. Unland and others.

Bridlington, England, or "Leeds by the Sea," a favorite watering place, is said to be one of the first cities in England to use electric lighting exclusively. The scheme has involved an outlay of about $150,000, and the plant is one of the finest in Yorkshire.

A. H. Bickmore & Co. of New York city have purchased the Marshall (Mo.) gaslight plant, owned by Thomas Boatright of Marshall, and the electric-light plant owned by W. E. McCully of Macon, Mo. The two plants sold for $62,000. Extensive improvements will be made at once and the two plants will be consolidated.

The Pueblo (Colo.) Chieftain publishes this item: "South Cheyenne Canyon is to be profaned by a syndicate. Colored electric lights and other 'popular' attractions are to be introduced. Possibly Colorado with her wealth of natural beauty can afford to endure this desecration of one of nature's temples until a wiser generation restores it as nearly as possible to its original beauty and sanctity."

Pike's Peak is to be made the lighthouse of the Rocky Mountain region. A 60,000-candlepower searchlight surrounded by several hundred incandescent lamps will be mounted on the summit of the peak this summer. Electrical experts say that the light may be visible for 150 miles over the plains. The light will be installed as a resort attraction and the current will be furnished from Manitou.

A picture of a fine cash register printed on a big card forms the subject of these remarks from the Denver Gas and Electric Company: "You won't mind—if we help you to make it ring, because the bell [on the cash register] is the sign of money. Start the ring now by the use of light. Light advertising is no longer an experiment. All who use it say that it pays." The company is also sending out a series of Egyptian card pictures in colors which are cleverly made to do duty in advertising its gas ranges and water heaters.

## ELECTRIC RAILWAYS.

George Switzer has been granted a franchise for a new trolley road through the town of Naples, N. Y. The road will be 10 miles long and will connect Atlanta and Woodville.

Articles of incorporation of the Chicago, Kankakee and Champaign Electric Railroad Company have been filed. The principal office is in Chicago, and the capital stock is, nominally, $100,000. The road is to connect the cities named. The incorporators

and first board of directors are E. D. Risser and R. A. McCracken of Paxton, Ill.; Upton Schaub of Watseka, Ill., and C. V. Donovan, C. C. Patton and W. J. Boot of Chicago.

Local capitalists have incorporated the Walkill Transit Company at Middletown, N. Y., with a capital of $350,000. This concern is a reorganization of the Middletown-Goshen Electric Railway Company.

The Chicago and Milwaukee Electric Railroad Company has opened the Rockefeller extension of its Libertyville branch, inaugurating a train service between Lake Bluff and Rockefeller where it connects with the Wisconsin Central railroad.

The Bloomington, Decatur and Clinton Traction Railway Company has been incorporated in Illinois with a capital of $150,000 to construct an electric railway from Bloomington to Decatur. This is one of the links of the interconnected system of electric railways which are planned to give through service from Chicago to St. Louis, and its location may be traced on the map given on page 249 of the April 1st issue of the Western Electrician showing the electric interurban railways of the central portion of the United States. The incorporators of the company are: H. W. Knight of Kansas City, Mo.; J. J. Danforth, James P. Ogden, William H. Schmidt, R. S. Buchanan and May S. Hyde of Chicago.

## PUBLICATIONS.

The application of storage batteries to lighting and power plants is the subject discussed in a late bulletin from the Electric Storage Battery Company of Philadelphia. Some interesting views of the installation in the Edison Electric Company's plant in Los Angeles are shown, with a general description of the plant.

The programme for the convention of the Southern Supply and Machinery Dealers' Association, to be held in Savannah, Ga., on April 25th to 28th, is printed in a fine 60-page book which also contains an article entitled "Savannah, Georgia, a City of Opportunities." The book has many fine pictures of the principal points of interest in Savannah and vicinity.

A neat stock list is distributed by the Plume and Atwood Manufacturing Company of Chicago. This company is well known as a manufacturer of brass goods, including sheet, rod, wire and tubing, together with german-silver and copper products. Its goods are in large demand by manufacturers in the electrical lines, to whom this latest list will be of interest.

No. 2 of "Electrical Catechism," the instructive series of questions and answers which is being printed and sent out by the National Electric Company of Milwaukee, has appeared and is devoted to the determination of the remainder of the electrical units not spoken of in No. 1, and takes up besides Ohm's law. These little pamphlets promise to make a compact and useful mass of information when the series is completed.

The Standard Varnish Works of Chicago manufactures three preparations which it deems of especial merit—quick-drying Voltalac, Gutta-percha black finishing and Gutta-percha light finishing. The company has issued a unique form of folder to advertise these particular products which at once catches the eye. It is printed in colors upon heavy wrapping paper and quite original in design. The three products mentioned, as stated on the outside of the folder, are "The Standard Electrical Trio."

## SOCIETIES AND SCHOOLS.

An interesting publication is that of the Michigan College of Mines, showing pictures of the principal buildings, of the interiors of some of the laboratories, shops and assay rooms and of parties of students doing actual work in the field and inspecting the mines.

The Southern Supply and Machinery Dealers' Association will hold its fourth annual convention at Savannah, Ga., on April 25th to 28th. Headquarters will be at the De Soto Hotel. All reservations should be made through G. V. Denny, chairman of the entertainment committee, Savannah, Ga. Railroads have offered reduced rates.

The ninth annual meeting of the National Fire Protection Association will be held in New York on May 23d to 25th. The meeting will be held in the Assembly Room of the New York Board of Fire Underwriters, No. 32 Nassau Street. Programmes and advance copies of papers will be sent out soon. The secretary of the association is W. H. Merrill, Jr., 67 East Twenty-first Street, Chicago.

A preliminary injunction has been ordered issued by the United States Circuit Court for the Northern Division of Illinois, directed to the Morgan-Gardner Electric Company, defendant, in the suit brought by the General Electric Company, restraining the defendant, until further order of the court, from making or selling trolley harps, trolley forks or trolleys for electric-railway service, and contact brushes therefor, which in any way embody or employ the eighth claim of United States patent No. 412,155 for improvements in trolleys for electric railways, granted to Albert Anderson, October 1, 1889. The eighth claim reads: "The combination with a trolley frame and trolley wheel, of metallic conducting brushes between the hubs of the trolley wheel and the said frame, to operate substantially as described."

The next meeting of the Association of Railway Telegraph Superintendents is to be held in Chattanooga, Tenn., on May 17th at the Read Hotel. The convention will last but two days, but plans are being made to entertain those delegates who desire to stay over the 19th by a carriage ride to Chickamauga battlefield.

Plans by which it is proposed to combine the Massachusetts Institute of Technology with Harvard University and discontinue the Lawrence Scientific School of the university have been made public. The question of the acceptance of the union agreement will, however, not be acted upon for several weeks, it is said.

The next reunion of the Old Time Telegraphers' and Historical Association will be held in New York, August 29th to September 1st. President J. C. Barclay at an informal meeting of the officers outlined some of the entertainment features planned. He also announced that through the courtesy of Col. Robert C. Clowry, president of the Western Union Telegraph Company, the cable steamer Western Union would be placed at the disposal of the members during the four days of the convention.

The next annual convention of the National Association of Manufacturers is to be held at Atlanta, Ga., May 16 to 18, 1905. The Louisville and Nashville railroad expects to furnish a special train to the convention if there is a sufficient number of delegates from the Central West who expect to attend. All factories who expect to be represented should notify President D. M. Parry, Indianapolis, at once. It is proposed to start a special train from Indianapolis at seven o'clock on the evening of May 14th, and visit the Chickamauga battlefield en route.

The fifth annual session of the Summer School for Artisans at Madison, Wis., held under the direction of the College of Engineering of the University of Wisconsin, will be begun on June 26th and continues for a period of six weeks. Courses of study are offered in the following subjects: Engines and Boilers; Applied Electricity; Mechanical Drawing and Machine Design; Materials of Construction, Fuels and Lubricants, and Shop Work. This school offers to those unable to take a regular four-year course an opportunity of obtaining a working knowledge of the methods of testing and the use of instruments, together with such theoretical principles in each case as the nature of the subject and the preparation of the student may permit. The instructional force is taken from the regular faculty of the College of Engineering and the entire laboratory and shop equipment belonging to the college is used by the students in the summer school.

## MISCELLANEOUS.

Mandamus proceedings have reached the Superior Court at Spokane, Wash., to compel the City Council to submit to a vote of the people the question of an amendment to the city charter, providing for a referendum vote on franchises, which the City Council has refused.

The formal dedication of the Simplon Tunnel, the longest in the world, took place on April 2d, when two trains, one from the Italian side and one from the Swiss side, started simultaneously and met in the center. Appropriate services, marked by prayer, speeches and music, marked the occasion.

In a recent encounter between the Japanese and Russians the Japs were required to crawl for a considerable distance under the glare of searchlights and fireworks. Finally they came to a number of mines, the electric wires of which had been left unburied. These consisted of four rubber-insulated 24-wire cables. The soldiers had no scissors or cutting tools, so they fell upon the cables with their teeth, so the story goes, and literally chewed the wires in two.

Machinery is being used to erect telegraph poles along the line of the Pennsylvania railroad between Wawa and West Chester, Pa. The work is being done to replace the telegraph line of the Western Union Telegraph Company, which was cut down by the railroad people. An engine and a flat car are used. On the latter are a derrick and a stack of poles. The car is run along the line, and as the holes for the poles are reached they are lifted with the derrick and dropped in, saving the work of a gang of linemen in raising them.

The Nurnberg Works in Germany desire it to be known that they use for their steam engines a trip-valve gear in accordance with their own patents (Marx gear). For their gas engines they also use their own patent gear, which works as follows: The cut-off of the valve always takes place at the same time, while the valve opens at different periods, i. e., at full load sooner, at small load later. If the engine is entirely unloaded the opening of the valve takes place at such a late period that it coincides with the cut-off, so that the valve remains shut altogether; the opening point only is therefore controlled by the governor, while it exercises no influence upon the cut-off mechanism.

The Truckee River General Electric Company, a large power-distributing company of California operating many high-potential lines, will add a 2,000-kilowatt alternating-current belt-driven generator, four 750-kilowatt and four 625-kilowatt transformers to its present equipment. Westinghouse low-equivalent lightning arresters and choke coils will be used for the protection of the apparatus.

A company in Cleveland, Ohio, is preparing to operate a line of electric-motor passenger coaches through the parks and boulevards of that city during the coming summer. The car with which the experiments have recently been made has a seating capacity of 25. Four motors of 2½ horsepower each furnish the motive power, a motor being attached to each of the four wheels. The batteries are carried beneath the seats.

A Boston dispatch says that experiments have been made recently at the Allston shops of the New York Central railroad with an electrical horseshoe magnet attached to a set of locomotive driving wheels to determine the degree of magnetic resistance possible to exert. It was found, it is said, that with the attachment employed the adhesion was increased fully 35 per cent. The company will have 30 of its locomotives fitted with the device, so as to do away with the use of sand.

## TRADE NEWS.

Tod Carruthers will open an electrical supply store in Astoria, Ore.

The Missouri Electric Company of Kansas City, Mo., has purchased the business of the A. H. Manning Electric Company.

A. P. Munning of New York, general sales agent for the Cutler-Hammer Manufacturing Company, who was in Chicago last week, says that the demand for Cutler-Hammer products is greater than ever before.

C. S. Van Auken gives notice that as assignee in the voluntary assignment of the Pacific Electric Company, he will apply to the Circuit Court of La Crosse County, Wis., at the regular term in May for a final settlement and discharge of himself and bondsmen.

The National Electric Company of Milwaukee, manufacturer of the Christensen air brakes and electrical machinery, is now occupying additional offices in the Old Colony Building, Chicago, and has moved the general sales office of the electrical department from Milwaukee to Chicago.

The executive committee of the Southern Hardware Jobbers' Association was held in Knoxville, Tenn., recently, at which arrangements for the programme for the Virginia Hot Springs convention, which will be held on June 6th to 9th, were completed. Some valuable papers concerning industry in the South will be read. Ample social features have been provided. C. B. Carter, Knoxville, Tenn., is secretary of the association.

The Belgian government has recently appointed a committee for the purpose of organizing an international commercial congress, to be held at Mons in the latter part of September, 1905. The object of the congress is to discuss commercial economics, industrial development and progress, facility of communication, opening and civilizing new countries, instruction, statistics, customs policy, maritime questions, and questions concerning the civilizing effects of expansion and the means and power of expansion in general.

In the case of the Thomson-Houston Electric Company, complainant, vs. the Morgan-Gardner Electric Company in which the complainant has brought suit to restrain infringement of certain claims of United States patent No. 393,323, granted on November 20, 1888, for a system of motor control for electric-railway motors, Judge Kohlsaat in the Circuit Court of the United States for the Northern District of Illinois has issued an order restraining the defendant from infringing the patent in suit until such time as the case may be disposed of on final hearing. Claims 21 to 31 inclusive pertain to a controller, wherein the regulation of the introduction of electric current to motors is effected by means of the combined use of both the rheostatic or dead-resistance coils and live-resistance coils, that is, the coils of the motor itself, so adjusted as to avoid the loss of energy and the danger arising from sparking or short-circuiting during changes of circuit connection, and also to the placing of the manipulation of the current under the control of one handle or its equivalent device.

In removing its general offices from Chicago to Milwaukee, as noted in the Western Electrician last week, the Allis-Chalmers Company is making another step in the direction of carrying out the plans of the present administration, which are gradually being brought to completion. One of the first conclusions arrived at by President Warren after assuming office a year ago was that for every reason connected with efficient administration of all branches of the work, from designing to manufacturing, and from selling to collecting and accounting, the chief offices of the company, covering all the ramifications

of it business, should be concentrated [illegible]. That place was logically Milwaukee, [illegible] though the company has four other works in three other cities, the largest works are in Milwaukee, and Milwaukee is where all the future expansion of the company's operations will take place. Besides, at the Milwaukee suburb of West Allis [illegible] the land to build upon. Plans for the workshop extensions at West Allis, which involve the construction of several more units, are practically complete and the extensions will be made in due course.

## BUSINESS.

The Chicago City Railway Company has placed an order with the McGuire-Cummings Manufacturing Company of Chicago for 424 of the latter company's standard M. C. B. trucks, to be placed under the new cars recently purchased.

The A. S. Doxsee Electrical Company of St. Louis has made a large shipment of desk fans to Yokohama, Japan. It notes that the business outlook in that city is very bright and it expects to have a large trade during the coming season.

The William Mueller Company, Chicago, established in 1862, and therefore probably the oldest cedar-pole producer, states that the cedar-pole business has picked up wonderfully within the last few weeks, with an unusual demand for short poles. The Mueller company has eight distributing yards and is well prepared for a large business. With its exceptional facilities for promptly filling orders, it expects to obtain its full share of business during the present season.

Three Westinghouse steam-turbine outfits have recently been ordered by the Public Service Corporation of New Jersey, one having an output of 500 kilowatts and two with ratings of 1,000 kilowatts each. There is also a 1,000-kilowatt turbo-generator building for the Indian Orchard Company, together with [illegible] with turning [illegible] ers. These will be put in under the direction of Westinghouse, Church, Kerr & Co.

The Robert Gair Company of Brooklyn, N. Y., will soon begin the installation at its factory in Brooklyn of three new power units with an aggregate capacity of 500 kilowatts to replace the plant which it now has. These units are to consist of heavy-duty horizontal non-condensing Reynolds-Corliss engines connected to Bullock generators.

Machado & Roller of New York, general sales agents for the Whitney Electrical Instrument Company, say that many people are of the opinion that the Whitney instruments are all of the hot-wire type, while others, who know that this is incorrect, still believe that the direct-current instruments are of the moving-coil type. This, however, is not the case, for the Whitney direct-current instruments are of the fixed-coil type, containing no delicate moving coil and current-carrying springs.

An old and reliable concern which has only lately commenced to push its tools in earnest is the Orr & Lockett Hardware Company of Chicago. This company issues a tool catalogue of about 450 pages, which it sends to anybody for a small sum, which is treated as cash with the first order of $5 or more. The catalogue is valuable to any electrical worker. The Orr and Lockett Hardware Company has been in business since 1872 and is noted for the fairness with which it transacts business, and the high quality of the goods it sells.

The Central Electric Company, Chicago, is sending out to its trade a new price list, dated April, 1905. This price list applies to the company's 1903 catalogue, and the two together make a combination of value to everyone buying electrical material. On the title page of the price list is shown a view of the company's new location at 207, 209 and 211 East Jackson Boulevard, and on the back page is [illegible]

[illegible]

Ice Company, Lebanon, Ind., 345 horsepower; city of Menasha pumping plant, Menasha [illegible]

The Northwestern Electric Equipment Company, which has been established in St. Paul for six or eight years in the motor and lamp business, has been admitted to membership in the National Jobbers' Association and has gone into the supply business on a large scale. Its stock of supplies is now one of the most complete in the Northwest and it is prepared to fill any order from a push-button to a complete telephone installation. The company is already well known in the northwestern territory, as it has been handling electrical machinery and building switchboards for some years past. It has secured some energetic salesmen who are acquainted with the trade, and, with a complete stock and prompt deliveries, its expectation of getting a fair portion of the business will no doubt be realized.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued (United States Patent Office) March 28, 1905.*

785,700. Electric-conductor Support. Johan M. Andersen, Boston, Mass., assignor to the Albert and J. M. Andersen Manufacturing Company, Portland, Maine. Application filed January 5, 1905.

Interposed strain insulators are connected to the line terminals and a hanger is connected with the strain insulators for supporting the whole.

785,712. Electric Cable Joint. Donald J. Chisholm, East Hampton, N. Y. Application filed May 11, 1904.

Cables enter one end of a coupling box and filling material is placed around the cables in the box, the ends of the cables extending beyond the insulating material. A sheet of insulating material is between the exposed ends of the cables, a cap for the coupling box being removably secured to the box.

785,728. Telephone System. Adolph C. Gilgen, Passaic, N. J., assignor to the New York Automatic Telephone Company, Passaic, N. J. Application filed June 11, 1904.

A central battery is common to all the stations, and at each station are a transmitter, receiver, receiver hook and a number of jacks. A talking circuit passes from one pole of the battery at each of two communicating stations, through its transmitter, hook, line-wire and jack at one station, and hook and receiver at the other station, to the opposite pole of the battery.

785,731. Means for Converting Electrical Currents for Induction Motors. Christian F. Heinkel, Cleveland, Ohio. Application filed August 4, 1904.

Associated with a transformer are a source of continuous current and a circuit breaker for the transformer. An induction motor is mechanically connected with the breaker, the latter to produce a timed movement with the motor.

785,754. Telephone-exchange Apparatus. James L. McQuarrie, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed May 27, 1901.

Combined with the several sections of a switchboard are overflow trunk lines between the sections, busy signals for each section at the other sections, and magnetically actuated apparatus at each section for controlling the busy signals thereof at the other sections, whereby each operator is automatically informed which of the other sections is at liberty to receive overflow calls. (See cut on next page.)

785,758. Electric-railway System and Conduit. George W. Olinger, Orchard, Ohio. Application filed June 19, 1903.

A form of conduit for electric railways is described which provides for an under-running trolley.

785,783. Paper Slack Provider and Winding Mechanism. Kirke West, New York, N. Y., assignor to the United States Graphotype Company, New York, N. Y. Application filed January 29, 1904.

An electromagnet actuates a pawl and ratchet mechanism which in turn controls the operation of the feed roll of the paper-winding machine.

785,797. Thermal Cut-out for Electrical Circuits. Frank B. Cook, Chicago, Ill. Application filed March 8, 1904.

A homogeneous resistance body is included in a circuit, a circuit-controlling means tending to break the circuit. Heat-susceptible material holds the device against operation and means apart from the device restores the latter to operative condition after the operation has been permitted by the softening of the heat-susceptible material.

785,798. Self-soldering Heat Coil. Frank B. Cook, Chicago, Ill. Application filed March 9, 1904.

Means for controlling a circuit are provided associated with a device operable upon an excess of current and adapted to engage the circuit-controlling means. Engaging devices each normally hold the excess operable device against rotation, the latter device disengaging the circuit-controlling means when operated.

785,803. Art of Transmitting Intelligence. Cornelius D. Ehret, Philadelphia, Pa. Application filed February 10, 1902.

The method of transmitting intelligence consists in generating electroradiant energy, modifying the frequency of the energy in accordance with the signal to be sent and receiving the energy in a device responsive to changes in the frequency of the transmitted energy.

785,804. System of Transmitting Intelligence. Cornelius D. Ehret, Rosemont, Pa. Original application filed February 10, 1902. Divided and this application filed July 8, 1902.

In a signaling system are a circuit, means for supplying energy thereto, means for varying the natural period of the circuit in accordance with a signal to be sent and means at the receiver responsive to the resulting changes in the frequency of the received energy for reproducing a signal.

785,809. Sparking Igniter for Explosive Engines. Louis D. Kinzig and George C. Riber, Dayton, Ohio. Application filed February 23, 1904.

An electrode tube projects into the combustion chamber and an electrode in the form of a rod is loosely confined within the tube.

785,832. Electrode for Electric Furnaces. Edgar F. Price, George E. Cox and James G. Marshall, Niagara Falls, N. Y., assignors to the Union Carbide Company, Niagara Falls, N. Y. Application filed October 19, 1903.

An electric furnace having a working chamber is supplied with a hood depending into the chamber and means for cooling the top of the hood. An electrode or electrodes within the hood are carried by electrode holders passing loosely through openings in the top of the hood with means for cooling the holders. There is a refractory lining between the holders and the top of the hood.

785,863. Electric Time Switch. William B. Coulter, Waterbury, Conn. Application filed November 11, 1904.

The switch is automatically operated by the drop of weights which is in turn controlled by means of a clock movement.

785,891. Railway Block-signal Apparatus. Allen B. Kendall, Maywood, Ill. Application filed October 17, 1904.

In a block railway-signal system there are the signaling or controlling relays and the signal circuit, each of the relays having a metal contact piece and an opposing loose metal contact piece. A mercury connection is normally in connection with the loose metal contact piece, whereby the fusing or freezing of the metal contact pieces together is prevented from interfering with the normal operation of the system.

785,909. Electric-railway System. John C. McDonald, New York, N. Y. Application filed February 9, 1904.

Supporting means carry a hollow receptacle so that it forms part of a pendulum and automatically assumes a normal position when the switch is not being operated, but can be [illegible] of its [illegible] terminal is [illegible] terminals [illegible] be electrically connected or disconnected by the material, depending upon the position of the receptacle.

785,936. Elevator Mechanism. John Dillon, Milwaukee, Wis. Application filed July 22, 1904.

In elevator mechanism [illegible] brake are combined mechanism [illegible] determine [illegible] means for [illegible] applied brake.

785,941. Compound Relay. Stephen D. Field, Stockbridge, Mass. Application filed January 14, 1905.

In an electromagnetic receiving instrument are combined a soft iron core having two pairs of free poles at separated points, means for permanently polarizing the cores, a polarized armature for one pair of pole pieces, a suitable magnetizing coil and a neutral armature for the second pair of pole pieces.

785,949. Double-throw Electric Switch with Indicator. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 11, 1903.

Combined with a double-throw switch having a transverse hole in its blade are an indicating pin slidable in the hole and pivoted with inclined notches and a spring plunger engaging with the notches.

785,961. Manufacture of Carbon-tetrafluorid Gas. John A. Lyons and Edward C. Broadwell, Chicago, Ill. Application filed September 16, 1903.

A process of producing carbon-tetrafluoride gas from the fluorides of the electropositive metals consists in passing a current of electricity through a fused bath of the fluoride of such metal in the presence of a cathode and an anode and subjecting the fluorine gas liberated at the anode to the action of carbonaceous material immediately surrounding the anode.

785,962. Production of Boron by Electrolysis. John A. Lyons and Edward C. Broadwell, Chicago, Ill. Application filed September 16, 1903.

The process consists in subjecting a fused bath of the borates of electropositive metals to electrolytic action and subjecting the anion produced thereby to a reducing action at the anode which is maintained at an intense heat.

785,970. Means for Regulating Electric Circuits. Walter S. Moody, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 26, 1902.

Combined with a main transformer are an auxiliary transformer arranged so that its secondary member forms a continuation of incoming and outgoing leads of the secondary member of the main transformer and means for supplying the primary of the auxiliary transformer with current variable in amount and reversible in polarity. (See cut on next page.)

785,980. Electric Arc Lamp. Ralph Scott, Wilkes-barre, Pa., assignor of one-half to Marcus A. Miller, New York, N. Y. Application filed October 14, 1903.

In an arc lamp there are a number of carbon supports and means for spacing them apart. A circuit for the supports, a helix interposed in the circuit for controlling the spacing means and a resistance bar interposed in the circuit and inclosed by the helix and spaced therefrom are the other features.

785,985. Switch. Samuel B. Stewart, Jr., Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 15, 1903.

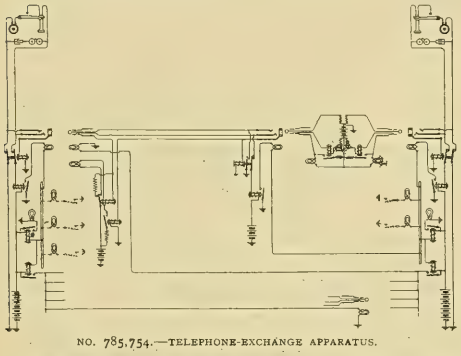
Associated with a pivoted three-armed contact carrier, provided with two main brushes arranged on opposite sides of its pivot are a bridging contact, two main contact blocks and two contacts in a shunt around the blocks.

785,989. Counting Apparatus. Walter P. Watts, Covina, Cal. Application filed March 26, 1904.

Electric terminals are secured upon the exterior of a runway having connection with the source of supply. A circuit-closing plate is secured to one of the terminals, a resilient rod extending through the runway and plate, whereby the weight of an article in the runway will bend the rod and draw the plate against the other terminal. Suitable indicating mechanism is provided.

785,994. Rheostat for Starting and Controlling Electric Motors. William C. Yates, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 14, 1904.

In connection with a rheostat having starting and controlling resistances arranged parallel with each other are a starting arm co-operating with the starting resistance,



NO. 785,754.—TELEPHONE-EXCHANGE APPARATUS.

a controlling arm co-operating with the controlling resistance and means for connecting the arms when the former has cut out the starting resistance. (See cut.)

785,995. Winding for Three-phase Motor. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 19, 1904.

In an alternating-current dynamo-electric machine are a three-phase winding composed of coils having a width equal to twice the distance between adjacent coils of the same phase and means for varying the connections of the winding to vary the number of its poles.

785,997. Incandescent Electric-lamp Socket. George C. Baillard, Brooklyn, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed May 28, 1902.

Details are described.

786,005. Electric Protector Apparatus. Frank B. Cook, Chicago, Ill. Application filed April 11, 1904.

Apparatus for protecting electrical apparatus against excessive current comprises a thermal cut-out and a spring socket switch in circuit therewith. The switch has normally closed contacts and is adapted to receive the connecting plug of a testing instrument.

786,008. Air-brake Control. Fred B. Corey, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 13, 1904.

In a vehicle carrying an electric motor are an air compressor driven thereby, governors responsive to different pressures and each adapted to control the motor, and means under the control of the motorman for cutting either of the governors into circuit with the motor.

786,010. Commutating Device for Armatures of Alternating-current Machines. Max Deri, Vienna, Austria-Hungary, assignor to the Stanley Electric Manufacturing Company, Pittsfield, Mass. Application filed March 31, 1903.

In an alternating-current dynamo-electric machine are independent windings on the armature and an independent commutator and brushes for each winding, the commutators and brushes being arranged to close and break the circuits of the windings alternately.

786,016. Combined Electric and Mechanical Signal Apparatus for Elevators. William T. Dulany, Jr., Brooklyn, N. Y. Application filed May 11, 1904.

An electrical system of signaling elevators and for indicating by different colored lights the position of the elevators is described.

786,017. Starting Rheostat. Edgar F. Dutton, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 13, 1902.

Combined with a motor rheostat are a circuit breaker, a coil for holding the circuit breaker closed and a circuit-closer on the rheostat arm in circuit with the coil.

786,024. System of Distant Electrical Control. Joel Gomborow, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 15, 1904.

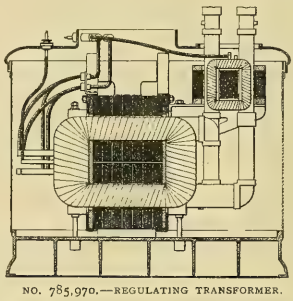
In a control system for a distant object there are two rheostats, a hand switcharm for one, a switcharm for the other geared to the object, an electric motor for moving the object and a switch for controlling the motor comprising two opposed electromagnets respectively in shunt to variable portions of the rheostats. (See cut.)

786,036. Trolley Wheel and Holder. Henry N. King, Adrian, Mich. Application filed June 20, 1904.

The trolley wheel is journaled in the fork, the wheel comprising two parts, each formed with a web and with a central chambered hub. The webs of the wheel are bolted together and a hardened peripheral ring engages between the parts, and serves as a tire to hold the chambers of the hubs in proper position.

786,038. Apparatus for Closing Electric Circuits. Rodolphe De Lamprecht, Paris, France, assignor to the firm of R. De Lamprecht et Cie., Paris, France. Application filed August 22, 1900.

A movable coin-actuated device, a contact member arranged to be engaged by it to establish a contact for an electric circuit, an electromagnet in the circuit, a motor and a stop mechanism for normally keeping the motor inactive are the essential parts of the circuit closer. The mechanism is under the influence of the electromagnet to release the motor when the electromagnet is energized.



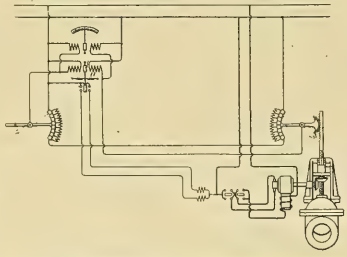
NO. 785,970.—REGULATING TRANSFORMER.

786,041. Vibrator for Sound-telegraph Apparatus. Arvid A. Lind, Stockholm, Sweden, assignor to Elektromilitara Aktiebolaget, Stockholm, Sweden. Application filed July 17, 1903.

The device embodies a guide and electromagnet and armature, and a contact for the armature connected to form the key of the apparatus and mounted slidably in the guide.

786,132. Wireless Telegraphy. Guglielmo Marconi, London, England, assignor to Marconi's Wireless Telegraph Company. Application filed October 13, 1903.

At a receiving station are an open circuit containing an oscillation-receiving conductor and inductance in circuit therewith and a closed oscillation circuit containing inductance and a condenser. An adjustable contact is arranged to alter the inductance of the two circuits.



NO. 786,024.—ELECTRIC VALVE-CONTROLLING APPARATUS.

786,146. Electric Hammer. Louis Paulero, Petersburg, Va. Application filed September 22, 1904.

In an electric hammer are a plunger serving as an armature and as a hammer head, magnetic mechanism for energizing the plunger, electric mechanism for controlling the magnetic mechanism, an adjusting plunger for limiting the throw of the first-mentioned plunger and means controllable at will for governing the position of the adjusting plunger.

786,148. Signal System for Electric Railways. Greenleaf W. Pickard, Amesbury, and Harold J. W. Fay, Westboro, Mass., assignors to the American Telephone and Telegraph Company. Application filed January 28, 1905.

Combined at a principal or despatching station with the railway main supply conductor is an associated signal-circuit conductor receiving current from the same source. Safety and danger signals are arranged for alternative connection in circuit with the associated conductor and means transfer the conductor from either of the signals to the other. Other means simultaneously reverse the direction of the current circulating in the associated conductor.

786,188. Trolley. James L. Brownlee, Pittsburg, Pa. Application filed June 10, 1904. Renewed January 31, 1905.

The trolley is provided with separable spindle-supporting devices, and spindles are rotatably mounted therein provided with contacting devices.

786,209. Electric Railway-signaling System. John D. Gordon, Riverside, Cal. Application May 5, 1904.

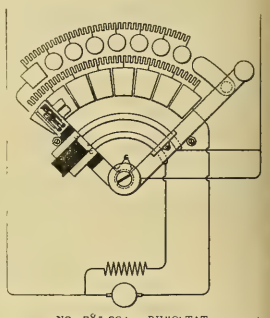
Open-circuit block conductors for the several blocks have fixed signaling devices connected to them. Relatively constantly charged conductors are connected in open circuit with the open-circuit conductors of the several blocks and a circuit-closer device carried by a train coacts with the open-circuit block conductors and the charged conductors to successively cut in the fixed signaling devices as the train proceeds.

786,219. Trolley. Sando Kacso, Allegheny, Pa., assignor of one-half to David Hollander, Allegheny, Pa. Application filed December 9, 1904.

Combined with a trolley pole and wire are an extension pivotally connected to the pole, arms pivotally mounted upon the extension, a trolley wheel journaled between the arms and adapted to engage the wire and a member carried by each arm. Each member consists of inwardly extending prongs adapted to overlie the trolley wire and means are carried by the arms to hold the members in close proximity to one another.

786,221. Process of Electrodepositing Metals. Edward D. Kendall, Brooklyn, N. Y., assignor of one-third to Edward N. Dickerson, Stovall, N. C. Application filed October 28, 1903.

Electrolytically depositing metallic zinc is done by the electrolysis of an aqueous solution containing zinc sulfoglycerate by means of a suitable body acting as the cathode opposed to a suitable anode.



NO. 785,994.—RHEOSTAT.

786,222. Trolley Wheel. Sigmund Klamborowski, Lodz, Russia. Application filed February 16, 1905.

Details are described.

786,226. Electric Time Switch. Henry C. Little, Boston, Mass. Application filed August 26, 1903.

In a switch-controlling apparatus are a pair of wheels each having detent-arresting and detent-releasing means, a pair of detents controlled by the wheels, a switch member connected with the detents and means for rotating the wheels and detents always in one direction.

786,227. Sight Illuminator. Robert R. Logan and Samuel P. Wetherill, Jr., New York, N. Y. Application filed July 20, 1904.

The gun-sight is illuminated by a small incandescent lamp in a circuit which is closed at the butt of the gun by a contact piece worn on the gunner's clothing.

786,231. Electric Lamp. George P. McDonnell, St. Louis, Mo., assignor to the American Electric Company, East Orange, N. J. Application filed January 5, 1905.

An electric lamp bulb has the material composing the teat located partially within the lamp or bulb.

786,244. Process of Extracting Aluminum or Other Metals. Henry S. Blackmore, Mount Vernon, N. Y. Original application filed September 12, 1903. Divided and this application filed January 7, 1905.

The process of reducing metal consists in exposing a fused substance containing only one metal combined with one halogen, fluorin, and one or more non-metallic elements other than a halogen, to the action of an electric current of a voltage below that necessary to liberate fluorin, but capable of liberating one or more non-metallic elements.

## EXPIRING PATENTS.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on April 3, 1905:

380,310. Telegraph Key. D. R. Borland, Montreal, Quebec, Canada.
380,316. Railway Signal. J. Hamilton Farrar, Chicago, Ill.
380,382. Electromagnetic Signaling Device for Mines. L. McKnight Bullitt and O. C. Greene, St. Paul, Minn.
380,426. Telephone Transmitter. M. G. Farmer, Elliot, Me.
380,430. Galvanic Cell. W. Frishmuth, Philadelphia, Pa.
380,435. Electric Arc Lamp. A. Harding, Oakland, Cal.
380,437. Telephone. W. D. House, Kansas City, Mo.
380,438. Telephone. W. D. House, Kansas City, Mo.
380,469. Underground Conduit for Electric Railways. A. A. Whipple, Detroit, Mich.
380,545. Arc Lamp. C. Berton, Paris, France.
380,554. Secondary Battery. N. DeBenardos, St. Petersburg, Russia.
380,589. Galvanic Battery. C. E. O'Keenan, St. Cloud, near Paris, France.
380,594. Electrical Time Stamp. C. A. Randall, New York, N. Y.
380,595. Electrical Time Stamp. C. A. Randall, New York, N. Y.
380,620. Dynamo-Electric Machine. W. A. Crowdus and H. M. Sutton, Dallas, Tex.
380,620. Dynamo-electric Machine. W. A. Crowdus and Cruces, N. M.
380,647. Electric Signal for Railway Cars. J. R. DeMier, Las Cruces, N. M.
380,655. Municipal Signaling. M. Martin, Malden, Mass.

# WESTERN ELECTRICIAN

EVERY SATURDAY

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## A Unique Private Garage in Minneapolis.

By Charles H. Coar.

Recently there has been added to the list of electrically equipped buildings in Minneapolis a private garage which is destined to attract much attention because of the many practical and convenient features embodied in its construction. This garage is the private property of Mr. G. H. Partridge of Minneapolis and adjoins his residence at Hennepin and Groveland avenues. Possibly

Fig. 1. Exterior of Garage.

no private garage in the United States is equipped with so many convenient appliances and with such adaptable electrical equipment and other accessories. Everything is arranged in a manner best suited for the maintenance of the automobiles.

The exterior of the garage, as shown in Fig. 1, is constructed of pressed brick, with terra-cotta trimmings, to match the residence. Placed in the wall, directly over the large garage doors, is an excellent bas relief of an automobile done in terra cotta of the same shade as that used in the trimmings. The building is two stories in height, and that portion directly over the generator room and chauffeur's bedroom is utilized for servants' rooms. The garage and residence are built together, suitable provisions having been made for direct connections between the two portions. The ground-floor plan of the garage, shown on the next page (Fig. 5), gives an excellent idea of the general arrangement.

The main room and garage proper, as shown in Fig. 2, is in the form of a semi-circle, 60 feet in diameter, and is surmounted by a dome to which the ceiling converges. The interior of the garage, and also that of the washroom, is constructed of the same kind of brick used as that in the exterior, and a wainscoting four feet in height of white glazed brick with green border of the same material extends around these rooms. The ceilings are plastered and tinted a light blue with gold borders, and in the ceiling, directly under the roof of the dome, a cloud effect has been worked in with the tint, which affords a very pretty appearance in conjunction with the large varnished Georgia pine beams and moldings used in the garage for finishing purposes.

The floor of the garage is constructed of green ceramic tile with red borders, and outlet ventilators are arranged in the floor back of each automobile position for the purpose of carrying off the fumes of the gasoline and storage batteries. The garage is accessible to the automobiles through two large hinged doors, which open inwardly directly from the driveway. The washroom (Fig. 4) is 15 by 20 feet and is equipped with overhead hose having hot and cold-water connections, and contains other necessary washing apparatus. The floor is of cement and slopes downward from the four sides of the room to the center, where a sewer inlet is provided for drainage purposes. A curtained entrance opens into the main garage.

The generator room and repair shop (Fig. 3) is 18 by 28 feet and has a hardwood floor, with a Georgia-pine wainscoting 7½ feet in height. In this room there is located a General Electric motor-generator set, a Christensen air compressor and controlling apparatus, a hydrant, a tool cabinet and a repair bench. Space is also provided for a drill and lathe, which are to be installed in the future. A storeroom and the chauffeur's bedroom are also located on the ground floor, as shown in the plan, Fig. 5.

The motor of the motor-generator set is designed for 25 amperes at 500 volts and is of 15 horse-power. The generator is designed for an output of 8½ kilowatts and delivers 77 amperes at 110 volts pressure. The speed is 1,200 revolutions per minute. The motor-starting box and the dynamo field rheostat are located and controlled from the switchboard, which will be described later.

The motor in the Christensen air-compressing set is arranged for 500-volt service, in conjunction with a Cutler-Hammer automatic pressure-gauge regulator

Fig. 2. Interior View, Showing Automobiles and Turntable.

and solenoid starting switch. This arrangement is much the same as is employed in air-brake systems on street cars. The air pump has a capacity of 11 cubic feet of air a minute, which is forced into a containing tank having a capacity of 105 gallons. The controlling pressure gauge causes the pump motor to start or stop as the pressure in the tank varies. This tank supplies air through pressure-regulating valves to the gasoline and machine-oil tanks and also to a pipe line having outlets provided back of the automobiles in the garage for tire-inflating purposes. The gasoline tank, which has a capacity of 105 gallons, is buried in the earth outside the garage, and the gasoline is forced out of the tank by approximately 10 pounds air pressure, which is allowed to escape into the tank through the pressure-regulating valve on the air feed. The gas-engine-oil and machine-oil tanks have a capacity of 31½ gallons each. Air is forced into these tanks through separate pressure-regulating valves at about 20 pounds, which is sufficient to force the oils out. The tanks are located in the basement, under the generator room. The tanks are all of boiler construction, and faucet outlets are provided for the different tank feeds at convenient points about the garage.

Located on the wall in the generator room is a white Italian marble cabinet three by two feet containing four pressure gauges, three of which give the pressures of the oil tanks, and register from zero to 30 pounds, while the remaining gauge registers the air-tank pressure and has a scale reading from zero to 180 pounds. The greater portion of the necessary piping from these tanks

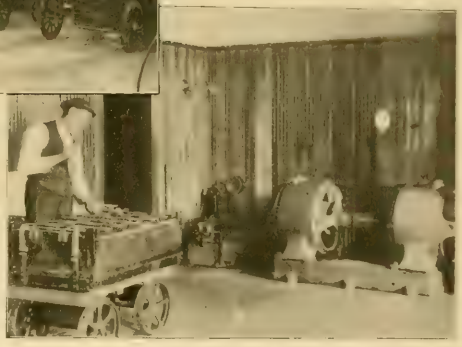

Fig. 3. Motor-generator and Storage-battery Truck.

UNIQUE PRIVATE GARAGE IN MINNEAPOLIS.

inches. The lift travels a distance of 3½ feet and at its highest position the platform, which is mounted directly on the piston, is three inches above the floor level. This is done so that the greater portion of the distance traveled by the lift will be beneath the floor level, thus affording a pit in which one may conveniently work under the automobiles when this is necessary. When it is desired to remove the battery cells from underneath the automobiles where they are placed, a four-wheel truck (shown in Fig. 3) is put on the lift, which is then lowered, thus allowing the automobile to be placed directly over the pit. The lift is then raised a sufficient distance to allow the locking devices on the battery-containing case to be loosened from the automobile, which can then be run out of the way by lowering the lift. After the automobile is wheeled out of the way the lift is raised to the floor level, and the truck and batteries may then be pulled to any position in the garage for inspection or charging. The intake and outlet valves on the pressure cylinder are controlled by levers placed at a convenient point near the lift. The lift has a maximum raising power of 5,000 pounds.

A white Italian marble switchboard (Fig. 6) six by five feet in dimensions is placed in the main garage, away from the wall. There is mounted on this board a Weston voltmeter, a Weston ammeter, a Bristol recording ammeter, and the necessary switches, circuit breakers and rheostats for controlling the motors, dynamos and charging leads. The motor-starting box and the dynamo field rheostat are located on this board, as is also a General Electric double-pole overload circuit breaker for the motor.

There are four charging circuits, and each circuit passes through a double-pole single-throw knife switch and also through a Ward Leonard overload and underload circuit breaker. The electric automobiles are in most instances charged directly from the brushes of the dynamo without any resistance, the current being regulated entirely by the field rheostat of the dynamo. However, the general arrangement is such that any number of automobiles may be charged independently of each other, as there is a resistance of approximately three ohms in each rheostat provided in the charging circuits. One rheostat has a resistance of about 40 ohms with a maximum current capacity of 40 amperes. This resistance is for use when individual cells are charged, because of underrating. There are four charging-plug receptacles, two of which are mounted in the switchboard, one in the wall of the main garage and one in the generator room. The plug receptacles in the main garage

and generator room have placed above them a double-pole single-throw knife switch mounted in a Bossert steel slate-lined cabinet having a bevel-plate-glass front. These switches are for the purpose of cutting out these pockets from the switchboard circuit.

The 32 single-throw single-pole knife switches mounted across the bottom of the switchboard are arranged in sets of eight, each set being placed directly under the corresponding charging switch, and are for the purpose of inserting resistance in these charging circuits. Each individual switch in a set has a number placed directly over it, which indicates the amount of current it is safe to pass through that switch. These switches are numbered in rotation, and when all the switches are closed the current in the charging lead should not exceed the total sum of all the switches. Thus if 30 amperes is required, three 10-ampere switches are closed.

The voltmeter and ammeter may be connected to any of the charging circuits by means of the switches associated with these instruments. The equipment also includes a double-pole single-throw knife switch, which can be used in cases of emergency to cut out the air-pump motor from the switchboard. In a slate-lined cabinet placed directly back of the switchboard in the wall is a double-pole single-throw knife switch, which, when thrown, cuts the 500-volt service out of the building entirely.

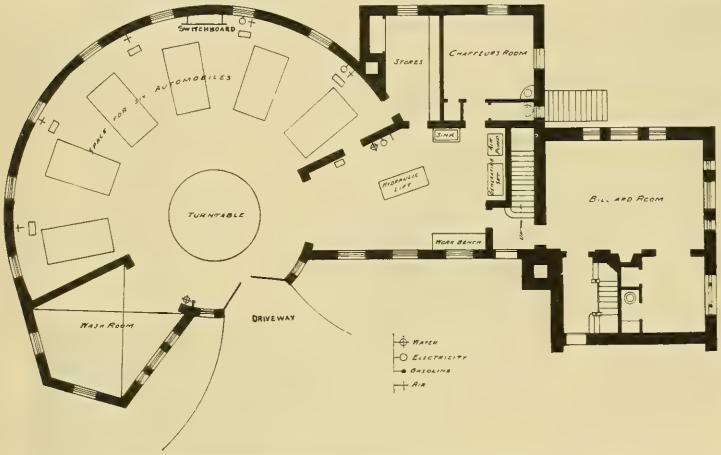


FIG. 5. GROUND-FLOOR PLAN OF UNIQUE PRIVATE GARAGE IN MINNEAPOLIS.

About 40 incandescent lamps and an enclosed arc are used for artificial illumination. The arc light is hung from the center of the dome. The lights are installed and conveniently controlled according to the latest practice. A number of flush receptacles are placed around in the walls of the main garage and generator room for the purpose of plugging in portable lights. All the wiring is concealed and placed in conduits. Metaphones and call bells are also installed for purpose of communication between the garage and residence.

One feature in connection with this garage which deserves much attention, because of its adaptability, is the turntable. The idea of utilizing a turntable for the purpose of turning the automobiles about, thus doing away with all the usual backing, etc., necessary to get an automobile in place, is original with the Minneapolis architects who designed the garage. This idea has already commended itself. The turntable is constructed of angle iron on which planking is placed.

On the planking is a coating of specially prepared cement about one inch in thickness which is bound around the circumference by a bronze ring for protection. The turntable is 12 feet in diameter and is mounted on an iron center pedestal having a ball-bearing surface. Eight rollers, placed at regular distances apart at the outer edge, run on an iron track provided for this purpose in the pit. The turntable moves very easily when the heaviest automobile is upon it.

The present equipment of the garage is a Columbia runabout containing 40 cells of battery, a Columbia victoria containing 40 cells, a Columbia brougham containing 44 cells, and a Columbia gasoline touring car.

Kees & Colburn of Minneapolis are the architects who designed and supervised the construction of this garage, and all the electrical equipment was installed by the Gugler Electric Manufacturing Company, also of Minneapolis. The writer wishes to thank the above-named firms; also Mr. Partridge, the owner, and William Welch, the chauffeur in charge, for courtesies extended him during the preparation of this brief article.

## Single-phase, Polyphase or Direct-current Traction—Which?

Eugene Cserhati, engineer for Ganz & Co. of Budapest, has sent an interesting communication, dated March 18th, to the London Times. Inasmuch as this company has been a pioneer in alternating-current traction, Mr. Cserhati's views are of some importance. In part, he says:

"As regards the system of current, every engineer, judging impartially of the matter, must recognize that the direct-current system, as used in many American cities, and also in London, Paris and Berlin, for metropolitan railways offers very considerable advantages over steam traction, and may be regarded as a good technical solution. This, however, does not mean that it is the best solution and that this system of current is the only one to be considered for railways of such a dense traffic as that of metropolitan railways. Evidence showing that the same result is attainable with multiphase-current motor cars or locomotives as with direct current has already been furnished. The new three-phase-current locomotives of the Valtellina line, supplied in the year 1904 by the firm of Ganz & Co., surpass, as regards capacity, the largest existing types of Italian steam locomotives, developing, with a weight of 62 tons, a drawbar pull up to 12,000 kilogrammes. They are capable on grades up to 17 per cent. of hauling regularly 200 tons at a speed of 60 kilometers, and 370 tons at a speed of 30 kilometers, having accelerated trains of 250 tons total weight on grades of 20 per cent. up to a speed of 30 kilometers without any difficulty. The capacity of these locomotives has so far only been surpassed by the direct-current locomotives of the New York Central and Hudson River Railroad Company, with the difference that the latter has the motors of considerable weight, not spring-borne, but directly built upon the driving axles, whereas the motors of the new three-phase-current locomotives are perfectly spring-borne.

"The possibility of building three-phase locomotives of such capacity as required for heavy-railway service can no longer be doubted. Taking into consideration the elimination of rotary converters and their operation, and the economy offered in the consumption of current due to the peculiarity of the three-phase-current motors, there is no denying that the alternating-current system is more economical in first cost and operation than the direct-current system. The electric service is not only of great importance for street railways, but also for the long-distance service on lines with dense traffic, and few will nowadays think of operating such railways with the costly direct-current system. At the present time everybody pleads for alternating current, but here again opinions differ.

"Ganz & Co., guided by their satisfactory experience, gained by several years' operation, assert more emphatically than ever that for heavy traction on main lines multiphase current is the most suitable. In this respect their opinion is not an isolated one, because those who have fully studied and tested the traction system worked out by Ganz & Co. concur. On the other hand, most of the American and European electrical firms maintain that, for heavy main-line traction, only single-phase current with commutator motors is the right solution. With this idea of perfecting the single-phase commutator motor, experimental lines are being installed, and every effort is being made to fulfill the hope attached to the future of single-phase motors.

"The results that have so far become generally known do not, in my opinion, justify these hopes. The multiphase traction is constantly showing its superiority over single-phase traction. It has been ascertained by experience that alternating current, not direct current, is the suitable one, and this has verified the assertions made by Ganz & Co. three years ago. It is therefore somewhat premature today to assert that the decision then arrived at in regard to the 'Inner circle' has been in favor of the best system. This question will in all probability be raised again on the occasion of the introduction of long-distance railways into the center of the city, and it may be safely predicted that the traction system to be used for the latter will neither be direct current nor the third rail."

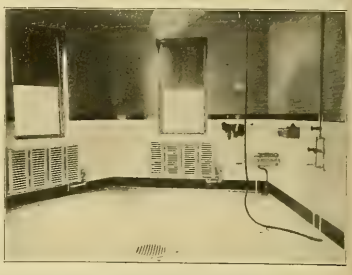

FIG. 4. WASHROOM IN MINNEAPOLIS GARAGE.

## Rules for Space Telegraphy in France.

The following rules governing the sending of space-telegraph messages, laid down by the French government, have been made public:

The word "radiotelegramme" is to appear before the address, and is charged for. Convention rules apply to these telegrams. The address of telegrams to ships at sea must give the name or official number of the ship and its nationality. Demands for assistance from ships at sea are given priority over other telegrams. The sender of a wireless message to a ship at sea may stipulate that it be held for a certain number of days by the coast station. For this purpose he must insert before the address and pay for the words "—— days," specifying the number of days. Should the ship not get into touch with the coast station within the time fixed by the sender, he is advised, and he may, by paid service or postal advice to the coast station, order the telegram to be held for a further period of 30 days, and so on. The rate is 75 centimes per word to the coast stations at Ouessant and Porquerolles for the present, as well as for other stations on the coast of France, Algeria and Tunis, and telegrams to or from ships at sea may only be accepted by these places, Monaca and Valless d'Andore.

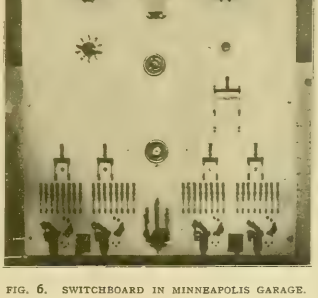

FIG. 6. SWITCHBOARD IN MINNEAPOLIS GARAGE.

The street-railway system of Para, Brazil, operated by animal power, has been sold to an English syndicate, which will install electric traction. Moller & Co. of London are the agents of the syndicate. It is said that a great part of the materials for reconstruction will probably be purchased in the United States.

## Barclay's Printing Telegraph.

Machine printing telegraph systems are destined in the opinion of many to play a conspicuous if not a dominant part in the telegraph of the future. The subject was one which attracted attention at the recent International Electrical Congress in St. Louis, and several good papers were read at that time. One of these was by John C. Barclay of New York, in which he described the most fruitful attempts which had been made up to that time in this line of work. It was known at the time that Mr. Barclay himself had near completion a system of this character which was expected to bring forth some new developments. In the latter part of December considerable space was given in the daily newspapers to the remarkable results which had been attained by a series of tests with a system of printing telegraphy invented by Mr. Barclay, who is assistant general manager of the Western Union Telegraph Company, and which operated with a marked degree of success. At that time a thorough technical description of the apparatus was unavailable. A patent was, however, issued to Mr. Barclay on March 21st, the application having been filed March 1, 1904, for improvements on such a system which in all probability covers the latest developments in the invention upon which he has been working for a considerable time and the success of which was demonstrated some months ago.

BARCLAY'S PRINTING TELEGRAPH.

The following description of the apparatus as embodied in the patent specification will be of interest:

For the transmission of the messages successions of current pulses are used which are the same in number for all the characters, but vary in length. These pulses are usually, but not necessarily, alternately of opposite directions. For transmitting the characters of the English alphabet there are employed six pulses for each message or character, which enables the operation at will of any one of the 32 magnets, thus permitting the transmission of all the letters of the alphabet and leaving a margin for transmission of punctuation marks and for the operation of spacing, carriage return, shift and paper-feed mechanism. The particular magnet corresponding to each message transmitted is selected by the action of primary and secondary selecting relays, a sunflower and a separator relay.

The invention consists in closing the circuit through contact points of the selecting relays to the printing magnet selected through a contact of the sunflower itself, in delaying completion of the restoring circuit during the operation of the carriage-return mechanism until the carriage has returned to its starting point, in improved means for operating the spacing mechanism without the operation of the selecting relays and in improved shift mechanism.

Referring to the accompanying diagram, signals incoming over the line wire (5) actuate a main-line relay (4), which is the primary actuating element of the printing telegraph and is the only element of the telegraph in the main-line circuit. This main-line relay may of course be differentially wound to permit of duplex or quadruplex operation the same as an ordinary main-line telegraph relay. The main-line signals for operating this relay may be produced by a hand key or by a keyboard transmitter or by any [illegible] means. The [illegible] tape, being arranged to be [illegible] direction of current in the line circuit. Obviously it may be a neutral relay [illegible] operated by [illegible] line relay [illegible] (6) and (7), connected to opposite contact points of the main-line relay, both of which circuits pass through coils of a neutral relay (8), termed the [illegible] relay" through opposite [illegible] operating escapement mechanism of the sunflower and through a synchronizer magnet (28) to ground at (10). A battery (11) or other suitable source of electrical energy is connected to ground and to the armature of main-line relay. One or the other of circuits (6) and (7) is completed through battery (11), according as the armature of relay (4) is in contact with the right-hand or left-hand contact of the relay. The main-line relay is very rapid in action and operates for each pulse produced in the main line, whether short or long. The separator relay is more sluggish in action and completes the circuit which it controls only when a long pulse is sent over the line. Being a neutral relay, however, it completes its circuit each time there is a long pulse, whether it be positive or negative. The circuit controlled by separator relay (8) passes from ground at (13) through battery (14), the armature of the separator relay and conductor (15) to a plate (16) of the sunflower, to which the first five contact points (17), (18), (19), (20) and (21) of the sunflower are electrically connected. This sunflower is of the type described in the patent issued to Buckingham, dated August 18, 1895, and consists of contact points (17), (18), (19), (20), (21) and (22), adapted to be actuated successively by teeth of a ratchet wheel (23) during movement of the wheel through the space of one tooth. The ratchet wheel is mounted upon a shaft (24), upon which is also mounted an escapement wheel (25), having three times the number of teeth of ratchet wheel (23) and controlled in its movement by the escapement anchor (26), which is actuated by the armature (27), which is polarized. The coils of magnet (9), through which circuits (6) and (7) pass, being oppositely wound, alternate pulses in these circuits will cause the vibration of the escapement anchor (26), and six such pulses, permitting rotation of escapement wheel (25) through the space of three teeth, will advance ratchet wheel (23) through the space of one tooth, causing contact points (17) to (22) to complete their respective contacts successively and completing one cycle operation of the sunflower. The shaft (24) of the sunflower is driven by any suitable device, such as a spring motor or friction drive, which will permit intermittent motion of the shaft. Magnet (28) beneath the sunflower is a synchronizer magnet operating an armature lever (29), having a hook adapted to engage the teeth of ratchet wheel (23).

It was stated above that the metal frame (16) carrying contact points (17) to (21) is connected by conductor (15), passing through contacts of separator relay (8), with battery (14) and thence to ground. These contact points (17) to (21), inclusive, which may be termed "selector contacts," when operated by the movement of ratchet wheel (23) complete circuits successively from the contact points of separator relay (8) through conductors (30) to (34), respectively, leading to the [illegible] through th[illegible]

[illegible]

the armatures of the several primary selecting relays are connected by a multiple-current lead (49) to a battery (50) and [illegible] magnet of any one polar-selecting relay is energized by a current passing through the sunflower, and its armature is deflected, the polar-selecting relay completes the circuit through the corresponding secondary selecting relay or relays which it controls, thereby operating them. The armatures of the primary or polar-selecting relays (35) to (39) tend to remain in contact with whatever contact point they are in contact with at the time. These relays are provided with a second or restoring circuit (52), passing in series through all of these relays, which circuit when completed by a restoring relay returns the armatures of all these relays to their normal positions, breaking the circuits of the secondary selecting relays (42) to (46). This restoring circuit is arranged to be completed by a restoring relay (53) after circuit is completed through the sixth contact piece (22) of the sunflower.

Referring now to the secondary selecting relays (42) to (46), the armature of relay (42) is connected to a circuit (54), arranged to be connected through the sixth contact (22) of the sunflower to a battery (55) and thence to ground at (56). The contacts of the secondary selecting relays are connected in tandem as follows: Relay (42) has two contact points connected by conductors (58) and (59), respectively, to movable contacts on the armatures of relay (43). Each of these movable contacts of relay (43) coacts with two contact points, each connected to a contact point on the armature of relay (44). In like manner the fixed contact points of relay (44) are connected each to an armature contact point of one of the two relays (45), and so on. The fixed contact points of relays (46) are connected to magnets (60), termed "printing magnets."

It will be seen that by means of the various secondary selecting relays (42) to (46) any one of the various magnets (60) may be selected at will for the completion therethrough of an energizing circuit. This is the circuit of conductor (54) and is completed, and the particular magnet selected is energized upon the closing of the sixth sunflower contact (22).

The carriage carrying the platen or printing roller of the machine may be of any suitable construction and may be arranged to be returned to its starting point at will by any suitable means, such as a spring or motor. One end of the platen is illustrated diagrammatically in the drawing, being designated by number (68). The return of the carriage is governed by an electrically operated detent mechanism, of which (61) in the drawing designates the magnet and (62) the armature lever.

For spacing is employed a message comprising six dots, which message therefore does not cause the operation of any of the selecting relays, although it does cause the operation of the sunflower. Circuit is completed upon the closing of the sixth sunflower contact (22) through a back contact of one of each of the five series of secondary selecting relays and a circuit (69) to a spacing magnet (70), which may operate suitable spacing mechanism, such as is used on electrical typewriters.

The shift mechanism may be either a carriage shift or type shift, as preferred. In the drawing is indicated diagrammatically a type shift. This shift mechanism (73) comprises a magnet (74), arranged to be energized upon the transmission of a suitable corresponding selective signal and when energized to attract its armature (75), thereby operating the shift mechanism.

The paper-feed employs a magnet (80) in one of the circuits controlled by the selecting relays, which circuit, like the circuit of the magnet (60), will be completed when the corresponding message is transmitted.

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The Inland Empire Traction Company has been incorporated to construct an electric railway from Walla Walla, Wash., to the Columbia River.

## The New York Lighting Investigation.

The investigation into the cost of public lighting in New York city was continued last week. The effort of the committee during the previous week had been to ascertain the tangible value of the plants behind the capitalization of $80,000,000, and the Consolidated Gas Company, which controls nearly all the gas and electric plants in the city, admitted that the assets were only about $27,000,000. The company now says that to reproduce these plants under existing municipal regulations would cost about $48,000,000, which allegation so far has not been disputed.

On Monday, April 3d, Benjamin A. Whiteley, assistant treasurer, testified that the Consolidated had purchased from other companies many billions of cubic feet of gas at an average cost of about 33 cents a thousand. This was sold to customers at $1.

Robert A. Carter, the Consolidated company's treasurer, stated that the company increased its capital by $19,000,000 for "construction" purposes, but of the money so raised by six-per cent. bonds $12,000,000 was reinvested at only three per cent. The loss of interest was charged to "cost of production," he said.

Henry M. Edwards, auditor of the New York Edison Company, said that when the New York Gas, Electric Light, Heat and Power Company acquired the Edison Electric Illuminating Company the Illuminating company retained a lien against assets valued at $12,307,296.98, according to the books. The Illuminating company paid 13 per cent. in 1898 and was capitalized on its earning capacity. When the New York Edison Company took over the power company it also took over a book surplus of $19,520,700. This included $13,643,300 for stocks and bonds of other companies held by the Power company, and against the surplus new stocks and bonds were issued to the amount of $66,500,000.

On Tuesday and Wednesday expert accountants were set to work on the books. On Thursday Mr. Whiteley was re-examined. He insisted that the average price of the billions of cubic feet of gas purchased during a period of four years was 35.27 cents "at the holder." Permission was given to record a statement that the total cost of this gas plus operating expenses was 64.64 cents per thousand cubic feet. In 1904 the difference between the total costs and receipts from sales was $4,654,168.16. Renewed questions as to what became of an amount of $5,917,906 received as part of the proceeds of certain stock issued at a premium were not answered.

Mr. Edwards, recalled, presented the following table, showing the cost of electric current per kilowatt-hour:

| | Manhattan. | The Bronx. | Yonkers. |
|---|---|---|---|
| Cost at generating plant | 2.40 cts. | 2.40 cts. | 4.03 cts. |
| Cost of current delivered | 3.70 cts. | 5.00 cts | 4.10 cts. |

The average cost of current delivered in Manhattan and the Bronx was 3.66 cents per kilowatt-hour. Mr. Edwards afterward revised his statements, saying: "The average cost per kilowatt-hour during the last year, everything included, was 6.32 cents and the average cost for the last five years has been 7.98 cents. Our average income from every kilowatt-hour sold for the last year was 8.04 and for the last five years 9.01. We are decreasing the costs every year."

John W. Lieb, Jr., a vice-president of the New York Edison Company, testified that the profit for 1904 was $2,293,839. The company did not pay a dividend, but had an accumulated surplus of $6,402,078, and wrote off $4,119,223 for depreciation. During the five years of the company's existence it had paid interest on $40,000,000 of bonds. He said that he was an operating officer and was not concerned with the company's finances.

On Saturday inquiries into the Edison company's affairs were resumed. The facts elicited showed that the city paid 12 cents a kilowatt-hour for current. First cost at the switchboard was 3.66 cents a kilowatt-hour, which, with distribution and interest on bonds, brought up the total cost to 6.32 cents.

Arthur Williams, general inspector for the New York Edison Company, explained that the small consumer was charged 15 cents for the first two hours, 10 cents for the next two, 7.5 for the next two, and after that five cents an hour.

Mr. Lieb, recalled, said that 34 per cent. of the total Edison output was sold to the retail consumer, who provided 49 per cent. of the income. This in 1904 amounted to $4,371,064.54 out of a total income of $8,991,635. The average income per kilowatt-hour was 12.27 cents.

## Lightning Arresters for Power Circuits.

By R. Scott.

Part II.

The S. K. C. line discharger, which is shown in Fig. 8, consists of a small air gap connected in series with a glass tube (S) containing particles of oxidized metal. These particles offer a very high resistance (an 18-inch tube having approximately 50 megohms), so that the dynamic current which tends to escape to ground is very minute indeed. To prevent the probability of such escape the air gap mentioned above is interposed. If a discharge of lightning should set up an arc within the tube, the glass would be broken, thus acting in the same manner as a fuse. The length of the tube is so proportioned that should such arcing occur it will be disrupted by such breakage of the tube, the enclosed gases also tending to this result. The tubes are so constructed that they may be replaced after operation in the same manner as an enclosed fuse. The principle of this device evidently fulfills a number of conditions that make up a successful protective device, and if a suitable fireproof housing be provided its operation becomes efficient and safe. The usual proportions adopted in the application of these

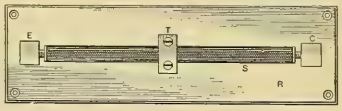


FIG. 8. S. K. C. LINE DISCHARGER.

discharges is nine inches of tube per thousand volts.

Such an arrangement has selective tendencies; for while not allowing a dynamic current of even high voltage to pass through, it allows very minute charges, even of low potential, to pass readily to ground. The arrangement of the oxidized particles is such that numerous multiple paths are presented to a static discharge, which, however, have a cumulative resistance that prohibits a dynamic current from so passing. The series air gap in itself also is sufficient to prevent such conduction. These discharges have also been applied to the removal of static charges from underground and aerial cables and generator frames, and they are especially valuable for electric-lighting cables carrying alternating

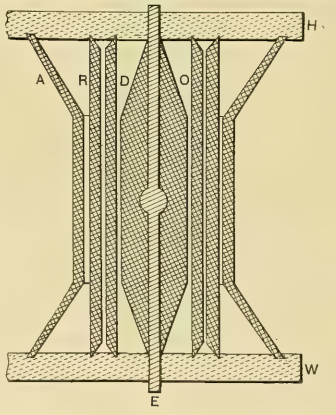


FIG. 9. ARRESTER WITH CONCENTRIC CYLINDERS.

current, removing the surges of potential set up by open-circuiting an inductive device. Such surges, unless eliminated, frequently puncture the internal insulation of the cable and ground the network.

Another form of arrester in shown in Fig. 9; this consists of the concentric metal cylinders (A) (R) and (D), held in place by the porcelain pieces (H) and (W). The innermost of these cylinders encloses a double conical piece (O), which is connected to the line to be protected by the rod (E). The outer cylinder (A) is connected to ground. The porcelain end pieces are provided with a number of perforations, in order to allow a free circulation of the air in the space intervening between the cylinders. The spark gaps are approximately one-sixteenth inch, there being three between the line terminal and ground. The operation of this arrester is as follows: When lightning enters the instrument it passes from the central cylinder to the external cylinder. The dynamic arc thus set up is disrupted by the currents of air, which force it to the top portions of the cylinders, where it is finally broken, due to the increase in the distance occurring between the cylinders, and also to the moving effect of the air. It is a well-known fact that a very slight current of air suffices to disrupt even a heavy arc. It is on this principle, therefore, that the instrument operates. The total air gap in this arrangement is very small, being but three-sixteenths of an inch, so

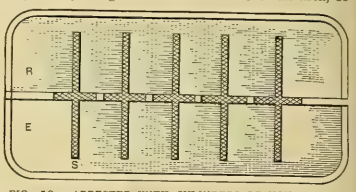


FIG. 10. ARRESTER WITH CYLINDERS OF NON-ARCING ALLOY.

that the sparking potential is also very small to a dynamic current. However, for under 5,000 volts potential, the air gap is sufficient to prevent discharging under all normal conditions, and even if this discharge takes place, the arc cannot long continue. An advantage of this arrangement is the large amount of metal presented to the arcs, the cooling effect of which is sufficient to aid in suppressing these arcs.

In Fig. 10 a type of arrester for alternating circuits is shown. This consists of the two porcelain pieces (R) and (E), which enclose a plurality (the number depending on the voltage of the circuit) of

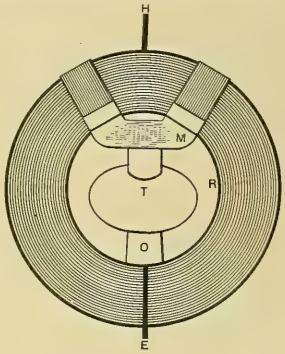


FIG 11. MANNER OF INSTALLING CHOKE-COIL.

cylinders of non-arcing alloy. The cylinders are connected in series between lines and ground, the arc being suppressed by the action of the volatilized alloy and the air currents which circulate through the aperture (S) in the housing.

A choke coil and the manner of installation is shown in Fig. 11. This coil may be installed upon a line pole or wherever convenient, and is mounted upon the special insulator (T), provided with the double lug (M), having recesses into which the coil is placed. This insulator may be affixed to the pole by the large pin (O). The line and air gap are connected, respectively, to the terminals (H) and (E).

In Fig. 12 is shown diagrammatically two static interrupters protecting a generator (Q). The air gap (N) is connected in series with the choke coil

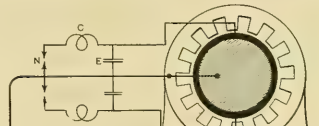


FIG. 12. STATIC INTERRUPTERS PROTECTING A GENERATOR.

(C) and shunted by the condenser (E), the frame of the generator being grounded.

In Fig. 13 the manner of protecting a transformer (R) by a static interrupter is shown. The interrupter (D) is connected to the primary of the transformer and the line (E) in a manner which is evident from the diagram.

An older form of arrester, which is again coming into extensive favor, consists of a plate of lignum-vitæ, upon which a ground and line terminal are

placed; between these latter the wood is charred. Atmospheric electricity will readily pass across a strip thus treated, although its resistance is approximately 50,000 ohms. Since this resistance is much higher than the average insulation resistance of electric-light and transmission systems, the leakage factor is very small. In Fig. 13 is shown a form of arrester which depends in operation on the fact that a discharge will take place readily across a

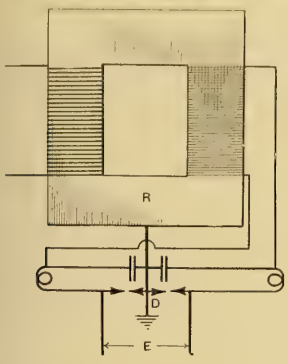


FIG. 13. STATIC INTERRUPTER PROTECTING A TRANSFORMER.

non-conducting medium provided with such a thin film of carbon, or a similar conductor placed across this surface, and also because of the fact that a discharge will pass more readily across a non-conducting surface, such as wood, than across an equal length of air gap. Upon the insulating base (T) a strip (R) of lignum-vitæ or similar wood is placed.

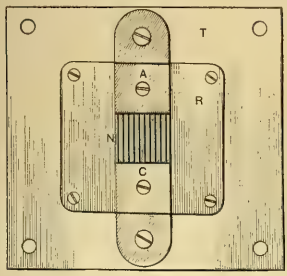


FIG. 14. LIGNUM-VITAE ARRESTER.

The heavy terminals (A) and (C), which are connected with line and ground, respectively, are placed flush with the surface of the wood block. On that a cover which will prevent the free circulation of air around this block is placed. The charred grooves (N) provide a ready path for the discharge of lightning between the two terminals, these charred grooves being in reality a thin film of carbon, which affords a good path for static discharges. Should a dynamic discharge pass between the terminals, it will be quickly suppressed, due to the fact that

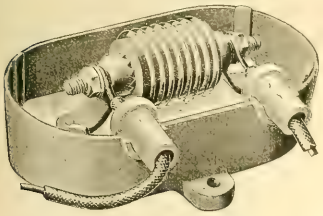

FIG. 15. DISK ARRESTER.

within this enclosed space it is impossible to maintain an arc, owing to the exclusion of the vapors necessary to keep up the arc. This, therefore, is a non-arcing arrester.

In Fig. 15 is shown a type of lightning arrester which is simple and solidly constructed. It consists of a series of disks separated by insulating sheets, through which a discharge will readily pass. Owing to the large cooling surface, and the numerous insulating gaps, the following current is of no consequence. The arrangement is enclosed within a cast-iron box and is suitable for installation in an unprotected location.

The Ajax arrester, which is shown in the accompanying figure, is constructed on a different principle to any above described. The metal strip (D) is connected to the arrester fuses (A) and also to ground by the conductor (B). The line wire is connected to the U-tube (C) by the wire (E). A carbon ball (F) is prevented from moving down the tube (B) by the projections at one end of the arrester fuses. When the fuse is blown, as by the dynamic current following a discharge, the heavy current burns the end of the wire and also the remaining portions of the fuse. This allows the carbon ball to drop within the tube and come in contact with the second fuse, thus leaving the apparatus in condition for another discharge. The arrangement thus acts as a magazine that will take care of a number of discharges, even though these discharges follow in rapid succession. This is an advantage, as numerous arresters will fail to give the desired protection if a discharge immediately follows the discharge which has produced a movement of the device.

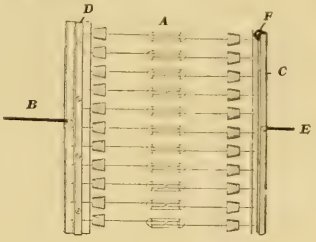


FIG. 16. AJAX ARRESTER.

In Fig. 17 is shown a combination fuse and spark gap, such as is used in the above arrester. This consists of two pieces of brass wire which are sealed within a glass tube (B), by the insulating fillets (C), an air gap of a given width being interposed at the loops shown in the tube. The length of air gap depends upon the working pressure of the line to which the arrester is connected, and for very high voltages a number are connected in series.

The advantage of enclosing the air gap within a glass tube is the fact that the spark gap is always

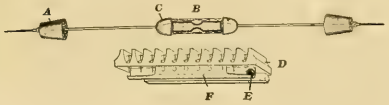


FIG. 17. COMBINATION FUSE AND SPARK GAP.

in a clean and moistureless condition, so that the sparking distance is invariable. Rubber stoppers (A) are fastened near the end of each wire. The fuses are mounted upon the insulating base (D) at the rear of which the common connection and the U-tube (F) are shown; this tube is provided with apertures to allow a good circulation of air. The fuses are held in place by the rubber stoppers (A). The arrangement shown is sufficient for 11 discharges, the block being recessed for each fuse to prevent interference during discharge. The ball (E) is shown in contact with the first fuse. This arrester is installed in connection with a choke coil and cut-out, in accordance with the ordinary practice.

[*The end.*]

## State Control of Lighting Plants Proposed.

A state commission for Illinois, modeled after the lines of the Interstate Commerce Commission, and with powers to fix rates for gas and electric lighting according to the individual merits of each locality, is advocated by a number of owners of gas and electric-light and power plants, operating in the small cities of the state. A committee of the House had under consideration legislation proposing municipal control and ownership of gas and electric plants. The representatives of the companies strongly opposed this idea, asserting that it would amount practically to confiscation of hundreds of small plants throughout the state. They also asserted the belief that municipal ownership of light and power plants would be very costly to the taxpayers, as experience had shown that such business was conducted cheaper by private enterprise, and that under municipal control the poorer taxpayers, those who could not afford to use gas or electric light, would pay in their taxes part of the bills of the users.

## High-voltage Locomotive for Sweden.

HIGH-VOLTAGE LOCOMOTIVE FOR SWEDEN.

service in high-tension transmission. The intention is to operate at a moderate voltage in towns and thickly populated districts, while a high-trolley voltage will be employed, carried overhead, on the greater part of the line.

The control system is electropneumatic and consists of an air compressor driven by a single-phase alternating-current motor, an air motor on the induction regulator, air cylinders on the circuit breaker and reverser and the necessary magnet valves. The air brakes and air sanders are also to be supplied by the above compressor. There are two connectors at each end of the locomotive so that two locomotives can be coupled together and operated by one master switch. The master switch is in the middle of the cab and is so situated that the operator has a clear view in all directions without leaving his seat.

The weight of the locomotive and equipment is 25 tons, all of which is on four 41-inch drivewheels. Two 150-horsepower, 3,000-alternation, single-phase motors are geared, one to each axle, with a gear reduction of 18 to 70, and have shown an ability to handle a 70-ton train at 40 miles an hour without exceeding the rise of temperature for which they were designed. The equipment, it should be mentioned, was supplied by the Westinghouse Electric and Manufacturing Company. It has been so installed on the locomotive as to permit ready access to all parts. Only the small operating devices have been placed in the cab, and the arrangement is such as to allow of the greatest convenience in operation with a maximum of safety to the operator.

## New York and London Street-railway Transportation.

J. Allen Baker, chairman of the highways committee of the London County Council, in his report on the street-railway systems of New York city, makes some interesting comparisons with the London system. Mr. Baker, on behalf of his committee, recently visited New York. The following table, taken from his report, shows, comparatively, construction and operating costs, revenue, speeds and the pay and hours of employes:

| Item. | New York. | London |
|---|---|---|
| Gross earnings per car mile | 25 cents. | 25 cents. |
| Operating costs per car mile | 15 cents. | 14 cents. |
| Cost per track mile for cleaning | $880.60. | $982.11. |
| Cost of construction line per car mile of single track | $7,000 to $120,062.5 | $72,[illegible] |
| Cost of feeder cables per mile | $15,872.00 | $[illegible] |
| Cost of power stations per mile single track | $20,232.00 | $28,96[illegible] |
| Average speed per hour | 10 miles. | 8 miles. |
| Hours of motormen and conductors | 10 hours labor in 12 consecutive hours. | 10 hours labor in 12½ consecutive hours average. |
| Pay of motormen per day | $2.21 to $2.81 | $1.15 to $1.52 |
| Pay of conductors per day | $2.01 to $2.[illegible] | $1.15 to $1.92. |
| Pay of conduit cleaners per day | $1.[illegible] | $1.50. |
| Pay of car cleaners per week | $10.56 to $12.28. | $6.68 to $6.68. |

The Kingman (Kan.) Light and Power Company has been incorporated with a capital stock of $25,000.

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## DATES AHEAD.

Iowa Electrical Association (annual meeting), Hotel Julien, Dubuque, Iowa, April 19th and 20th.

American Electrochemical Society (annual meeting), Boston and Cambridge, Mass., April 25th to 27th.

Association of Railway Telegraph Superintendents (annual meeting), Read Hotel, Chattanooga, Tenn., May 17th and 18th.

National Electric Light Association (annual convention), Denver, June 6th, 7th and 8th, and Colorado Springs, June 9th, 10th and 11th.

CONTINUED USE has made the one-half-inch carbon the standard for enclosed-arc lamps, and this size is almost the universal practice today. The question arises, however, whether other sizes of carbons may not be used to better advantage, either in point of current consumption or in improved illuminating qualities. The paper presented by Mr. George N. Eastman before the last meeting of the Chicago branch of the American Institute of Electrical Engineers, an abstract of which is given elsewhere in this issue, is an important one, and some of the results which the author has obtained in an extensive series of experiments indicate that the present one-half-inch carbon may not be the most desirable. For instance, he found that the luminous intensity of a 3.5-ampere lamp using five-sixteenths-inch carbons was 52.8 per cent. greater than with half-inch carbons. In a five-ampere lamp the candlepower was 38.3 per cent. greater with five-sixteenths-inch carbons than with one-half-inch carbons. These are results that arrest attention.

RAILROAD PROJECTS in the Philippines have reached a stage where it is believed that 700 or 800 miles of line are to be built soon. Since Mr. Taft, the present secretary of war, returned to this country he has endeavored to interest American capital in the advantages of railroad building in the islands. For some time his efforts met with no great success, but since the election the business men approached appear to feel that they are taking no great risk in investing money in Philippine railroad projects. These projected railroads, or a large share of them, might, no doubt, be operated by electric power to advantage. The prospect is especially good, because the construction work will be entirely new, unlike many electric-railway propositions in this country, where, when electricity is discussed, the cost of discarding existing equipment must be carefully considered. We hope that the great American electrical companies will neglect no effort to present the merits of electric railroads to the group of capitalists interested in the Philippine project.

IN CONSIDERING the export trade of the United States, which, in manufactured products, is far from being as large as it should be, one is apt to lose sight of the rapid development of American manufacturing in foreign countries, which development, however, affects the export trade of this country unfavorably rather than favorably. American factories are in truth building or have been built in many countries of Europe. They are constructed under American direction by American capital, and the production and marketing of their output is managed by American business ability. A recent writer on the subject avers that American money to the extent of $50,000,000 is already invested in these undertakings. Sewing machines, printing presses, electrical machinery and apparatus and other manufactures are produced by American methods and after American designs by comparatively cheap European labor directed by American superintendents. This pronounced movement, while it may minister to national pride, really curtails the exports of American manufactures to foreign countries, and is a serious feature to be considered in studying the problem of extending our export trade.

PLATINUM is of so much importance in the electrical arts—not so much on account of the quantity used as from the fact that for several purposes it is practically indispensable—that the efforts of the United States Geological Survey to examine the platinum resources of the country, with the idea that they may be sensibly extended, is of significance. It is proposed to collect the heavy sands from all placer mines in the United States where evidence of platinum has been found by preliminary tests. The samples thus obtained will be used in determining the best methods of extracting the various minerals which have economic value. Miners or other persons are invited to mail to the office of the director of the Geological Survey in Washington, D. C., not more than four pounds of material most likely to contain platinum in placer deposits. This material will be carefully examined, and senders will be duly notified of the results. After an examination of these samples experts will be sent to all localities where preliminary tests give promise of platinum in profitable quantity. The experts will report on the size of the deposit and superintend the collection of representative samples for concentration.

It would be a great advantage to the electrical and several other industries of the country if a large supply of platinum could be found in the United States. This effort of the government, under the supervision of Mr. Charles D. Walcott, the director of the Geological Survey, to extend the platinum resources of the country, is in every way praiseworthy. No doubt there are many readers of the Western Electrician in the mining districts who may be interested in the government's offer to examine samples, and we hope that they will avail themselves of the suggestion.

THE FIRST STEPS taken by Mayor Dunne to secure "immediate municipal ownership" of the street railways of Chicago are not of a nature to indicate a realization of the difficulties to be grappled with. Even before he was installed in the mayor's chair Judge Dunne cabled to the lord provost of Glasgow, asking that the manager of the municipal tramways of that city be given leave of absence to come to America to confer with him. The gentleman addressed answered the "lord mayor of Chicago" to say that his request had been agreed to, but that the tramway manager of Glasgow would be unable to leave until May 10th.

It would be instructive to know what lessons Mayor Dunne intends to learn from the estimable gentleman from Glasgow. It can hardly be the gospel of double-decked cars, for the people of Chicago certainly would not "stand for" these cumbersome vehicles. The two-story cars would lend themselves but poorly to the quick, sharp operation which the business of Chicago demands. The crowding of the rush hours, with the difficulty of collecting fares, the stops at every street intersection, the low headway of some of the elevated-railroad crossings in Chicago and the climate of the city are other reasons which would preclude the use of the cheaply operated but rather awkward cars used in Glasgow. Nor can it be the zone system of fares as used in Glasgow which should be an example to Chicago. The five-cent fare tends to quicker operation and is a great incentive to the workingmen to live in healthful suburbs. This sociological aspect of the fare question is an important one.

Aside from the type of cars used and method of computing fares, the Glasgow system was built very largely after American methods. An American-born consulting engineer was retained, and machinery either of American type or American manufacture was used in the plant. Unless it be in the financial operation of the municipal tramways, it is difficult to see how the experience of Glasgow will be of value to the people of Chicago; and in this particular the working conditions and legal difficulties are so entirely different here that it would seem that the advice of foreign experts would be of little assistance.

Mr. C. T. Yerkes, now of London, who is perhaps too well known to all interested in the Chicago street-railway situation, makes some pertinent reflections on Mayor Dunne's programme: "Judge Dunne is a man of much intelligence; but what does he know about street railways? If he were infinitely more able than he is, he could not achieve what he has set himself to do. Municipalities cannot manage great, complex affairs with success. Every great business must be run scientifically if it is to be run long or at all. How can Chicago run railways scientifically? Chicago needs a lesson, however, and could not get it any other way. I am glad the city is taking the direct path to disillusionment. The principle of private ownership will issue from the experiment indisputably vindicated."

Mr. Yerkes is not popular in Chicago, but he certainly does know a good deal about the operations of street-railway systems, and he seems to have hit the nail on the head. Judging by the beckoning finger extended toward Glasgow, we do not consider that the methods which must prevail in street-railway operation have been happily entered upon by the municipalization advocates in Chicago.

## QUESTIONS AND ANSWERS.

### Equipping Telephone Line for Telegraph Service

An inquirer in Vallejo, Cal., writes: "I have a line operating three telephone. It is about two miles long and multiple. I wish to put in a telegraph between another person and myself. In order to save wire, I thought I could use one leg of the telephone circuit and ground the other end. What effect would this have on either the telephones or telegraph, if any? The telegraph instruments are 20 ohms, operating on five gravity cells."

Answer.—The existing arrangement, in general, is shown by Fig. 1, which represents a line with the telephones connected at each end and intermediate station between. Now in order to equip this line for telegraph service, two plans are available: First (perhaps the most reliable one) there may be installed at each end of the line an impedance coil (R) and (R'). This impedance coil is to consist of two parallel windings with the center winding brought out, as shown, to the telegraph instruments. The instrument is then connected to the battery (B), the opposite terminal of which connects to the earth. At station (T) the instrument is connected to the earth. In setting up this portion of the circuit sufficient battery must be added at (B) to permit the telegraph sounders to operate satisfactorily. It is suggested that the windings of the impedance coils (R) and (R') should be approximately as follows: Each winding to have a total of 6,000 turns of wire, using about a No. 31 B. & S. gauge, single silk-insulated copper wire. Suitable coils, however, may be obtained by applying to makes of telephone supplies.

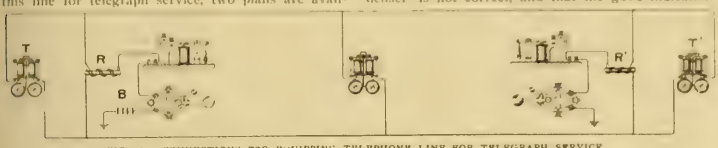



FIG. 1. CONNECTIONS FOR EQUIPPING TELEPHONE LINE FOR TELEGRAPH SERVICE.

In case the line wires are not of equal size or the same kind of wire, it may be necessary to balance up the circuit, though it is not probable that in a two-wire line any trouble will be met with in obtaining a service free of interference.

Another suggestion may be offered, which plan, if available, would avoid the necessity of purchasing the impedance coils (R) and (R'). By this plan (Fig. 2) the telegraph instruments are connected to the wire between the two halves of the ringer coils of the telephone. A point will be found where the two coils are connected together, and if the coils are wound uniformly, the telegraph circuit may be connected to these wires, and a very satisfactory service obtained, and that without purchasing any apparatus aside from that already in the correspondent's possession.

If the latter plan is adopted, it is absolutely necessary that the ringers be permanently bridged across the line. That is, the usual hook-switch contact breaker must be cut out and the ringer connected directly across the two line wires.

### Finding the Area of a Circle.

A reader of the Western Electrician in Green Bay, Wis., writes for information concerning a solution of a problem in arithmetic which was performed, he says, in an unusual manner by a government inspector. The problem was to find the area of a piston 10 inches in diameter. Of course, the usual method would be to use the formula: Area $= \frac{1}{4}\pi d^2$, or, in this case, the area would equal $\frac{1}{4} \times 3.1416 \times 100 = .7854 \times 100 = 78.54$ square inches.

The figuring of the government inspector is said to have been as follows:

$10^2 = 100$

$.7722$

700
700
1400
1400

78.5400 square inches.

This is the correct answer, but the method by which it is obtained is not clear. In the first place how is the multiplier .7722 obtained? It is not $\frac{1}{4}\pi$, though very close to it. The method of multiplying is a novel one, though possibly it is one of the "short-cut" methods sometimes employed, but in this case making the process longer if anything. Perhaps some reader of the Western Electrician can explain the method employed.

### Commutator Explanations Desired.

C. Lee Pickett of Springfield, Mo., writes: "In your issue of February 11th, in the article describing a 250,000-volt continuous current generator, it is said that 'shunt-wound condensers were placed between the sheets of the commutator.' The query arises in my mind, What is a shunt-wound condenser?' or is there some mistake?"

Answer.—Evidently there was a mistake, and the editor of the Western Electrician applied to the author of the article, Mr. Emile Guarini of Brussels, Belgium, for a correction. Mr. Guarini writes: "Please advise Mr. Pickett that 'shunt-wound condenser' is not correct, and that the good indication is 'shunt connected.' This was a mistake made by my translator, for which I apologize." Apparently the segments of the commutator are shunt-connected to condensers. These condensers, as Mr. Guarini mentions in his article, are mounted on the machine.

### Four-way Switches

A subscriber asks for an explanation of the action and circuits of four-way switches. Such switches are in general similar in construction to an ordinary knife switch, except that the blades are fastened to a centrally pivoted crossbar. The four pairs of jaws are arranged around a plane circle having the switch pivot for its center. In this way one pair of blades can be used to close any of four separate circuits. The special value of the four-way switch lies in the fact that by its use only one circuit can be closed at any given time, and thus short-circuits due to the careless closing of one switch before another is opened are made impossible. This form of switch is frequently employed in connection with three-phase apparatus.

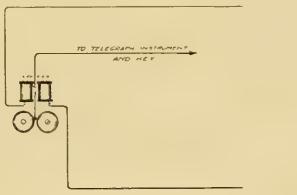



FIG. 2. TELEGRAPH CONNECTED TO TELEPHONE LINE WITHOUT IMPEDANCES.

### Vulcanized Fiber.

Question.—What is the temperature coefficient of expansion of vulcanized fiber, its dielectric characteristics, etc.?

Answer.—The coefficient of linear expansion of vulcanized fiber is approximately 0.0000636 per degree Centigrade, or 0.0000353 per degree Fahrenheit. The coefficient of cubical expansion may be taken as three times the linear coefficient.

According to the best authority the sparking distance for vulcanized red fiber is given by the following equation:

$$D = 7.66\,E + 2.3\,E^2.$$

In this formula D represents the sparking distance in millicentimeters and E the impressed electromotive force in kilovolts. If it is required to know, for example, the thickness of vulcanized fiber that will be punctured by 10,000 volts, substitute 10 (the kilovolts in this case) for E in the formula with the result

$$D = 76.6 + 230 = 306.6 \text{ millicentimeters.}$$

Thus it is found that a sheet of vulcanized fiber about three-tenths of a centimeter (118 mils) thick will break down under 10,000 volts pressure. To insulate for such a pressure a factor of safety of at least 100 per cent. should be allowed, or, in other words, the thickness of the fiber should be doubled.

### Resistance Metals.

A Colorado subscriber wants to know the "physical and electrical properties of the modern

[illegible] tained."

[illegible] per cent. manganese, three per cent. nickel) and "Advance" (a copper-nickel alloy containing no zinc).

[illegible] perature coefficients of the alloys above referred to:

| | |
|---|---|
| Copper | [illegible] |
| Platinoid | [illegible] |
| German silver | [illegible] |
| Platinoid | [illegible] |
| Manganin | [illegible] |
| Advance | [illegible] |

It will be noted that the temperature coefficients decrease as the resistance [illegible] erally a characteristic of resistance alloys that it may be said that the higher the specific resistance of the material the lower will be its variation of resistance with temperature. The majority of resistance metals have either a positive or a zero temperature coefficient. It is possible, however, to make copper-manganese alloys having a negative coefficient—that is, their resistance will actually fall as the temperature rises. Such wires are used in connection with a positive temperature coefficient metal in cases where it is necessary that the resistance of a certain apparatus should remain the same at all temperatures.

Platinum-silver, platinoid, manganin and "Advance" can be recommended for use in standard resistances; german-silver wire is objectionable for this purpose, in that coils wound with it show a continuous change in resistance, due apparently to the crystallizable nature of the zinc which forms a part of this alloy.

(2) The requirements for resistance wires to be used in the manufacture of rheostats, motor-starting and controlling devices, etc., are good mechanical strength and ductility, fairly high specific resistance and fairly low-temperature coefficient. Freedom from corrosion and from structural change when exposed to temperature variations and mechanical vibration are also necessary requirements in some lines of work.

German-silver has been much used in rheostat work and has given fairly good service. It is open to the objection, however, that it tends to become brittle in course of time, and especially so when it is subjected to repeated heating and cooling. The numerous nickel-steel wires now on the market are said to be free from this objectionable feature and their excellent mechanical quality and high specific resistance count strongly in their favor for manufacturing purposes. These wires are sold under various trade names. Their specific resistance is about 50 times greater than copper, and their resistance increases with a rising temperature at the average rate of 0.04 per cent. per degree Fahrenheit. Temperatures below a red heat do not injure nickel-steel wires, a quality that enables them to stand a heavy overload without deterioration. One precaution should, however, be observed—they should not be wound upon asbestos, as corrosive action may take place.

Business addresses are not given in this department, but the inquirer can doubtless obtain the names of makers or importers of resistance metals by applying to any large dealer in electrical supplies.

### Two-phase Transmission.

In an answer to a question published in the Western Electrician of March 25th relative to two-phase transmission, it was wrongly stated that two wires are used for the purpose, two circuits being meant, which would in reality be four wires. Three wires may also be used for the purpose of trans-

mitting two-phase current. This is in answer to W. F. Hankins of Gordon, Neb.

### Changing Direct-current Motor to Alternating-current Machine.

A reader of the Western Electrician in Odessa, Mo., wishes to know how to change a small direct-current motor to an alternating-current motor. The data given are insufficient, for many things, such as the number of poles, the kind of armature winding, whether single or two-part, or series or parallel, the nature of the field windings, etc., have a bearing on the problem. In general it may be said that a direct-current machine readily adapts itself to changes required to make it into an alternating-current machine, but that the reverse does not hold true.

### Voltage and Current that Human Body Can Withstand.

The same correspondent also desires to know how many volts at one-fourth ampere are required to kill an ordinary man. This is a subject that has been much discussed, but which can never be answered satisfactorily on account of the varying conditions which obtain. It is generally conceded that it is the current which kills rather than the pressure. As stated editorially in the Western Electrician of April 1st, 20 or 30 milliamperes is considered to be the limit which can be borne by most persons with safety; 50 or 60 may cause serious trouble and 100 milliamperes may be considered as always fatal. This being the case, the factors to be considered are the resistance of the human body, the area of contact, the path taken by the current in passing through the body, the condition of the skin and clothing as to moisture, and the like. In rare instances persons have been killed, apparently by 110 volts pressure, when working in battery rooms with wet hands and where all conditions were most unfavorable, whereas in other instances shocks at a pressure of several thousand volts have been survived. There is no doubt that any pressure which will send one-quarter of an ampere through the vital organs would result fatally, but this pressure would vary over a very wide range, depending on the resistance.

### Electrical Current for Treatment of the Eyes.

A correspondent in Louisville, Ky., says that he is wiring five No. 6 dry cells without a coil for treatment of "obscured" sight, one pole to be applied to the base of the brain and the other to the eye through sponge contacts. He wishes to know if the batteries have enough power or if an induction coil should be used. In the first place, in answering this question it may be said that the method is a doubtful one, as far as can be learned, for treatment of diseases of the eye. It is true that the so-called faradic method has been tried, in which case the current is continuous, and therefore an induction coil could not be used successfully, as the current it delivers is alternating. To obtain any results with only five dry cells would be impossible, as the effect would not be noticeable with so low a voltage. Physicians who use what they call the faradic method of treatment for various diseases often have as many as 40 or 50 cells at their command, which if connected in series would give in the vicinity of 80 or 90 volts.

## Metropolitan West Side Elevated Railway.

The new directors of the Metropolitan West Side Elevated Railway Company of Chicago have elected Howard G. Hetzler president and general manager of the company, to succeed Dickinson MacAllister, who has resigned. Mr. Hetzler resigned as superintendent of terminals of the Chicago, Burlington and Quincy Railroad Company at Chicago to accept the new position. He will begin his duties on April 24th.

Passenger traffic for the year showed a gain of 1.06 per cent. President MacAllister, in his annual report, said that the demands on the company during rush hours were such as to make necessary the purchase of 68 additional cars. Then it was found necessary to change the method of operation from single-motor cars hauling trains to the multiple-unit system. The addition in equipment makes a total of 157 motor cars and 262 coaches. The air-brake system was also changed and storage batteries were provided at Robey Street, the junction of the Humboldt Park and Logan Square lines, and at Forty-sixth Avenue on the Garfield Park line, each battery being of 998.8-kilowatt capacity.

## The Use of Small-size Carbons in Enclosed Arc Lamps.[1]

By George N. Eastman.

Although there was a great sacrifice in the light efficiency in changing from the open-arc lamp to the enclosed lamp, the advantages which Mr. Marks outlined [in an Institute paper in 1897] were sufficient to warrant the change.

With the enclosed lamp the one-half-inch carbon became standard, and is the carbon which is universally used today. It is the object of this talk to present to you results obtained and observations made on a series of tests on the enclosed arc for the purpose of determining whether or not its efficiency could not be improved without too great a sacrifice in maintenance cost.

It should be borne in mind that the arc lamp

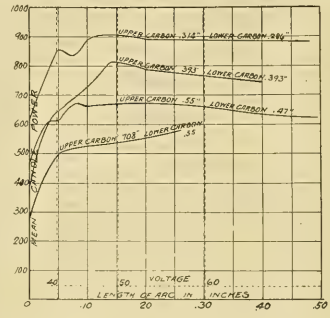



FIG. 1. CURVES SHOWING VARIATION OF LUMINOUS INTENSITY OF OPEN ARC WITH SIZE OF CARBON.

has its own particular field of illumination, this field demanding a long-hour burning and having a high load factor. There should be, therefore, no objection in allowing the arc-lamp maintenance to exceed the cost of maintenance of the short-hour illuminants by an amount which is in proportion to the total fixed charges when the load factor of the illuminants is taken into consideration.

The variation in the candlepower in the open arc obtained by varying either the arc voltage or the size of the carbon is clearly shown in the curves plotted in Fig. 1, which is obtained from data given in Mrs. Aryton's book on "The Open Arc."

Fig. 2 shows the variation in efficiency obtained by varying the size of carbons, the current being maintained at 10 amperes and the arc voltage at 50 volts.

From Fig. 2 it will be seen that the candlepower of the 10-ampere open arc is increased 70.7 per cent. by decreasing the size of the lower carbon from 0.55 of an inch to 0.286 of an inch. If these results can be obtained with the pointed carbons of the open arc, it would seem that equal results

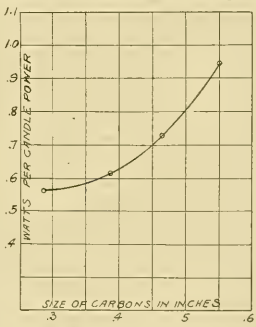



FIG. 2. CURVES SHOWING VARIATION OF EFFICIENCY OF ARC WITH SIZE OF CARBON.

could be obtained with the flat-burning carbons of the enclosed type.

To determine the variation of candlepower by varying the size of the carbons a lamp was taken with clear glass and closed-bottom bulb, it being desirable that the test should represent the conditions which would be obtained in ordinary practice, the carbons used were selected from the regular stock of one-half-inch American carbons. The lamp was equipped with its regular one-half-inch carbon-holders and the different sizes of carbons tested were obtained by turning down the one-half-inch carbon to the desired size, care being taken that no shoulder was left on the lower carbon which would shadow the arc. The length of the carbon turned down varied from 1½ to two inches.

1. Abstract of a paper read before the Chicago branch of the American Institute of Electrical Engineers, March 28, 1905. Mr. Eastman has charge of the testing laboratory of the Chicago Edison Company.

Candlepower measurements were made by means of the Abady-Simmance flicker photometer, the light being reflected from both sides of the arc by means of two adjustable mirrors. The photometer was standardized by means of standard incandescent lamps.

The arc was allowed to burn for half an hour before candlepower measurements were made, and from 10 to 60 readings were taken at each angle, depending upon the amount of fluctuation of the light. All measurements were made with a potential difference of 80 volts at the arc and with a current of 3.5 amperes. Table No. 1 gives the results obtained on these tests, and light-distribution curves are shown in Fig. 3.

Table No. 1.

Variation of Candlepower with Size of Carbons. 80 Volts—3.5 Amperes.

| | Size of Carbons. | | | | | | |
|---|---|---|---|---|---|---|---|
| Angle. | ½ in. | 7–16 in. | 3/8 in. | 5–16 in. | ¼ in. | 3–16 in. | 1/8 in. |
| 30 degrees..... | 77 | 97 | 77 | 121 | 65 | 140 | 155.5 |
| 15 degrees..... | 51 | 64 | 71 | 95 | 95.3 | 159 | 190 |
| 0 degrees..... | 86 | 99 | 73 | 93 | 56 | 165 | 229 |
| 15 degrees..... | 149 | 151 | 177 | 189.5 | 175 | 249 | 322 |
| 30 degrees..... | 291 | 292 | 299 | 310 | 306.5 | 401 | 431 |
| 45 degrees..... | 196 | 322 | 251 | 304 | 378 | 485 | 554 |
| 60 degrees..... | 182 | 212 | 240 | 323 | 343 | 481 | 556 |
| 75 degrees..... | 50 | 105 | 116 | 141 | 208 | 387 | 498 |
| 90 degrees..... | 50 | 90 | 25 | 25 | 37 | 56 | 66 |

It will be noted in table No. 1 that at the angle of 30 degrees below the horizontal the increase in

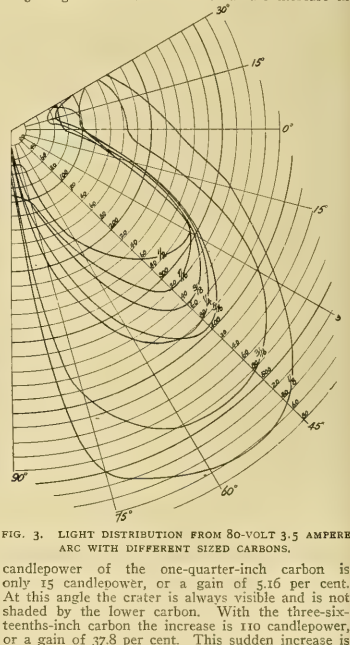



FIG. 3. LIGHT DISTRIBUTION FROM 80-VOLT 3.5 AMPERE ARC WITH DIFFERENT SIZED CARBONS.

candlepower of the one-quarter-inch carbon is only 15 candlepower, or a gain of 5.16 per cent. At this angle the crater is always visible and is not shaded by the lower carbon. With the three-sixteenths-inch carbon the increase is 110 candlepower, or a gain of 37.8 per cent. This sudden increase is probably due to the fact that the crater of the three-sixteenth-inch carbon covers the entire end of the positive carbon, and the carbon is maintained at a high state of incandescence for some distance back from the tip.

The mean lower hemispherical candlepower for the various sizes of carbons tested and their corresponding efficiencies are given in table No. 2.

Table No. 2.

Variation of Candlepower with Size of Carbon. 80 Volts—3.5 Amperes.

| Size of Carbon. | Arc Volts. | Arc Amps. | Arc Watts. | M. L. H. C. P. | Watts per M. L. H. C. P. |
|---|---|---|---|---|---|
| ⅛ inch..... | 80 | 3.5 | 280 | 417.6 | .672 |
| 3–16 inch... | 80 | 3.5 | 280 | 351.6 | .787 |
| ¼ inch..... | 80 | 3.5 | 280 | 255.4 | 1.095 |
| 5–16 inch... | 80 | 3.5 | 280 | 255.4 | 1.095 |
| ⅜ inch..... | 80 | 3.5 | 280 | 228.8 | 1.223 |
| 7–16 inch... | 80 | 3.5 | 280 | 211.4 | 1.325 |
| ½ inch..... | 80 | 3.5 | 280 | 182.6 | 1.533 |

The mere statement of increase in light obtained gives no appreciation of the quality of the light from the small carbon. When the crater covers the entire end it is evident that the wandering of the arc practically ceases and the light becomes more stable.

To illustrate this point 60 readings were taken at one-half minute intervals on the 45-degree angle below the horizontal. To show the relative variation, Fig. 4 was plotted, in which the variation of candlepower is shown in per cent. above and below the normal.

It should be borne in mind that these candlepower readings were taken with the light reflected

from both sides of the arc. If the candlepower had been measured from one side only the increase in the amount of fluctuation of light from the one-half inch carbon would have been increased in a much greater proportion than the increase in [illegible] tuation in the smaller size carbons.

In order to confirm the increase in efficiency to be obtained by burning five-sixteenths-inch carbons, two lamps were sent to the Electrical Testing Laboratories in New York and the following tests [illegible] made and results obtained:

The carbons submitted were of American make, two pairs being one-half inch in diameter, one pair five-sixteenths inch in diameter. These carbons were burned in two similar enclosed arc lamps. Both lamps were adjusted for 3.5 amperes, with 80 volts at the arc for the first test, and five amperes

FIG. 4. FLUCTUATION IN LUMINOUS INTENSITY FOR DIFFERENT SIZED CARBONS.

with 80 volts at the arc for the second test. All measurements were made when the current and voltage were at these values. In the results given in tables Nos. 3, 4 and 5 each value given is the mean of at least 20 readings. The same opalescent inner globe was used in all tests and placed in the same position in regard to the mirror system, so that light measured in all tests passed through the same portions of the globe. After the completion of one set of measurements the inner globe was removed, cleaned and placed in the same position on the second lamp. The photometric measurements were made by means of a Matthews arc-lamp photometer. The carbons were allowed to burn an hour before any measurements were taken. Distribution of light is shown in table No. 3.

TABLE No. 3.

Distribution of Luminous Intensity.

| Angle. | ½-inch Pencils. Average Amp. 5.0 | ½-inch Pencils. Average Amp. 3.5 | 5-16 inch Pencils. Average Ampere. 3.5 | 5-16 inch Pencils. Average Ampere. 5.0 |
|---|---|---|---|---|
| 60 deg. above | 84 | 37 | 62 | 121 |
| 45 deg. above | 147 | 76 | 122 | 240 |
| 30 deg. above | 104 | 125 | 143 | 301 |
| 15 deg. above | 200 | 100 | 184 | 328 |
| Horizontal. | 223 | 125 | 191 | 316 |
| 15 deg. below | 312 | 177 | 250 | 433 |
| 30 deg. below | 458 | 176 | 259 | 449 |
| 45 deg. below | 414 | 174 | 261 | 498 |
| 60 deg. below | 186 | 113 | 216 | 342 |
| 75 deg. below | 116 | 52 | 148 | 181 |

TABLE No. 4.

Mean Spherical Candlepower

| Size of Carbons. | Line Voltage. | Arc Voltage. | Current Amps. | Mean Sph. C. P. | Watts. | Terminal Watts per Mean Sph. C. P. | Arc Watts per Mean Sph. C. P. |
|---|---|---|---|---|---|---|---|
| ½ | 120 | 80 | 3.5 | 123 | 420 | 3.41 | 2.27 |
| 5-16 | 120 | 80 | 3.5 | 188 | 420 | 2.23 | 1.49 |
| ½ | 120 | 80 | 5.0 | 238 | 600 | 2.52 | 1.68 |
| 5-16 | 120 | 80 | 5.0 | 330 | 600 | 1.82 | 1.21 |

TABLE No. 5.

Mean Lower Hemispherical Candlepower.

| Size of Carbons. | Line Voltage. | Arc Voltage. | Current Amps. | Mean Sph. C. P. | Watts. | Terminal Watts per Mean Sph. C. P. | Arc Watts per Mean Sph. C. P. |
|---|---|---|---|---|---|---|---|
| ½ | 120 | 80 | 3.5 | 150 | 420 | 2.80 | 1.87 |
| 5-16 | 120 | 80 | 3.5 | 222 | 420 | 1.89 | 1.26 |
| ½ | 120 | 80 | 5.0 | 320 | 600 | 1.87 | 1.25 |
| 5-16 | 120 | 80 | 5.0 | 406 | 600 | 1.48 | [illegible] |

It will be noted that the increase in luminous intensity of the 3.5-ampere lamp with five-sixteenth-inch carbons over the one-half-inch carbon is 52.8 per cent.; the increase in candlepower of the five-ampere lamp with [illegible] bons over the [illegible] per cent.

The principal objection [illegible] the introduction of the [illegible] shorter life and the resultant increased cost of trimming. The increased cost [illegible] a small part of the [illegible] it need not be considered. [illegible] of the use of small carbons [illegible] previously considered, is the decrease in light due to the carbon deposit on the inner globe. Where 12-inch one-half-inch carbons are used and are allowed to burn throughout their entire life without cleaning the inner globe the light is decreased from 40 to 50 per cent., due to the deposit of carbon. This deposit varies in proportion to the size of carbon and is therefore an important factor in the selection of the size of carbon to be used.

It will be noted that while the title of this paper covers all types of arcs, only the direct-current enclosed arc with solid carbons has been considered. Sufficient time was not available to extend the tests to the alternating-current arc or cored carbons.

The principal objection which will be raised to the introduction of the smaller-sized carbons is the shorter life and the resultant increased cost of trimming. The increased cost of carbons is such a small part of the total cost of maintenance that it need not be considered. Another point in favor of the use of small carbons, which has not been previously considered, is the decrease in light due to the carbon deposit on the inner globe.

In the tests made by the Electrical Testing Laboratories in New York the increase in candlepower of the 3.5-ampere lamp, due to the five-sixteenths-inch carbons, was 52.8 per cent. In these measurements the inner globe was perfectly clean. Had the candlepower been measured at the end of the carbon life the carbon deposit on the inner bulb would have cut down the light with the one-half-inch carbons approximately 32 per cent., and at the end of the five-sixteenths-inch carbons approximately eight per cent., making the efficiency of the five-sixteenths-inch carbons 104 per cent. greater than the one-half-inch carbon at the end of its life, the average increase in candlepower being 73.7 per cent.

In tests of carbon consumption with variable sizes of carbon it was found that, although the total grams consumed remained practically the same for all sizes of carbon, the consumption of the lower carbon decreased and the consumption of the upper carbon increased as the size of the carbon diminished. These results, for the three-ampere 80-volt arc, are shown in table No. 6.

With the one-half-inch carbon the consumption of the lower carbon is 38.9 per cent. of the total consumption of the arc. In the one-eighth-inch carbon the consumption of the lower carbon is only 11.8 per cent. of the total.

TABLE No. 6.

Consumption of Lower Carbon Relative to the Total Carbon Consumption of a Three-ampere 80-volt Arc.

| Size. | Total Consumption. | Lower. | Lower in Per Cent. of Total. |
|---|---|---|---|
| 1-8 | .51 | .06 | 11.8 |
| 3-16 | .96 | .21 | 21.9 |
| 1-4 | .90 | .24 | 26.7 |
| 5-16 | .96 | .33 | 34.4 |
| ½ | .96 | .373 | 38.9 |

It was also noted that when burning a three-sixteenths inch carbon with six amperes and 80 volts at the arc a mushroom would be formed on the lower carbon. When this phenomenon took place the consumption of lower carbon ceased and its weight would increase with further burning. The entire consumption of carbon then being obtained from the upper carbon. Further decreasing the size of the carbon to one-eighth inch and maintaining the current at six amperes the mushroom increased in size, the arc smoked and a heavy deposit of soot was obtained on the carbons and the glass bulb; under this condition the upper carbon burned away very rapidly. With four amperes and 80 volts at the arc, no mushroom formation was obtained with the three-sixteenths-inch carbon, but a mushroom formation was obtained on the one-eighth-inch carbon. With three amperes a mushroom formation would occasionally be obtained with the one-eighth-inch carbon. Apparently the mushroom formation is obtained with a current density at which the lower carbon ceases to be consumed.

DISCUSSION.

W. D'A. Ryan, Lynn, Mass.: Speaking of the use of a carbon smaller than three-eighths-inch, Mr. Ryan said that this depends to a large degree upon how low it is possible to go in light. The question of the possibility of manufacturing the smaller carbons without the difficulty of crookedness also comes in. For those caring for long life more than efficiency, perhaps the half-inch carbon is better, but personally he thought the efficiency to be the consideration of greatest moment. In changing from the open to the enclosed arc much light has been sacrificed for long-burning qualities. There are four factors of prime importance—steadiness, distribution, color and efficiency. We [illegible] diffusion.

[illegible] smaller if desired.

Regarding the matter of distribution, he said that the ideal condition would be to have one large [illegible] impracticable because the brilliancy of the arc would be so great as to be blinding. One trouble with the modern arc is that the intrinsic brilliancy is too high. One thing which it is always preferable to do when possible is to place the arcs so high that they will not throw the light into the eyes on entering the building. This must be accompanied by [illegible] above than would naturally be there, and, also, by means for throwing the light out into the room. This is sometimes accomplished by what is known as a diffuser, which, though not artistic, does the work.

E. P. Warner of Chicago, following Mr. Ryan, said that he believed that there is room for considerable advance in the commercial adaptability of an arc light by a decrease in the size of the carbons. Lamps using three-eighths-inch carbons in which the current is carried to six and 6½ amperes have proved successful in practice. Mr. Warner asked Mr. Eastman whether any experiments had been made to ascertain whether the admission of air to the enclosing globe can be restricted more with the reduced carbon than with the carbons of ordinary diameters. Mr. Eastman answered that the air could not be restricted as much with the small-sized as with the large-sized carbons. The deposit on the interior of the globe is reduced in a small-carbon lamp in a greater proportion than the relative volume of the carbon.

Carl Wiler, Chicago: The universal practice now is to use one-half-inch carbons in five-ampere arc lamps and three-eighths-inch carbons in three-ampere arc lamps. A type of lamp has now come into use which is adjustable in current, and, as far as I am aware, a good many manufacturers are equipping these lamps with one-half-inch carbons. It seems to me that this type of lamp had better be equipped with three-eighths-inch carbons, so as to get a higher efficiency at the lower current. A one-half-inch carbon in a three-ampere lamp does not give good results, as the arc is too short and too unsteady, and the lamps are not adaptable for circuits in which the line voltage fluctuates considerably.

Last summer I had occasion to investigate the use of enclosed-arc carbons in Europe, and I found that as a rule the European manufacturers follow our practice. They equip enclosed-arc lamps of from four to seven amperes with half-inch carbons, and those of smaller current use three-eighths-inch carbons. In Europe they are now using arc lamps for currents from 1½ to three amperes. These arc lamps are designed to compete with the outdoor Nernst lamps. In order to get the high efficiency, they use extremely small carbons. These carbons are either three-sixteenths or one-eighth inch in diameter.

I have some data which give the mean hemispherical candlepowers of these lamps. A two-ampere lamp gives 115 candles, and three-ampere 248. This is equivalent to 1.90 watts per candle for a two-ampere lamp and 1.33 watts per candle for a three-ampere lamp, or a gain of 43 per cent. in efficiency. It is understood that the figures mentioned in Mr. Eastman's paper refer in particular to indoor lamps. Outdoor lamps are usually operated at a much higher current density in the carbons. While for indoor direct-current lamps at five amperes the watts per candle, at an average, are 2½, for outdoor lamps about two watts per candle is the rule. Mr. Eastman advocates the use of five-sixteenths carbons for three-ampere lamps; that is, a current density of 39 amperes per square inch. The European three-ampere lamps with three-sixteenths-inch carbons operate at a density of 110 amperes per square inch. In some special lamps which we have built for engraving and blue-printing we have even gone higher and operated the lamps with 150 amperes per square inch in the carbons. We believe we reach in these lamps an efficiency which compares favorably with the efficiency of the "flame-light" and the Bremer lamps.

T. J. Smith, Chicago: We (Chicago Edison Company) have used five-sixteenths-inch carbons and have perhaps 50 lamps at this time. I find in every case where we have changed from seven-sixteenths to five-sixteenths-inch carbons it has made a wonderful difference to customers. While carbons in the smaller size are not perfectly straight, they were sufficiently so to make operation satisfactory.

P. Junkersfeld, Chicago: There seems to be little

question that the carbon men can, if they are forced by demand, bring out satisfactory small carbons. Within the last year or two considerable business has been done in the way of importing carbons.

Van Rensselaer Lansingh, New York, showed a number of curves demonstrating the results of a number of tests made upon different combinations of globes in street arc lighting. The method of testing was first to put on a clear inner globe, then different outer globes. Afterward an opal inner globe was used with the same series of outer globes. In the curves of the first series it was noticed that a very high illumination was obtained at 15 feet away from the lamp-post and that this increased very rapidly with increasing distance. Using the opal globe a much better distribution was obtained, and at long distances (above 150 feet) the opal globe began to show up much stronger than the clear one.

J. G. B. Replogle, Chicago: We are educated too much to a glare and without it we are inclined to think we do not have good lighting. Mr. Replogle thought it time that the term candlepower be eliminated and illumination be made the factor to be considered. The real secret in good illumination is to have as much light as possible reflected from the object and not to have a glare thrown in the eyes.

## Chicago Traction Situation after the Election.

Now that the election is over and the voters of Chicago have emphatically declared for the policy advocated by the immediate municipal-ownership adherents, a glance at the present state of affairs in the complicated "traction situation" in Chicago should be interesting and of some value. Considering first the attitude of the City Council, it is of interest to note that the new body has been organized on a non-partisan basis. While the new mayor is a Democrat, the majority of the aldermen are Republicans; this, however, does not indicate the position of the council on the question of municipal ownership.

The new council committees do not differ materially from the list of last year except that there have been radical changes made in the local transportation committee, which was constituted to give municipal ownership a good working majority. Alderman Foreman was dropped as chairman and Alderman Werno put in his place, while the committee itself was changed, so that now it has a majority committed to municipal ownership. The members of the committee on local transportation are: Werno, chairman; Dever, Finn, Carey, Zimmer, Maypole, Raymer, Bradley, Foreman, Bennett, McCormick [Ward 21], Hunter, Young.

Taking up next the plans by which the new administration expects to bring about municipal ownership, the public utterances of the new executive may be cited. Mayor Edward F. Dunne said to a party of newspaper men that he was confident of giving to the people of Chicago the municipal ownership of their street railways by the end of his two-year term of office. "Dealing with a mayor of iron will and a friendly council," said he, "the traction interests will recognize the inevitable, take a fair price for their property, and give us municipal ownership in two years. This I expect in every probability. If they want a fight we will give it to them in and out of court."

The lines on which Mr. Dunne said he expects to bring about municipal ownership may be summed up as follows:

1. By the appointment of a commission of street-railroad experts and eminent lawyers, placing at the commission's head a $50,000 man, in merit if not in price, raising the money to pay him by public subscription, if need be.

2. By requiring this commission to consider the situation, the value and utility of all present street-car properties, and to arrive at a conclusion for general action, no radical move to be taken prior to the decision of this body.

3. By making, while these larger plans are in process of evolution, a direct experiment with the line upon which the franchise already has expired, the Chicago Passenger railway in Adams Street, securing the right to operate by moving Judge Grosscup to release the line from the injunction proceedings which now tie it up. Should the line be found large enough for trunk purposes the experiment will be declared a municipal-ownership success; should "twigs and branches" in the shape of unoccupied West Side streets be found necessary to make the property pay, tracks will be built in them and the verdict of success or failure be made to wait upon the further test.

4. By prosecuting what court actions his corporation counsel and other advisors decide will be fitting. In this category is the action against the City Railway, begun in Judge Mack's court by Mayor Harrison and the City Council recently. The federal-court situation of the Union Traction properties enters into the problem chiefly as an entanglement upon which the new mayor will bend his energies toward understanding before trying to solve.

As a first step toward securing for Chicago the city ownership of its street-railway lines Mayor Dunne has secured the services, in an advisory or consulting capacity, of the tramways manager of the city of Glasgow, Scotland, where the street railways are the property of the municipality and have been under municipal operation since 1894. It appears to be the idea of Mr. Dunne that the Glasgow system approaches the ideal and is the proper one for Chicago to copy. Following is the cablegram sent by Mr. Dunne to the lord provost of Scotland, and that gentleman's answer:

Chicago, April 5, 1905.—Lord Provost of Glasgow, Glasgow, Scotland: Chicago, as the first great city in America following the lead of Glasgow and other progressive European cities has declared for the municipalization of its street cars by 25,000 majority. Will you give the manager of your municipal tramways a vacation of 30 days to visit Chicago to confer with me? All expenses, first-class travel, hotel bills, etc., will be paid by me.

EDWARD F. DUNNE,
Mayor-elect of Chicago.

Lord Mayor of Chicago: The corporation of Glasgow unanimously and cordially agreed to the request of your municipality. Tramways manager unable to leave before May 10. Letter follows.

JOHN USE PRIMROSE, Lord Provost.

There are 70.34 miles of double-track line in Glasgow's street-railway system. The power is overhead electric, being supplied by the municipal plant. In October, 1898, the overhead system of electric traction was started on an isolated line of 2½ miles of double track. In January of the following year the work of installing trolleys throughout the system was started, and in 1901 all the horse cars had disappeared. The majority of Glasgow's cars are of the double-deck, single-truck pattern, for 55 passengers. Most of the cars have been built at the company's own works. A large number of the old horse cars were converted into electric vehicles. The system of graded fares, according to distance, is in use. In this respect, in the use of the cumbersome double-deck cars, in the scale of wages paid, in the headway and speed of cars and in many details of operation the Glasgow lines are inferior to what is considered good street-railway service in the United States.

John Young was the superintendent who put Glasgow's system in operation. Six months ago Charles T. Yerkes, the particular bete noire of Chicago municipal-ownership advocates, engaged Mr. Young to manage his London traction system. It is understood that James Dalrymple is Glasgow's present traction expert who is coming to Chicago. Mr. Dunne expects to raise by subscription the funds with which to defray the visitor's expenses. In a letter to Mr. Dunne of previous date it was stated by Mr. Dalrymple that the citizens of Glasgow and the surrounding districts are perfectly satisfied with the operation of the street railways by the municipality and that corruption in municipal affairs is unknown.

The following figures have been published as showing the result of municipal ownership of the street-railway lines in Glasgow:

| | 1902–1903. | 1903–1904. |
|---|---|---|
| Total amount of investment | $ 10,647,560 | $ 10,539,400 |
| Passengers carried | 177,179,549 | 188,962,610 |
| Number of car miles run | 14,008,750 | 16,291,082 |
| Total receipts | $1,281,760 | $3,625,255 |
| Working expenses | $1,521,775 | $1,784,100 |
| Percentage of expenses to receipts | 46 | 49 |
| Net receipts | $1,761,285 | $1,840,155 |
| Percentage of net receipts to capital | 16.54 | 17.46 |
| Interest charges and lease rentals | $330,655 | $ 321,870 |
| Repayment charges | $216,470 | $ 227,765 |
| Surplus | $1,214,160 | $1,290,510 |
| Provision for depreciation and reserve | $1,054,160 | $1,165,510 |
| Contribution to rate fund | $12,500 | $125,000 |
| Traffic receipts per car mile | 22.38c | 21.18c |
| Expense each mile run | 10.42c | 10.52c |
| Average fare each passenger | 1.76c | 1.82c |

Regardless of the decision of the citizens, by their votes, to grant no franchises to the street-railway companies, plans for the development and rehabilitation of the Chicago City Railway system are going on and nothing is permitted to interfere with the policy adopted just before the reorganization of the road. The company has engaged the engineering firm of Ford, Bacon & Davis to make a careful survey of its property and report as to what can be done to improve the service. The engineers have been given offices next to those of Vice-president Mitten at 2020 State Street, and the work is being done under his supervision.

Mr. Mitten's plan is to have for the consideration of his board of directors a comprehensive report showing what the shortcomings of the road are, what can be done to correct them, and, from the directors' point of view, what it will cost. His hope is to have it ready soon. The contract for the 200 new cars authorized by the directors has been let. They are to be made by the J. G. Brill Company of Philadelphia and delivered in June. The cars are to be of the new double-truck, cross-seat pattern, and will seat 44 passengers each. They are to be run on the Indiana Avenue and Sixty-third Street lines.

It is said that the City Railway and the Union Traction companies are working more closely together than at any other time. At the recent meeting of the receivers of the Union Traction Company, it is reported, details involving the merger of the two systems were discussed. The question of the Chicago Passenger Railway system and the desirability of submitting a bid for the rehabilitation of these lines was not brought up at the meeting of the receivers.

At a recent meeting of the retiring City Council Mayor Harrison obtained permission to close a contract with Bion J. Arnold for the preparation of the plans and drawings necessary for the advertisements the city has authorized for bids for the construction of a municipal street-car line covering the Chicago Passenger company property (operated by the Union Traction Company, and on which the franchises have expired) and as many more streets as are necessary to make a complete system. The streets covered by these expired grants are: Adams, from Clark to Desplaines; Desplaines, from Adams to Harrison; Harrison, from Desplaines to Western Avenue; Western Avenue, from Harrison to Twelfth. The advertisement contemplates the subsequent construction of lines in Halsted Street, from Harrison to the river, and in Ogden Avenue, from Harrison to Fortieth Avenue. Payment for the work is to be made either in Mueller law certificates or in cash from the proceeds of the certificates, one purpose of the advertisements being to bring on a test case in which the status of the certificates will be decided. Possession of the streets cannot be given until the United States Circuit Court has decided the injunction suit now pending before Judge Grosscup. Bids may also be submitted on the basis of a 20-year lease of the new lines to the successful bidder.

A suggestion has been made by certain of the traction interests that the value of the street-railway lines of Chicago be based on the earning capacity in case the city determines to take over the properties. Were this arrangement carried out on a five per cent. basis, on which terms it is understood the owners of the properties are willing to sell, it is figured that the city would pay $33,744,880 for the Chicago City Railway and $30,325,980 for the system of the Union Traction Company. The traction people give this price, it is said, as based on what the roads are able to earn after operating expenses and a reasonable charge for depreciation have been subtracted. The fixed charges of the Union Traction Company are not taken into consideration.

Alderman Foreman, chairman of local transportation committee under Mayor Harrison, said in regard to this proposition: "It is not difficult to see where this would lead to. In fact, the finish seems plain. If the companies are not now earning more than five per cent. the city cannot well hope to do more. The result would be a foreclosure, and the companies would come back to what they call their own again after a season of rest they sorely need."

On account of its economic bearing the decisive declaration for municipal ownership in Chicago has already assumed national importance. Railroad and financial men admitted in advance that this result in Chicago might have a vast influence on traction lines and other public utilities in other cities. The wide influence which Chicago exerts might, it is pointed out by financial writers, create a fad for municipal ownership, and this might develop into a similar fad for government ownership of railroads.

Judge Peter S. Grosscup of the United States Circuit Court in Chicago in speaking at a banquet given by the Pittsburg Traffic Club on April 7th said that he does not believe it practicable for Chicago, under the administration of Edward F. Dunne, to take over the ownership of the street railways. He said: "The city has not money enough to buy out the companies outright and obtain control. Besides, the franchises do not all expire at the same time, and there are legal disputes over those which it is asserted have expired. Chicago is divided into certain zones of franchise operation, if such a term can be used."

Judge Grosscup gave a brief history of the franchise situation in Chicago, and continued: "About the only plan Mayor Dunne can pursue in order to accomplish his purpose of municipal ownership and operation is to take over the ownership of the lines the franchises of which have expired, and let their operation to responsible parties until the revenues are sufficient for the city itself to undertake the operation.

"Personally, I do not believe in municipal or government ownership and operation of public-service corporations, but I am in favor of municipal and governmental control which shall exercise just and equitable supervision of rates and conditions of operation looking to the best interests of the public. Monopolies, properly controlled by the government, are almost necessities in certain commodities, such as gas, electric lighting, telephones, and all forms of transportation."

Judge Dunne became mayor of the city at 7:30 p. m. on April 10th. In his brief inaugural speech he said that should his chosen mission of introducing municipal ownership of the traction lines be accomplished within the next two years he would retire from the office of mayor at the end of one term.

Mayor Harrison, who at the same time closed a term of eight consecutive years as mayor, presented his final message to the council, embracing 24,000 words. In it he reiterates his belief in a settlement of the traction question along the lines of the tentative ordinance prepared by the former committee on local transportation. His ultimate view of municipal ownership begins with the plan for taking over the Adams Street line, bids for the equipment of which are now being advertised in the daily papers.

Already men having full authority from both traction companies are in Chicago and willing, it

is said, to negotiate with Mayor Dunne, being prepared, they say, to name prices for their properties. John J. Mitchell, who can speak to the Chicago City company, came back from New York on the same train on which Mayor Dunne returned from the East, where he went immediately after his election to speak before a large municipal ownership gathering. R. R. Govin, representing the Gotham interests which own the Union Traction Company, is also in town. Mr. Mitchell said that the company would go right ahead improving its property. The course of the board of directors in ordering the expenditure of $6,000,000 in improvements, exclusive of the new power house, will be followed the same as if the election had resulted differently.

## The New Morrison Storage Battery.

One of the chief difficulties encountered in the operation of storage batteries of the lead type has been the tendency of the active material to disintegrate and fall to the bottom of the cell, thus resulting not only in the deterioration but in the short-circuiting of the plates. This difficulty throughout the development of the storage battery has always confronted the designer as one of great importance. Many methods to eradicate the evil have been tried, such as treating the active material by various processes to harden it, applying it mechanically under great pressure, etc., which only result in the hardening of the material and making it the more impervious to the penetration of the electrolyte and

Fig. 1. View of Battery Element.

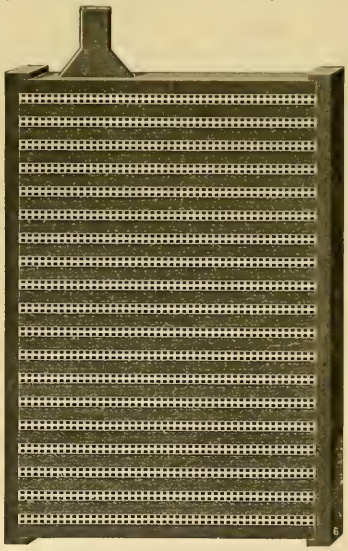


Fig. 2. Complete Electrode.

THE NEW MORRISON STORAGE BATTERY.

gases and without accomplishing the desired result.

It is evident, therefore, that if a method is devised in which a maximum quantity of active material is held in place at all times during the charge and discharge so that no part of it is dislodged and separated from its support and yet affords a free penetration of the electrolyte and gases, a great advance has been made in the production of a long-lived and efficient battery.

Illustrated herewith is a new storage-battery cell which is a product of the inventive genius of William Morrison of Chicago, who is well known as an inventor and who has heretofore done much research work in the storage-battery line. It is called the Morrison battery and the two strongest claims made for it are that the plate is so strong, electrically and mechanically, that no amount of electrical abuse or of vibration in traction service can dislodge even the slightest particle of its active material, and also that the weight efficiency, calculated conservatively from a series of tests made by Forée Bain, consulting engineer and patent expert of Chicago, is 14 watts per pound total weight. In point of mechanical strength the plates are so constructed that breakage or buckling is apparently impossible.

The following description of the battery will be made clear by inspection of the accompanying cuts: Fig. 1 is a view of a battery element, the cell of which has been partly broken away to disclose the electrodes and their connections. Fig. 2 is a side elevation of a complete electrode. Fig. 3 is a view showing a plate section (4) for holding the active material, also a similar solid section (5) which serves as the bottom of a completed plate.

Fig. 4 is a view [illegible] which are as follows: [illegible] porous retainer, (2) [illegible] top of the plate, (3) [illegible] active material and (4) [illegible] retaining ring. The ribs supporting [illegible] lined on, forming a solid rigid [illegible]

The method of assembling the different parts of the element is as follows: First, the solid bottom conducting support, shown at (5) in Fig. 3, is laid down, and upon this is placed an apertured or grooved retaining strip, shown at (3) in Fig. 4. Then a porous retainer is next laid upon the apertured retainer; then a plate section bearing the active material; then a porous retainer; then an apertured retainer, and so on, until the plate is completely built up and the top conducting support (1), Fig. 4, is put in place. When these various parts have been assembled the conducting side supports marked (6) in Fig. 2 are secured to the top and bottom conducting supports, thus securely binding and holding the various parts together and forming one complete electrode, as shown in Fig. 2. The plates may then be arranged in the cells in the usual manner.

From the foregoing description it is evident that an electrode or plate is provided for the battery in which the material to become active is applied to and within the receptacles or openings in the plate sections, the exposed faces of the active material being opposite to each other in the constructed plate. These faces or surfaces are completely covered or enclosed by means of the porous retainers, which are held firmly and securely in place against the faces of the material by the apertured or grooved retainers, which permit free circulation of the solution and the gases. The plate sections themselves firmly hold the porous retainers and the apertured retainer holding members between them, all of the plate sections in each complete electrode being electrically connected and of the same polarity.

It is clearly apparent that the electrode provides means whereby the active material is completely and entirely enclosed in each plate section. This is accomplished by means of the porous retainers and the metallic sides of the plate sections. The porous retainers cover the exposed surface of the active material adjacent to the opposite plate section in each electrode, and the metallic sides of the plate sections are opposite to the adjacent electrode in a complete battery element. The porous retainers permit free circulation of the gases

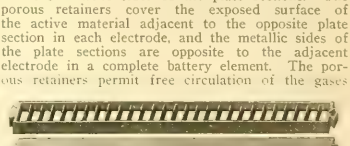


FIG. 3. PLATE AND SOLID SECTION OF MORRISON BATTERY ELECTRODE.

and solution to and from the active material and completely prevent any escape of the active material from its position within the plate sections. The apertured retainer holding members, provided as they are with a multiplicity of grooves, present openings directly for the passage of the solution and gases to and from the porous retainers to permit free circulation.

By this construction the porous retainers are held facing the opposite electrodes of the element. Thus [illegible] the surfaces of the active material and thus also [illegible] material.

The [illegible]

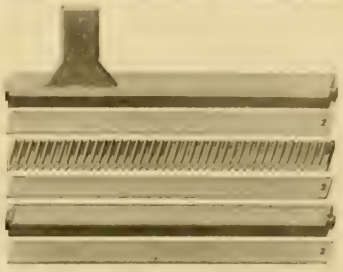


FIG. 4. DETAILS OF MORRISON BATTERY PLATE.

factured by the Universal Electric Storage Battery Company, a corporation organized under the laws of the state of Delaware and having offices in suite 1355 Railway Exchange, Chicago, and its factory at 472-478 Carroll Avenue in the same city. Mr. A. F. Callahan, the president of this company, was one of the vice-presidents of the United States Cast Iron Pipe and Foundry Company from the time of its formation until September 1, 1904. The secretary and treasurer is Mr. J. S. Burnet. Mr. William Morrison, the inventor of the Morrison battery, is acting as electrical engineer of the company, and the batteries are made under his direction.

## Proposals for Government Supplies.

Sealed proposals are being invited until May 4th for furnishing the various branches of the government of the District of Columbia with electrical supplies during the next fiscal year. Specifications and blank proposals will be furnished on application to the property clerk, District Building, Washington, D. C.

The Bureau of Supplies and Accounts, Navy Department, is inviting sealed proposals until April 25th for furnishing eastern navy yards with cable and electrical supplies (schedule 149). Blank proposals can be obtained at the navy pay office in New York. On May 9th the bureau will open bids for furnishing the Mare Island and Puget Sound navy yards with conduit lamp cord, clusters, transformers and miscellaneous electric supplies (schedule 156), and motors (schedule 157). Applications for proposals should designate the schedule desired. Blank proposals can be obtained on application to the navy pay offices in San Francisco and Seattle.

The public printer is inviting sealed proposals until May 4th for furnishing the government printing office with a quantity of electrical supplies required during the next fiscal year. Detailed information furnished on application to F. W. Palmer, public printer, Washington, D. C.

The Navy Department is also inviting sealed proposals until April 25th for furnishing and installing complete outfits of space-telegraph apparatus and fittings at stations to be erected by the government at Cape Henlopen, Del., Beaufort, N. C., Charleston, S. C., St. Augustine, Fla., Juniper Inlet, Fla., and at New Orleans. Applications for blank proposals, which should be addressed to the bureau or to the navy pay office in New York, should refer to schedule No. 160.

## Electric Decorations in a Church.

Colored electric lights were used by Rev. Father Pfaffhausen of St. Patrick's Church, St. Louis, for the recent 40-hour devotional exercises. Father Pfaffhausen is no mean electrician himself, and his work of decorating is described by the St. Louis Globe-Democrat: "The altar was adorned with 50 electric lights of a leafy green. The saint's statue and the altar stand in an alcove, which appears charmingly cavernous. In order that the altar of the Blessed Virgin, on the opposite side, may not be eclipsed, 50 pale-blue electric lights have been placed around it, and these give the heavenly hue to the delicate tracing of the statue and the marble decorations. The main altar is aglow with 72 golden lights, at the top of which the crucifix is outlined in lights of red, the color that represents the love of God."

## High-potential Laboratory for Insulator Testing.

In the manufacture of insulators for high-tension work an important part of the factory equipment is the high-potential testing apparatus which is necessary to the manufacturer that he may know that his product is up to the rigorous standards necessary in this class of construction. The Locke Insulator Manufacturing Company of Victor, N. Y., has a well-equipped laboratory for this purpose, and Fig. 1 of the accompanying illustrations shows the motor-generator set in this laboratory.

The laboratory is full fireproof construction, measuring 20 by 48 feet. The foundations and floor are of heavy concrete, designed to carry the heavy machinery without communicating vibrations to any delicate apparatus.

The electrical equipment includes a transformer with a guaranteed capacity of 200 kilowatts at 300,000 volts. It is of the core type, with approximately 10 by 10 inches cross-section of iron and has a primary wound for 1,100 volts, made up of four wires in parallel, allowing of some flexibility in connection. The secondary consists of approximately 42 miles of No. 26 wire, which, under oil, will carry 100 per cent. overload for considerable periods of time and at an overload potential of 400,000 volts this transformer is one of the most powerful electrical testing equipment in present use. The secondary winding is divided into two parts which can be connected in parallel or series, giving full loads at low potentials.

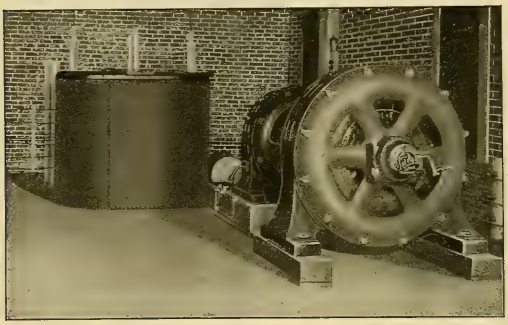


Fig. 1 High-potential Laboratory for Insulator Testing.

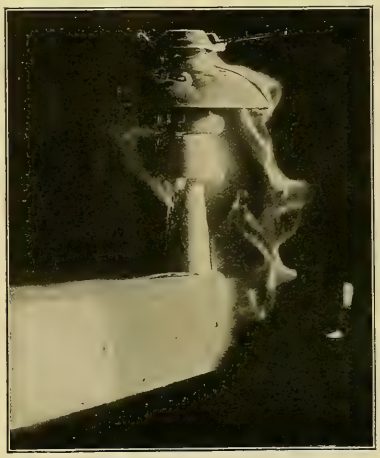


Fig. 2. Arcing Over an Insulator During a Rain Test at 40,000 Volts.

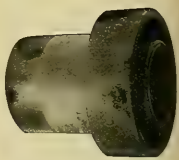


Fig. 3. Type of High-tension Wall Insulator.

HIGH-TENSION INSULATORS AND METHODS OF TESTING.

Current for the primary of the transformer is provided by a motor-generator set, power for which is obtained from a local transmission line. The set consists of a 440-volt, three-phase, 25-cycle, 200-kilowatt induction motor direct connected by flexible coupling to a 60-cycle, 1,100-volt, single-phase generator of similar capacity. For purposes of experimentation or for special commercial test requirements, higher or lower frequency is obtained by belt connection, using various sizes of pulleys.

The controlling switches for the generating set are located on a slate board placed so that the operator can overlook any test being carried on in the commercial testing room nearby. Ordinary controlling switches and rheostats, together with instruments, are located on this board.

To facilitate measurements of secondary voltages a spark gap, adjustable by hand, is provided with a scale calibrated to 480,000 volts, enabling a test of any material to be made. For more accurate measurement of the high voltages a secondary voltmeter has been installed. This instrument submerged in oil transfers its readings by means of a mirror to a calibrated scale, which is read by means of a telescope. The very small secondary currents are measured by means of an inclined-coil instrument inserted at the point of earth potential of the secondary winding.

Extending some distance from the laboratory is an experimental pole line of standard poles and cross-arms adapted to receive any style of pins or insulators, whose distances apart may be varied.

A simple form of dynamometer provides facilities for the testing of tensile and crushing strength of insulators and insulating materials. For the study of very refractory substances an electric furnace capable of absorbing 200 kilowatts is provided.

Fig. 2 illustrates an actual test being made on an insulator mounted on a metal pin and cross-arm. The arc, which is well shown in the picture, took place during a rain test at 40,000 volts. The precipitation was three-fourths inch a minute.

The company manufactures many creditable types of insulators, among which is a wall insulator (Fig. 3) for high-tension work. These wall insulators may be used in passing high-potential wires out of and into the power house or sub-station and can also be used as insulation in the wall between high-potential transformer compartments. When used in this way they serve as full fire protection between the compartments, presenting a great abundance of mechanical strength as well as efficient insulation.

## Interurban Belt Railway for Indianapolis.

A second belt railway, encircling Indianapolis far beyond the tracks of the Indianapolis Union Railway Company's belt line, is projected by the men back of the Indianapolis, New Castle and Toledo Electric Railway Company, which has recently been granted a 50-year franchise into Indianapolis over a private right-of-way. The proposed new belt railway, while constructed so that it may accommodate steam traffic, is intended for electric service and will, according to plans of the company, form a square about the city, each side of which will be about 12 miles long. That the project will be carried out is indicated by the fact that agents are buying a 100-foot right-of-way and surveys are being made. The object of the company in building the new belt is to afford additional factory sites.

A passenger service over the 48 miles of track is also contemplated, offering additional advantages to those who wish to maintain country homes, since the line would connect at some point with the nine interurban lines now entering Indianapolis. It is also suggested that under this arrangement the freight and express cars of all the interurban companies could be run into Indianapolis over the electric belt and over the private right-of-way to the terminal freight station which the company proposes to build on Tenth Street and Massachusetts Avenue.

The promoters of the belt are figuring on securing electric locomotives powerful enough to haul a train of 50 cars of loaded freight. The fact that D. M. Parry, W. E. Stevenson and Eli Marion, officers and directors of the Indianapolis, New Castle and Toledo Traction Company, are also directors in the Indianapolis Southern steam road, now building and controlled by the Illinois Central, has aroused the presumption that that system may be back of the project for a new belt line. While this is denied the officials of the Indianapolis Street Railway and Terminal Company are kept guessing as to what will be done and how far it may interfere with present terminal arrangements.

## Transportation Arrangements for Iowa Conventions.

The fifth annual convention of the Iowa Electrical Association will be held at the Hotel Julien, Dubuque, Iowa, on April 19th and 20th. The Iowa Association has extended an invitation to the members of the Illinois Electrical Association to meet with it at Dubuque as its guests, and a large attendance of central-station men from both states is confidently expected. The Iowa Street and Interurban Railway Association will hold its second convention at the same place on April 20th and 21st.

Chicago transportation arrangements for these conventions are in the hands of a committee consisting of Walter Goll (telephone, Central 216), W. H. Colman and P. R. Boole. This committee has selected as the most convenient the Chicago-Great Western train No. 1 from Chicago to Dubuque, leaving the Grand Central Station, Harrison Street and Fifth Avenue at 6:30 p. m., Tuesday, April 18th, and arriving at Dubuque at 11:10 p. m. Returning, trains leave Dubuque at 4:05 a. m., 9:05 a. m. and 4:05 p. m. daily, arriving at Chicago at 8:55 a. m., 1:40 p. m. and 9:30 p m, respectively. This train is made up of the finest equipment on the Great Western railway, is electrically lighted and carries several sleepers, a diner and a library-buffet car. Provided a sufficient number of passengers for Dubuque is guaranteed a round-trip rate of a single fare and one-third will be made, and a special car will be attached to the train for the use of the electrical men.

## Plans for International Railway Congress.

Included in the plans for the seventh session of the International Railway Congress to be held in Washington, D. C., beginning May 4th and ending May 13th, are the plans of Rear Admiral Chester, superintendent of the observatory in Washington, by which there will be sent out a series of telegraphic time signals to encircle the globe, beginning at 11:55 p. m., United States eastern time, on May 3d and ending at midnight. The signals may serve to afford fairly accurate determinations of longitude at any telegraph station on the continent.

Buildings for the congress have been erected on the public grounds between the monument and the White House and the official sanction of the government has been extended to the gathering in every possible way. The president expects to be gone in the West long enough to keep him away from Washington when the railway congress is being held. He therefore has designated Vice-president Fairbanks to preside at the reception at the White House, when delegates to the congress will be received in all due form. The vice-president on that occasion will receive the guests exactly as the president would do.

There are 1,491 delegates expected to attend the sessions; 748 are from non-English-speaking countries, 346 from English-speaking countries outside of America and 400 from America. The headquarters will be at the New Willard, the meetings to take place in the ballroom and in the audience room of the Interstate Commerce Commission.

One of the most important features of the coming congress will be the American railway-appliance exhibit. It is doubtful if ever before so many prominent men representing the railway-supply business of this country have united in an enterprise, and the exhibit of American equipment and supplies promises to be the largest on record.

## To Complete Indiana and Ohio Trolley Connection.

It is announced that work has been begun on a traction line that will give Indianapolis interurban electric connection with Toledo, Detroit, Cleveland, Dunkirk, N. Y., and Lake Erie towns. The new line, which will connect Lima and Findlay, Ohio, will be only 32 miles in length, but it will be of importance because it will fill up the missing link and complete the chain of tracks that will connect the Indiana roads with the lines along Lake Erie. The electric lines forming this system of roads are plainly shown in the map printed on page 249 of the April 1st issue of the Western Electrician.

F. D. Carpenter, general manager of the Western Ohio Railway Company, which is building the Lima-Findlay line, says that the company has begun work on the connection. When the new line is completed there will be an unbroken connection of electric roads from all points in Indiana now linked with Indianapolis, with all the principal Lake Erie cities, and as a line is in course of construction from Dunkirk to Buffalo, that city will ultimately be reached.

## Proposed Electrical Exhibitions in London and New York.

A meeting of representatives of central station companies, municipal electrical undertakings and manufacturers was held in London recently, at which the proposed electrical exhibition in London was discussed. There was long discussion as to the raising of promoting money, who should assume the direct control of the exhibition and as to returns. The chairman, W. H. Patchell, of the Charing Cross and Strand Electricity Supply corporation, thought that the Institution of Electrical Engineers had not done all it could in the matter. Many of the central-station companies had intended to give local exhibits, but said they would abandon their projects and support the larger one. A committee was elected composed of supply representatives, which is also to have a representative from the municipal works. The secretary of the National Electrical Manufacturers' Association was instructed to correspond with various authorities to ascertain what support they would give. It was announced that the exhibition will take place for about one month, beginning September 24th.

There is to be held at Madison Square Garden, New York city, from December 12 to 23, 1905, an electrical trade show, wherein is to be shown the many applications and developments of electrical engineering. There has not been an electrical exhibit in New York city since 1899, and on account of the many advances that have taken place, both in the construction and development of electrical appliances, it is felt that this show will provide an excellent opportunity for demonstrating to the trade, as well as to the general public, the advances in the different lines of applied electricity.

The construction of dynamos and motors of various types, the progress in telephony and telegraphy, motor speed control, and its use in machine-tool driving, and the various types of power-transmission engineering will be illustrated to the trade. Exhibit space will be sold, and selling privileges for electrical novelties and other specialties will be disposed of.

Applicants for space should state the number of square feet required for a creditable presentation of their display, and should mark upon the official diagram, which will be sent upon request, the spaces preferred, numbered in the order of their choice. It being the intention to make this exposition exclusively an electrical and mechanical exhibit, the management reserves the right to decline and prohibit any exhibit, exhibitor or proposed exhibitor or exhibits, not approved of by the management, and to permit only such matter and conduct as shall be approved of by the management. George F. Sever, Room 903, 26 Cortlandt Street, New York city, is director of exhibits. The show is under the management of the Exposition Company of America.

## Bids Received for Space-telegraph Outfits.

The Navy Department has received the following bids for furnishing and installing on board the U. S. S. Maryland one complete space-telegraph outfit and fittings: American De Forest Wireless Telegraph Company, $3,400; International Telegraph Construction Company, $2,225; W. W. Massie, $2,300 and $2,500; Marconi Wireless Telegraph Company of America, $11,851; National Electric Signaling Company, $6,250; Ostheimer Bros., $4,500, $5,400 $7050 and $5,250.

For furnishing two complete sets of space-telegraph apparatus and fittings to the New York navy yard, the following bids were received: American De Forest Wireless Telegraph Company, $5,900; International Telegraph Construction Company, $3,750; W. W. Massie, $4,500; Marconi Wireless Telegraph Company of America, $23,102; National Electric Signaling Company, $12,500; Ostheimer Bros., $8,000, $9,800, $13,100 and $9,500.

## Electric Signs.

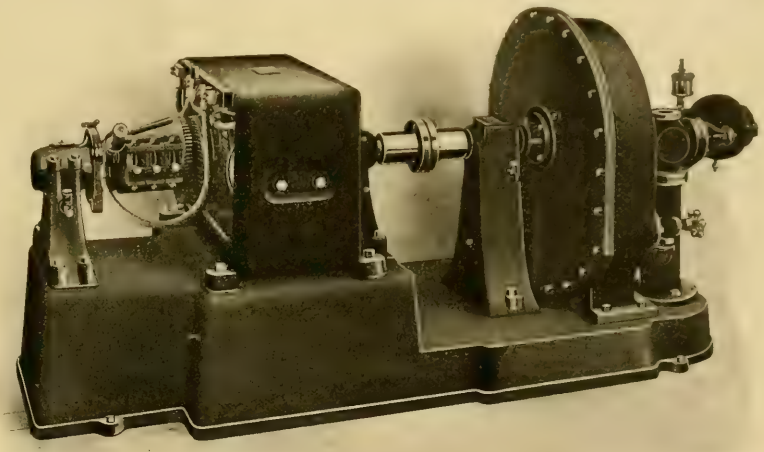
Before the Denver (Colo.) Ad Club recently George E. Turner said in regard to electric signs: "Outside of the big advertisers the people in the East are the same as they are in Denver. They want to get too many words in a given space. An electric sign, or any other sign, should be boiled down to the fewest possible words. There are two good ways of getting up an electric sign. One is to have it large and the letters plain and distinct; no flashing on and off, but to be quietly read with the fewest possible words you can use to keep yourself before the people. The other way is to have some 'moving' feature in your sign that the people will be interested in."

## Crocker-Wheeler-Terry Turbo-generating Set.

A 30-hot-power steam-turbine direct-current electric generating unit of novel design is shown in the accompanying illustration. The generator was designed and built by the Crocker Wheeler Company, Ampere, N. J., and the turbine is the invention of Edward C. Terry, Hartford, Conn.

In the generator it was not found necessary to introduce any special features to help out the commutation, which is well taken care of by the standard Crocker-Wheeler design. The ring that carries the plain carbon brushes is provided with means for shifting them, but it has been found entirely unnecessary to do so. The generator has carried loads ranging from zero to full load for many hours at a time with absolutely no sparking. Overloads of 50 and 75 per cent. have been carried for half an hour without sparking. A factor favorable to the sparkless commutation is the ample brush-contact surface.

A long commutator running at 2,500 revolutions a minute offers no small difficulties to the designer. This one is well within the safe limits, as was shown by running the completely wound armature at a speed of 4,500 revolutions a minute. A microscopic examination of numerous parts of the armature and commutator showed that the stresses in no part had approached the elastic limit.



CROCKER-WHEELER-TERRY TURBO-GENERATING SET.

In the turbine the force-producing rotation is directed tangentially to the periphery of the wheel, completely avoiding the end thrust present in all forms through which the steam passes parallel to the axis. The velocity of the moving steam is not all absorbed in a single impact or on a single bucket. The buckets on the wheel are confronted by similar stationary buckets or reversing chambers, which return the steam to the wheel after each rebounding until all of its effective energy has been abstracted. The wheel consists of two steel disks secured to a cast-steel hub on the shaft and bolted near their circumferences, where they clamp the forged buckets. The reversing chambers are fastened to the case and are grouped in sets of four, each group being supplied by a separate jet. These jets are each operated by a valve, thus enabling one or more jets to be closed, and those in use to be used to their full capacity, when less than full load is required of the turbine.

The buckets and reversing chambers are essentially flat semi-cylinders, with their open sides facing one another. They are formed of plates on the broad sides, with curved walls set at right angles to the plates. These chambers are arranged in a circular series, lapping one upon the other in the form of a series of steps—that is to say, the axes of the several buckets and chambers are set obliquely to the circumference of the wheel. Their open edges are inclined at a slight angle with the axis of the shaft, so that steam, after being reversed in each chamber, is delivered to the next succeeding bucket, this being repeated four times. Steam issuing from the jet passes to the bucket, and from the bucket to the reversing chamber, back again to the bucket, etc., until finally it escapes through a crescent-shaped hole in the central part of the reversing chamber. The wheel being in motion, this action does not take place between the same reversing chamber and the same bucket.

In this manner the problem is overcome which has always proved a difficult one in steam-turbine

## Allis-Chalmers to Build Electrical Machinery in Milwaukee.

The Allis-Chalmers Company decided on April 8th to begin immediately a [illegible] its Milwaukee works for the manufacture of electrical machinery of all kinds of the largest types and for the construction of steam turbines, hydraulic turbines and gas engines. Three large buildings will be erected and two of the existing buildings extended. The electrical department at Milwaukee will be operated in connection with the plant of the Bullock Electric Manufacturing Company of Cincinnati, which is owned by the Allis-Chalmers Company.

These unique facilities will provide in the West what will undoubtedly be one of the largest engineering establishments in the world, and the first to concentrate under one organization the design and construction of steam-electric units, turbine and reciprocating, on a large scale, as well as hydraulic-electric units. The importance of this, in connection with the immense development of electrical engineering which is everywhere taking place, is regarded as a matter of unusual interest.

## Two-cent Fares a Failure in England.

Sheffield, March 27.—Sheffield is faced with a traffic difficulty. It was one of the first of the cities to equip itself with an efficient system of electric trams, and the financial success of the undertaking made it rather lose its head. The City Council adopted the universal penny fare, and now finds that the handsome profits of former years have vanished. There are demands for further extensions of the tram system, but with penny fares the city cannot afford to carry the lines further into the suburbs. Any effort to increase the fares would result in the defeat of the party proposing such a necessary but unpopular change, and so the system is practically being strangled by the penny fare. As a way out of the difficulty it is now proposed to go in for motor omnibuses to supplement the trams, and parliamentary powers are being sought. Efforts are also being made to secure a motor service between Sheffield and Dronfield, a little town in North Derbyshire.—London Times.

## The Telephone in Canada.

The Bell Telephone Company proposes to do much work in Winnipeg this spring and summer. The underground wire system is to be extended and more aerial cables will be strung in sections where circumstances will not warrant underground construction. The growth of the telephone system has been so great in Winnipeg during the last two years that a larger building for the office and exchange became absolutely necessary.

The Stark Telephone Company has been awarded permission to install its plant in Toronto as an independent telephone service. A 21-year franchise is given with the city's right to purchase at any time after giving six months' notice, the value of the plant to be fixed by three arbitrators. A forfeit of $5,000 will be made if the company does not procure 3,000 subscribers within six months after the installation of the plant, and if the system is not in operation within 15 months after the awarding of the contract. No subscriber is to be entitled to a service if an aerial line has to be built a greater distance than 440 yards and an underground for more than 100 feet. The rates are not to be more than $36 for business telephones and $18 for residences. Desk telephones are not to be more than $5 extra. Electric current for power and lighting purposes is not to exceed 10 cents per kilowatt-hour, and a discount of 10 per cent. for all accounts paid before the 15th of the month must be furnished. The company is to pay to the city 2½ per cent. upon all revenues for the first five years and five per cent. for all following years during the term of its franchise. If the city does not take over the system at the end of the 21 years the company may continue to operate it under the conditions obtaining prior to the expiration of the franchise. At the annual meeting President John J. Dryden stated that a dividend of 3½ per cent. would be declared in July on the preference stock of the company for the first six months of the present year, being at the rate of seven per cent. per annum.

An American company has purchased the local telephone plant of Moose Jaw, N. W. T., and will immediately begin to enlarge the plant. It is proposed to make connections with the surrounding districts.

The Bell Telephone Company contemplates an important extension around Carberry, Man. F. C. Peterson, general superintendent, and C. B. Handcock, superintendent of construction, have been on the spot making all the necessary arrangements. It is proposed to extend the system through the Pleasant Point district to the south and to Petrel and Kerfoot on the north. The company also proposes to make Carberry a first-class station along with Winnipeg, Brandon and Portage la Prairie. The present service will be entirely modernized and long-distance telephones installed in place of the present instruments. A continuous day-and-night service will also be inaugurated. The company proposes to raise the annual rental of residence telephones from $15 to $18 and to reduce the office telephones from $25 to $24.

The local telephone company at Nanaimo, B. C., has been absorbed by the British Columbia Telephone Company, which will build a metallic system and make the plant first class in every respect, the negotiations having been completed between the local directors and William Farrell and Dr. Lefevre of Vancouver.

The Town Council of Dauphin, Man., has granted a 10-year franchise for a telephone exchange to R. J. Malcolm. The terms of the agreement are that the town has the option of purchase at the end of the 10 years, or the company the privilege of the extension of the franchise for an additional five years should the Town Council decide not to take it over. The rate for places of business is to be $2 a month and $1.50 a month for private residences. When 100 telephones are in use the company agrees to supply a 24-hour service. The plant has to be installed within six months' time.

The telephone line lately built and opened for business by the British Columbia Telephone Company is giving the greatest satisfaction. The route taken is via New Westminster, Bellingham and Washington and then across the islands to Puget Sound. Its length is 100 miles of land lines and 14½ miles of cable. The toll will be 50 cents per minute's conversation and 10 cents for every additional 15 seconds.

The Ontario Telephone Company has been incorporated, with a general authority to carry on a general telephone business and for other purposes. The head office is in Toronto. H.

## Southeastern Telephone Developments.

The Locust Telephone Company of Albemarle, N. C., has been chartered with $10,000 capital. J. D. Love and others are interested.

The annual financial report of the Gainesboro Telephone Company, with headquarters at Sparta, Tenn., has been issued and shows that there are now 2,000 miles of lines and 25 exchanges. The gross revenue was over $47,000 and the dividends were over $10,000. The company operates in Tennessee and Kentucky.

The Chuckatuck (Va.) Telephone Corporation has been chartered with $5,000 capital to operate telephone lines. W. A. Willis of Chuckatuck is secretary and general manager.

The People's Telephone Company of Berryville, Va., has been chartered with $5,000 capital. Charles H. Thurman is president.

The annual meeting of the Columbus (Ga.) Automatic Telephone Company was held recently and officers elected for the coming year as follows: President, T. E. Blanchard; secretary and treasurer, J. B. Huff; vice-president, J. T. Norman. L.

## Indiana Telephone Items.

The following telephone companies have been incorporated recently in Indiana: Chalmers Co-operative Telephone Company, Chalmers—capital stock, $4,000, J. F. Higgins, Wallace Nance and others; Farmers' Telephone Company, Birds Eye—capital stock, $1,010, George T. Veach, J. E. Harmon and others; Markleville Co-operative Telephone Company, Markleville—capital stock $10,000, Robert Collier, Robert Palmer and others; Farmers' Union Telephone Company, Uniontown.

The Majenica Telephone Company of Majenica has increased its capital from $3,000 to $10,000, and the Denver Co-operative Telephone Company of Denver, Miami County, from $3,000 to $10,000. Both companies propose extensions and improvements.

Davis B. Wilson and Daniel Deprez, two of the principal stockholders of the Mutual Telephone Company of Shelbyville, after inspecting a number of underground systems have announced that they have secured the services of an engineer to make plans and specifications for a similar plant in Shelbyville.

An electric-light wire fell across the wire of the Mutual Telephone Company on the 4th inst. and burned out 50 telephones.

Joseph Studebaker and others have purchased the Flora-Logansport telephone franchise and will, they say, build a line from Flora to Logansport.

Bert Hufford, a lineman employed by the American Telephone and Telegraph Company, was killed by a live wire while at work on the company's lines in Indianapolis.

A judgment for damages recovered by the Greenwood Telephone Company against Margaret Heck because she cut down the telephone poles that had been planted across her property in Greenwood was reversed by the Appellate Court on the 6th inst. The company, acting on the presumption that an alley extended, or would be extended, across her lot, planted poles thereon and Miss Heck promptly cut them down. The court held that there was a total lack of evidence that the land was a street or in process of condemnation for a street. S.

## Ohio Telephone Notes.

Druggists of Sandusky have agreed to use the service of the Sandusky Telephone Company again, the differences that arose some time ago having been settled.

At a meeting of the superintendents of the Central Union Telephone Company in Columbus a few days ago, arrangements for systems at Athens, Lancaster and Coshocton were discussed, as well as improvements at Columbus, Logan and Zanesville.

The Bell people have reduced their rates at Toledo from $72 to $54 for business telephones, and from $36 to $27 for residence telephones. The manager of the Home Telephone Company states that there will be no change of rates for his service, which were recently increased.

The Riverside Telephone Company of McConnellsville has been incorporated with a capital stock of $25,000 by John D. Erwin, W. A. Cosgrave, W. P. Scott and others.

The appeal of the Queen City Telephone Company of Cincinnati from the decision of the Circuit Court has been filed in the Supreme Court. The Circuit Court decided that the Probate Court did not have authority to grant the company a franchise, on the ground that it was not properly organized. The decision of the higher tribunal will be watched with considerable interest.

The Charleston Home Telephone Company of Charleston, W. Va., declared a quarterly dividend of one per cent. a few days ago. It was also decided to enlarge the switchboard to accommodate 500 more lines. The long-distance service between Columbus and Charleston will be in operation shortly, and several other long-distance lines in West Virginia have been arranged for. C.

## Telephone News from the Northwest.

The Mesaba Telephone Company will make a number of improvements to the local exchange at Virginia, Minn., including considerable new cable work.

The Deuel County Telephone Company has been formed at Toronto, S. D.

The Polk County Telephone Company of Crookston, Minn., has been incorporated with $50,000 capital stock.

The Hughes Company, which has just bought the local exchange at Bismarck, N. D., has bought a site and will erect a building for the central offices.

The Duluth Telephone Company will extend its system, making improvements, including a central-energy system in West Duluth, Old Superior and Virginia, Minn.

The Iowa Telephone Company is contemplating improvements in Burlington, Iowa, during the coming summer. A new exchange building is to be erected and wires put underground in the center of the city.

J. D. Ream has been elected president and M. S. Eddy secretary of the new co-operative telephone company which was recently organized at Custer, Neb., and which proposes to buy out the Central Telephone system.

The Emerson (Iowa) Telephone Company has been organized and will begin the construction of a line at once.

The judiciary committee of the Minnesota House of Representatives has decided that the bill which would compel telephone companies to make physical connections with each other to be unconstitutional. The bill contemplated making telephone companies common carriers.

The St. Paul City Council proposes to fix rates for the telephone systems operating in that city. The city attorney has given it as his opinion that such action would be strictly legal. R.

## Kansas Telephone Progress.

W. T. Reeser, who has had a franchise in Lawrence and has been trying to work up an automatic system, has sold to the Kansas City Home Telephone, which will install an Independent plant in Lawrence soon.

Rosehill, Pleasant Ridge, Franklin, Harmony and Durby are now all connected under the Durby and Rosehill Rural Telephone Company, with headquarters at Durby.

The Ninnescah Valley Mutual Telephone Company has made a contract with the Bell interests and, it is thought, has sold the entire system.

The Home Telephone and Electric Company of Conway Springs is figuring on building an Independent plant in Harper. H. O. Frantz is manager.

It is reported that the Bell interests have bought the long-distance line in Oklahoma and Kansas, between Medford and Wichita.

The Valley Mutual Telephone Company of Attica has signed a contract with the Bell people and will use all Bell instruments on its system. It has about 100 rural telephones.

The Coats and Southwestern Telephone Company of Coats has completed several rural lines. The company has close to 200 subscribers.

The Wayne Telephone Company has been organized and will build rural lines radiating from Wayne.

The Edwards County Telephone system has been organized to build rural lines out of Lewis, Kan.

The contract for building the exchange at Macksville, and rural system, has been let to R. W. Kemp & Co. of Wellington, Kan.

The Chickaskia Mutual Telephone Company of Milan has its system completed with over 100 telephones installed.

The Ransom Rural Telephone Company has been organized to build rural lines out of Ransom.

The Ness County Telephone Company's exchange at McCracken burned last week. The total loss of central equipment was about $1,200.

L. C. McCutcheon, manager of the Nevada Telephone Company of Nevada, Mo., has been granted a franchise to build and operate an Independent telephone exchange in Fort Scott. K.

## Constitution Adopted for National-Interstate Telephone Association.

It will be remembered that a joint committee of 10 members from the National Independent Telephone Association of America and the Interstate Independent Telephone Association was appointed and met on January 21st to bring about the consolidation of the two organizations. The committee at that time formulated a plan of reorganization and also adopted a written constitution, which has now been issued in printed form. The committee was invested with full power to act and the reorganization is entirely in its hands. Officers of the new association will, however, not be elected until the first annual meeting to be held in Chicago on June 21st to 23d.

## To Lower Long-distance Rates.

As a result of the meeting of the Central Illinois Independent Telephone Association at Peoria, Ill., a few days ago it is expected that a uniform toll rate will be adopted for long-distance calls by the Independent companies belonging to the association considerably less than those at present in force. E. R. Conklin of Aurora and J. W. Barrett of Pekin were appointed to arrange a schedule. The association elected the following-named officers: President, G. H. Glass of the Citizens' Telephone Company, Pekin; vice-president, C. A. Camp, Henry; secretary, Albert Schuler, Streator; treasurer, B. F. Wasson, Clinton.

## TELEPHONE MEN.

Paul Milburn of Miles City, Mont., has been promoted to take charge of the Rocky Mountain Bell Telephone Company's exchange at Helena, Mont.

Charles Avery, manager of the Minnesota Mutual Telephone Company and Maple Leaf Telephone Company of North Branch, Minn., has resigned and will engage in other business.

Horace Kendall has resigned the management of the Waupun, Wis., office of the Wisconsin Telephone Company and has gone to his old home, Hartford, Wis., where he takes the management of that office.

F. C. Fallows, local manager of the Northwestern Telephone Exchange Company at Winona, Minn., has been promoted to take charge of the Bell company's office at Phœnix, Ariz. He is succeeded in Winona by George Dodds of Minneapolis.

## GENERAL TELEPHONE NEWS.

The Bertrand (Neb.) Telephone Company has signed a 20 year contract with the Independent Telephone Company of Holdrege for the use of its lines.

The City Council of Logan, Utah, has granted to the Utah Independent Telephone Company a franchise for 50 years to operate its system in that city.

A contract for the establishment of a telephone system between Las Vegas and Bull Frog, Nev., has been made by the Bull Frog, Tonopah and Las Vegas Telephone Company.

The City Council of Mineral, Kan., recently bought out the local telephone exchange for the city. Some of the citizens complained and now the council offers to sell the exchange to a stock company of citizens.

E. M. Burgess, general superintendent of the Colorado Telephone Company at Denver; T. J. Matthews, manager of the company at Socorro, N. M., and J. E. Elder, local manager at Albuquerque, N. M., have made final plans for the building of a long-distance telephone line from Las Vegas to Socorro, a distance of 200 miles.

The Jones & Reynolds Telephone Company has been reorganized under the laws of the state of Michigan as the Cassopolis Telephone Company. The present officers are: President, M. L. Howell; vice-president, A. M. Armstrong; secretary-treasurer, William Jones; general manager, W. W. Reynolds. This company has been operating a telephone exchange at Cassopolis, Mich., for some time.

The United States Telephone Company is to have at Columbus, Ohio, one of the largest, if not the largest, toll boards ever built for an Independent company. The board is to be of the Stromberg-Carlson make and the equipment, already contracted for, is to consist of the following apparatus: Eleven toll sections, of two operators' positions each, to be arranged in one line; two recording sections, of two operators' positions, arranged in one line; one rural section; one pay station and heavy-users' toll section; one test board; one chief operator's desk; one switching section, and one messenger call box.

Mr. Herbert Laws Webb delivered the second of the series of lectures on "Telephony" before the Society of Arts in London on March 20th. The lecture was devoted to the subject of line plant and the special methods necessary in the construction of a telephone line as distinct from a telegraph line. One great difficulty arose out of the necessity of having to use so many circuits on one line. This meant great cost. In the trunk line between London and Glasgow 300 tons of copper are used, worth at the price of the metal alone about $100,000. Those who complained of the cost of using long trunk lines might reflect that in speaking between London and Glasgow they had the exclusive use of plant worth about $200,000.

## MANUFACTURERS AND DEALERS.

The International Telephone Manufacturing Company, Chicago, in order better to serve its increasing number of customers in Iowa, has placed Mr. J. C. Murray in charge of its business in that state, with headquarters at Des Moines.

The Swedish-American Telephone Company of Chicago has issued a large-sized circular entitled "Extra Special Features," wherein it endeavors to explain in a few brief but concise paragraphs the distinct advantages of its latest telephone products. It also points with pride to the fact that everything described in the circular was originated by itself.

The Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., reports having closed contracts for switchboards for Coal City, Iowa, Rochester, N. Y., Yorkshire, Ohio, Round Knob, Ill., Jefferson City, Tenn., Rockland, Ill., Ossian, Ind., Castalia, Iowa, Minot, N. D., Hemlock Lake, N. Y., Ames, Iowa, Kimball, Minn., Birmingham, Ala., and Des Moines, Iowa.

# CORRESPONDENCE.

## Great Britain.

London, March 29.—A legal [illegible] portance, in which the [illegible] of the Manchester corporation [illegible] just been concluded. The [illegible] nated in the action [illegible] The Manchester corporation [illegible] are laid upon the solid system, and it appears to have been the practice for many years to follow the policy of "burning out" in order to [illegible] short circuits. A firm having [illegible] close to one of the corporation cables had its [illegible] door broken down by a paving [illegible] which was upheaved in consequence of the burning out of a fault, and the fire and smoke which followed the explosion caused damage to the extent of nearly $3,500. The corporation did not deny that it was responsible for the damage, but the point which the courts had to decide was whether the plaintiffs had the right to recover damages, in view of the fact that the system of mains employed was working under Board of Trade rules. A sum for damages was agreed upon in the event of the verdict being against the corporation. The two main points submitted on behalf of plaintiff were: (1) Did the system of mains adopted by the defendants constitute a danger to persons having property adjacent to the mains? (2) Was the method of localizing faults by burning out or smoke tests a reasonable and proper method, having regard to the risk of fire? After a large amount of expert evidence had been heard, the jury decided against the corporation and awarded damages. The verdict was that the system of mains adopted constituted a nuisance, and that the corporation was guilty of negligence in its method of dealing with faults.

The bill which is seeking to incorporate a company to supply electrical power wholesale over the whole of London and its adjacent districts is still being considered by a committee of the House of Lords, and further interesting details have come to light since last week. I mentioned last week the size of the generating stations proposed and the extremely low cost per kilowatt. The estimated works costs per Board of Trade unit are: Wages, 0.0225d.; coal, 0.11d.; water, oil, etc., 0.0054d., and repairs, 0.017d., making a total works cost of 0.154d. All the promoters' estimates are based upon the condition of the undertaking in 1910, and by the estimated revenue it is seen that a sale of 137,500,000 units is anticipated at an average price of 0.7d. per unit. The generating stations will, if the bill passes into law, be constructed of iron, and the peculiarity of the scheme is that the promoters deny any possibility of competition with the existing electric supply authorities, their point being that, owing to the present congested condition of the sites of the existing generating stations, extension to any great extent is impossible, and that by undertaking the generation of energy on a scale of the magnitude proposed, the new company will be able to supply at a cheaper rate than it is at present generated. Naturally enough, all the existing authorities are up in arms against the bill, and evidence is now being given to refute, point by point, the contentions of the promoters. Much, also, is being made of the point of unfair competition, for, whereas, among other things, the existing companies are bound to sell to the local authorities 26 years hence without any compensation, the new company seeks exemption from such purchase.

The fund which was subscribed by the members of the Institution of Electrical Engineers for the benefit of the wife and children of the late secretary, Mr. W. G. McMillan, has now exceeded $10,000, the amount asked for. The trustees to administer the fund are Sir William Preece, K. C. B., and Mr. R. Kaye Gray.

The Metropolitan District Railway Company is now very busy making the final tests upon the Inner Circle in preparation for the inauguration of electric traction, which is expected to take place early in April.

Pending the report of the Royal Commission on London Traffic, the bills which have been deposited in Parliament this session seeking authorization to construct new tube railways in London, have been postponed. Whether the report will be issued in time to allow the bills to be considered this year is uncertain.

An attempt was made in the House of Commons last week to reject the proposal of the London County Council to spend money upon the wiring of premises for electric lights. As I have previously mentioned, it is felt very strongly that this is an extension of municipal trading quite beyond reason, and the wiring contractors are trying to get the bill rejected. At their first attempt, however, they were unsuccessful, but they will yet have three or four more opportunities, of which they will no doubt avail themselves.

The municipalities in Great Britain which own telephone systems are still loud in their denunciation of the agreement between the Postoffice and the National Telephone Company. The view taken is that the local authorities can deal with their own particular districts at cheaper subscriptions [illegible]

## New York.

[illegible] ious to secure a foothold in M[illegible] Street [illegible] build and operate three four-track lines from the Battery to Harlem. Chief Engineer G. S. Rice has also published [illegible] Twenty-third Street cross-town subway. Some progress is reported on the preparatory work of the old "Steinway" tunnel between Manhattan and Queens Borough.

Judge E. F. Dunne, mayor-elect of Chicago, was in New York city on Friday evening, when he addressed a large audience at Cooper Union. The judge's speech, of course, was upon the advantages of municipal ownership and was generally regarded as part of a new boom for the candidacy of W. R. Hearst for mayor of New York next November.

Some small boys of this city have discovered a way of obtaining unlimited pyrotechnic effects by dropping pieces of metal in the under-running electric-railway slots. The police have been prompt in suppressing this dangerous form of amusement.

Assemblyman Salomon has introduced a measure at Albany to compel the New York traction companies to convey passengers for a 2½-cent fare during rush hours and to grant unlimited transfer privileges.

It is probable that electric omnibuses will shortly be used exclusively for passenger traffic on Fifth Avenue in place of the antiquated horse stages. The Fifth Avenue Coach Company is planning to put on the service a number of vehicles driven by 40-horsepower motors.

One of the new incorporations of the week is the Williamsburg Power Company, which is capitalized at $150,000. The directors are F. P. Forster, James Foster and W. H. Robinson.

The Electric Amusement Company has been incorporated with a capital of $20,000. The directors are A. G. Raff, P. C. Schenk and T. L. Hickey.

W. D. Henry and associates have incorporated the Electric Cab Company with a capital of $1,000.

The Appellate Court has handed down a decision asserting that a traction company does not acquire any prescriptive right after 20 years' operation of a line to immunity from damages to adjoining property. D. W. W.

## Dominion of Canada.

Winnipeg, Man., April 8.—The Port Arthur Electric Railway Company is calling for tenders for its electric plant until May 5th. As the company proposes to install a new plant, it will offer for sale one 150-horsepower Wheelock compound condensing engine; one 80-horsepower boiler, shafting, pulleys and belting; one 500-volt 45-kilowatt railway generator; one 60-kilowatt 2,000-volt 125-cycle alternator, with all necessary switchboard and attachments. All can be inspected at the power house at Current River, Port Arthur. J. Mitchell is secretary of the company.

The Toronto Electric Railway Company has placed a million dollars' worth of insurance upon its cars with an American company known as the Duluth Mutual, taking it away from the Canadian companies, who have always carried it before. The Toronto insurance men wanted 1½ per cent. on a million-dollar risk, and the American company has taken it at one per cent. The value of the cars is given at $2,000,000.

The City Council of Winnipeg has appointed a sub-committee, consisting of Aldermen Fry and Gibson, to interview the Winnipeg Electric Street Railway Company and see upon what terms it will operate street cars in Winnipeg on Sundays.

The Board of Trade of Stratford, Ont., has taken the preliminary steps toward securing the charter for the radial railway from Stratford to Grand Bend. The name of the road has not yet been decided on. The Board of Trade also indorsed the Ottawa River railway.

The Cataract Power Company of Hamilton, Ont., is negotiating for the purchase of the Masonic Temple, which adjoins its station at the corner of James and Gore streets. If the company gets the property, it is said that it will build a big station to be used by all of the electric lines, including the Hamilton, Grimsby and Beamsville electric railway.

The Gas Equipment Company of Brandon, Man., has been incorporated to establish gas, water and electric plants, with a capital of $40,000.

The town of Oak Lake, Man., will establish an electric-light plant, with a supply of power, to be obtained from Leitch's Mill.

The citizens of Grand Forks, B. C., have decided by a large majority in favor of bonding the city for $30,000 for the purpose of installing an electric-light plant.

The City Council of Calgary has taken final action in establishing a plant of its own. There were three tenders for the electric-light plant, and R. S. Kelsch of Montreal was engaged to examine them and report as to which would be the most economical. This plant will be run as a municipal concern.

The Grand Trunk railway is arranging to light its station at St. Lambert with electric light, and a movement is on foot by the residents of that town to have all the streets illuminated in similar fashion. The council will take up the matter at an early date.

The Town Council of Indian Head, N. W. T., is preparing a by-law calling for $140,000, a large part of which will go toward the payment for an electric plant, to be installed in that town. John Galt, C. E., who was engaged to make a report on the matter, stated that there was 500,000 gallons of water available daily, which would have to be brought only seven miles from the Squirrel Hills, and that this would be ample to supply both the town and railway company. The money is to be raised by 50-year debentures. A sinking fund will be established. H.

## Ohio.

Cleveland, April 8.—Toledo business men are endeavoring to bring about some measure that will relieve the blockade of interurban traffic by the closing of the Cherry Street bridge against the cars. The city took this action some time ago and the cars are now compelled to stop outside of the city. As a result the receipts of some of the roads began to fall off. The Toledo merchants want the city to repair the bridge and allow the interurban cars to enter the city again as soon as possible.

The City Trust, Safe Deposit and Surety Company of Philadelphia a few days ago filed an attachment suit against A. E. Appleyard in the local courts at Springfield to recover $18,688.36, alleged to have been paid to him on two checks. A few days ago Appleyard's private car, costing $6,000, was sold at auction for $418, and a little later another car was chained to the track by Clark County officials, in order to satisfy a tax lien against the Springfield and Western for $1,200. This line extends from Medway to New Carlisle, and the officers want a receiver appointed. It is said that two offers have been made to purchase the Dayton, Springfield and Urbana line, one coming from Boston and the other from Buffalo. The habeas-corpus case brought in Boston by Appleyard to escape being taken to Buffalo in connection with the German Bank failure, has been continued to April 12th. He is making a hard fight against the order of extradition issued by Governor Douglas.

The Forde Light and Heating Company of Elyria has been incorporated with a capital stock of $50,000 by J. C. Hill, J. B. Seward, D. L. Warden and others.

Walter M. Ball of Bucyrus has announced that the Galion and Southern will be financed by eastern parties. It will extend from Bucyrus to Galion and other points.

A franchise has been asked at Bloomdale by the Bloomdale, Fostoria and North Baltimore Electric Railway Company, which is to be built from Fostoria to Deshler. S. P. Douglass of Toledo is at the head of the movement.

Thieves stole half a mile of trolley wire on the line of the Cleveland and Southwestern, near Lindale, a few nights ago. They cut out the wire and hauled it away while the line was not in operation, between midnight and 4:30 in the morning. The amount of wire taken was about 600 pounds.

Settlement of the last claim against the Everett-Moore syndicate is being arranged. This is with the Kellogg Switchboard and Supply Company and a misunderstanding has prevented settlement for some time. It is understood that the business of the syndicate will all be turned over to it by the bankers' committee when this matter is finally adjusted, which will be within a few days probably.

Employes of the traction companies entering Akron, Cuyahoga Falls, Kent, Barberton and other towns in that section have formed what is known as the Northeastern Ohio Trolley League, and the coming summer some exciting games of ball will be witnessed between the various teams.

The Toledo, Port Clinton and Lakeside Railway Company has purchased a tract of land on the lake shore just east of Port Clinton, on which the car barns and power house will be erected.

The commissioners of Sandusky County have declared the bond of Kerlin Bros. forfeited because they did not complete the line of the Tiffin, Port Clinton and Lakeside road within the time specified. The bond is for $3,000 and the prosecuting attorney has been instructed to collect on it.

The contract for equipping the power house of the Columbus, Delaware and Marion has been let to the General Electric Company, it is said. Steam turbines will be used for power.

Arrangements are being made to use water from the Whitewater River to generate electric current for factories and other purposes at Harrison.

An agreement has been reached between the officials of the Cleveland and Southwestern and the motormen and conductors, an advance in their wages being granted. The company now pays the same scale as the Cleveland city roads pay.. First-year men get 20 cents an hour; second-year men, 22, and for those in the company's employ more than three years, 23 cents. O. M. C.

## Indiana.

Indianapolis, April 8.—A new interurban electric railway, to connect Indianapolis with Danville, Greencastle and Brazil, Ind., is to be constructed immediately by the Indianapolis and Western Railway Company, to connect at Brazil with the Terre Haute Street Railway Company's line into Terre Haute. Contracts have been let to the firm of Townsend & Arnold, for the construction of the line, to be completed into Danville by July or August, and to Brazil on or before January 1, 1907. J. W. Chipman, general manager of the Indianapolis and Eastern Traction Company, is authority for the statement. The contracting firm is made up of George Townsend of Indianapolis, formerly of the firm of Townsend, Reed & Co., and Ward S. Arnold of Chicago, formerly with the General Electric Company and later with the Bullock company.

The Indianapolis and Martinsville Rapid Transit Company announces that it will extend its line from Martinsville to Bloomington this season. Paul H. White is superintendent of the line. The business men of Bloomington have encouraged the building of the extension in every way.

In the matter of electric-railway building in Indiana, at least in some localities, much depends upon the question of subsidies. A number of elections have been ordered, and a few are being held up by opposers, who have asked the courts to enjoin county commissioners from holding such elections. The opposition to subsidies is confined largely to Miami and Fulton counties, where rival companies have, in a measure, destroyed confidence. The taxpayers are demanding that the companies get down to business and build the roads, and then, when there is something visible, the aid will be voted. The commissioners of Miami County have ordered an election in Perry Township to vote $15,000 to the Winona Interurban Railway Company, which proposes to rebuild to Warsaw. As a result of the defeat of a subsidy in Bethlehem Township, Cass County, the Indianapolis, Logansport and South Bend Traction Company has changed its route so as to pass through Adams Township. Some time ago the company likewise retaliated against Plymouth and changed its route to pass through Bourbon instead, and obtained a subsidy of $21,000 from Bourbon.

The Dayton and Muncie Traction Company has been granted a 50-year franchise to enter the city of Muncie, and the promise is that cars will be running by May 15th. The line is now in operation to Selma, six miles east of Muncie.

The Evansville and Princeton Traction Company's officials announce that work on the new lines of the company through the "pocket" of Indiana, which will mean an expenditure of $500,000, will begin at once, the company having received franchises in Mount Vernon and other towns during the week.

The Indiana Union Traction Company has received a renewal of its franchise in Middletown, extending the time limit for operation to January 1, 1906, and continuing the life of the franchise for 99 years.

The Louisville and Southern Indiana Traction Company, to which have been granted subsidies aggregating $40,000 in Harrison County, has placed a surveying corps in the field for the extension of its lines from New Albany to Corydon, a distance of 26 miles. The traction company's line from Jeffersonville into Louisville, officials say, will be in operation by June 1st. Ground has been broken for the company's terminal station in Third Street, Louisville.

Albert Goshen of Chalmers reports that the difficulties which stood in the way of securing a certain route for the Chicago Air Line Traction Company, through the counties of White, Carroll and Clinton, have been adjusted and the right-of-way secured. It is now generally believed that the proposed air line between Indianapolis and Chicago will be built, and that actual work will be begun in a few weeks.

William S. Baugh of Lafayette will be at the head of the Lafayette and Southwestern Traction Company, which proposes to build from Lafayette into the Indiana coal fields near Covington. The capital stock will be $1,000,000. Arrangements have been made to use the right-of-way of the Fountain-Warren Traction Company.

After a year of litigation, a decree in the federal court at Indianapolis has been made ordering the sale of the Chicago and South Shore railroad for cash, without redemption, to satisfy the claim of the Royal Trust Company. The selling price is placed at $85,000.

Kerlin Brothers of Toledo, Ohio, have assumed control of the Montpelier (Ind.) electric-lighting plant. Municipal control has proved a failure. The enabling act of the last Legislature opened a way to dispose of it, and no time was lost in selling out to Kerlin Brothers.

The municipal lighting plant of Richmond turned $1,000 back into the city treasury for the month of March. This represents, it is said, the excess over running expenses. S. S.

## Michigan.

Detroit, April 8.—In a recent report to the Common Council made by the municipal lighting commission concerning the proposition of the manager of the Detroit Edison Company to pay $1,000 for the services of an expert to examine the municipal-lighting system the statement is made that the offer was not made in good faith and was for the purpose of discrediting the principle of municipal lighting. The commission further says that its accounts and vouchers, showing how the appropriations have been expended, are open to the public and that there is no secret in regard to the conducting of its business and that it believes that the offer of furnishing an expert by the Edison company to pass upon the question of whether the commission in its bookkeeping system charges off enough depreciation on the plant is uncalled for. The commission makes the recommendation that the Common Council make an appropriation in connection with the Edison company's offer to employ the city electrician of Chicago and a third electrician to investigate both the municipal electric-lighting plant and the Edison plant and ascertain whether or not the Edison company is charging too high a rate to the people.

The Comstock-Haigh-Walker Company, engineers and general railway contractors, have decided to remove their operating headquarters from Rochester to Detroit and will do their practical work from this city. W. A. Comstock, F. W. Walker and B. G. Broad, members of this firm, are now in London to examine and investigate electrical high-speed construction of cars and locomotives.

As stated in these columns last week, the differences between the Lansing Suburban Traction Company and the Boland interests at Jackson have been harmonized and as a result the organization of the Lansing and Jackson Interurban Electric Railway Company has been perfected, which puts off the threatened building of two competing lines between Lansing and Jackson. The new corporation is capitalized at $1,000,000 and the officers are: President, M. W. Mills, Port Huron; vice-president and treasurer, George G. Moore, Port Huron; secretary, James R. Elliott, Lansing; directors, David W. Mills, Cleveland, and W. A. Boland, New York, acting in conjunction with the above officers. It is understood that the whole of the stock will be controlled by the gentlemen named who, with the exception of Mr. Boland, will be holders of the Lansing Suburban Traction Company's property. Arrangements will be made with the Jackson and Lansing street railways for terminal facilities in each town.

The Union Trust Company of Detroit, as receiver of the City Savings Bank, has acquired complete control of the electric-lighting, power and sewer companies of Mackinac Island. It is understood that this has been done to save the expense of foreclosing the mortgage held by the bank. In order to enable the bondholders to realize on the property the Municipal Light and Power Company and the Municipal Sewer Company have been organized.

The report that the Detroit, Ypsilanti, Ann Arbor and Jackson electric railroad has increased its passenger rate between Ann Arbor and Jackson to two cents a mile has been denied, as it could not be done under the franchise. Fares have been raised from 55 cents to 60 cents. The rate was formerly one cent per mile.

It is reported that the Michigan Central railroad has acquired the franchises of the St. Joseph, South Bend and Southern electric railway and that that company will proceed to build from its present line to St. Joseph. The St. Joseph, South Bend and Southern railroad recently secured franchises in the city of Niles, and it is understood had acquired some right-of-way between St. Joseph and Niles.

Municipal lighting by the village of Hart has not proved an unqualified success and J. N. Cotton of that town now proposes to undertake the lighting of the town and has offered to take over the business with waterpower privileges. He proposes to obtain power by damning the Pere Marquette River on the northern county line, where it will be possible to obtain a fall of 28 feet with a dam 400 feet wide.

The assistant corporation counsel of Detroit has prepared some important information for the Common Council in regard to the Detroit United street-railway franchises for its fight against the street-railway company. It is understood that the street

railway lays claim to the perpetual rights on certain streets not included in the old City railway franchise. This claim covers streets now within the city limits which when built were in township territory, in which the rights are either perpetual or void. To bring an early solution of the right of municipal ownership in Detroit it is proposed to make an appropriation of $10,000 for building a test street car line, which will be the nucleus of the municipal ownership plan. This proposed movement will be the initial action on the part of the city of an apparently hard and long-fought battle between the street railway and the people of Detroit. The attitude of the people and also of the council is such, it is said, that something will be done along the lines of municipal ownership and possibly operation.

C. G. W.

## Rocky Mountain States.

Salt Lake City, April 5.—A contract for the machinery for the big Shoshone Falls (Idaho) power plant has been awarded in Chicago by I. M. Perrine, one of the incorporators of the company, and the equipment, including two dynamos, will arrive within a few weeks. It is stated by the management that the machinery will be installed and the plant in full operation early in June of this year. Bonds in the sum of $2,500,000 have been issued, and part of this amount will be expended in the construction of an electric railroad from the power plant to Twin Falls. While a capacity of 20,000 horsepower will be available at the plant, only 1,000 will be generated during the present year. The officers and directors of the company are: I. M. Perrine, president and general manager; H. B. McCullom, secretary; R. B. Faris, S. B. Hayes, H. L. Hollister and Walter Bruce.

Many protests from citizens have been filed with the City Council at Salt Lake City, Utah, against the granting of the application of the Utah Light and Railway Company for a 50-year extension of its numerous franchises. The committee of the council which has had the matter under consideration has decided upon a compromise report, recommending the extension of the various franchises so that all will expire in 50 years.

F. H. Fitch of Chicago has filed an amended application for a franchise for the construction of an electric railroad between Lewiston and Kendall, Idaho. The Citizens' Electric Company is the incorporation which will undertake the enterprise.

The Utility Power Company of Boise, Idaho, capitalized at $300,000, has filed articles of incorporation, with the purpose of establishing a power plant.

G.

## Pacific Slope.

San Francisco, April 7.—An electric power plant is to be erected on Hat Creek, Shasta County, by the Shasta Power Company, with San Francisco offices at 308 Schmiedel Building. Power will be supplied to operate the smelters and mining plants in the copper belt. Power and light will also be furnished to Redding and other nearby towns.

The Bay Counties Power Company has men at work remodeling the sub-station at Lincoln, Cal. Three large transformers are being installed and other electric machinery will be added.

Charles R. Miller and F. A. Keith, who have been in San Francisco recently, have closed a contract for the construction of an electric power-transmission plant to be located in California, just across the line from Nevada. The men who are to build the new power plant will be called upon to supply a copper transmission wire capable of carrying 22,000 volts. At the outset, 15 miles of poles will be placed, upon which to carry transmission wire.

A new stock company has been formed at Fallon, Nev., by R. L. Douglas, I. H. Kent, William Sanford and others, with a capital stock of $50,000, for the purpose of providing that town with electric lights and power.

Representatives of the Seattle-Bellingham Electric Company have been working in and around Marysville, Wash., recently securing the necessary right-of-way for the proposed electric railway from Seattle to Bellingham, Wash.

It is reported that an electric railway will soon be constructed, to be known as the San Jacinto-Hemet line, to connect San Jacinto, Hemet and Riverside, Cal. It is given out that a San Francisco syndicate will engineer the project. H. E. Huntington is thought to be largely interested. The total distance is 30 miles, and the cost of construction and equipment is estimated at $500,000.

The survey of the proposed scenic electric road to Lick Observatory on Mount Hamilton will be completed within two months, and propositions to build the road will then be entertained by the San Jose Exploitation Company of San Jose, Cal., which is doing the preliminary work. The cost of the road completed is estimated at between $500,000 and $750,000.

The San Luis Obispo Gas and Electric Company of San Luis Obispo, Cal., is advertising for bids for the construction of an electric plant, which is to be erected near the gas works in San Luis Obispo. The plant is to cost about $30,000.

A.

## PERSONAL.

F. Moody Boynton, inventor of what is known as the bicycle railway, formerly reputed to be worth $1,000,000 and prominent in financial circles, has filed a petition in bankruptcy, with liabilities of nearly $107,000 and no assets.

Frederick A. Huntress, general manager of the Worcester (Mass.) Consolidated Street Railway Company, has resigned to go to Brazil as general manager of the Rio Janeiro Light and Power Company, a corporation with New York and Canadian backing.

Charles G. Armstrong's name appears as that of the consulting engineer on a postal card relating to Representative Apgar's bill for New York state water supply. The card says: "Vote for this bill and kill the Ramapo steal." When in Chicago Mr. Armstrong was known as a mechanical and electrical engineer.

John Olmsted, aged 84, president of the Springfield (Mass.) Street Railway Company for 29 years, died on April 6th. He had been president also of the Northampton Street Railway Company and of the United Electric Light Company, and was interested in other manufacturing concerns and in banking institutions in Springfield.

Arthur Breese Davis, general manager of the Viaduct Manufacturing Company's works at Baltimore, Md., died on March 21st. He was born in Waterford, Conn., in 1831. He has been connected with the Viaduct company about 20 years. He was a descendant of Colonel Livingstone, the first lord of the Livingstone Manor on the Hudson River.

George B. Shepley, president of the Shepley & Field Contracting Company, Worcester, Mass., died on April 3d in his 45th year. He was at one time with the Thomson-Houston Company, had been engaged for many years as a builder of railroads and railways and previous to forming the company of which he was the head had been the superintendent of construction for the Worcester Consolidated Railway Company.

T. T. Lyman has been appointed to the position of general sales manager of the H. W. Johns-Manville Company of New York. The position will call for the installation of various comprehensive systems in connection with the work of the company's branches in Milwaukee, Chicago, St. Louis, Boston, Philadelphia, Pittsburg, Cleveland, New Orleans and San Francisco. Mr. Lyman has been connected with the company for many years, and from his management it is believed that an increased efficiency in trade relations will result.

Walter I. Barnes has assumed the position of assistant general manager of the Narragansett Electric Lighting Company of Providence, R. I. He has for six years past been general superintendent of the company, having been promoted to the new position upon the resignation of Arthur B. Lisle. Mr. Barnes became identified with the Narragansett Electric Lighting Company 13 years ago, and was in the office of the treasurer three years. Ten years ago he was transferred to the station on Elm Street, and had charge of the generating and distributing of current and the purchasing of supplies.

Lord Kelvin has been awarded the John Fritz medal for "cable telegraphy and other general scientific achievements." The medal was established on August 21, 1902, by the associates of John Fritz of Bethlehem, Pa., to perpetuate the memory of his achievements in industrial progress. The board which made the award to Lord Kelvin was composed of representatives from the American Society of Civil Engineers, American Institute of Mining Engineers, American Society of Mechanical Engineers and the American Institute of Electrical Engineers. Those on the board from the last named were Carl Hering, Charles P. Steinmetz, Charles F. Scott and Bion J. Arnold.

Edward B. Ellicott, city electrician of Chicago, and who was also chief electrician at the Louisiana Purchase Exposition, has been chosen to fill the responsible position of principal assistant engineer in charge of the hydro-electric development of the Sanitary District (Drainage Canal) of Chicago. A salary of $5,000 a year will be attached to the position. Mr. Ellicott is a native of New York state and is 39 years old. He came to Chicago in 1890 and was for several years superintendent of construction for the Western Electric Company, which position he left to become city electrician in June, 1897. As city electrician under Mayor Harrison Mr. Ellicott has won the respect of all by the able, straightforward and businesslike way in which he has conducted the affairs of the department of electricity of the city of Chicago.

## ELECTRIC LIGHTING.

Swift & Co. have ordered for their plant at Fort Worth, Texas, a 600-kilowatt alternating-current, revolving-field, 60-cycle Bullock generator—three-phase, 240 volts—with a normal speed of 120 revolutions a minute. This is for supplying both light and power.

[redacted] furnished the municipality.

[redacted] three vertical, cross-compound, non-condensing engines, one horizontal single engine, all direct connected to Bullock generators.

## ELECTRIC RAILWAYS.

The electric street railway of Manila, P. I., has been formally opened for traffic.

An electric railway in Chautauqua County, N. Y., is to be constructed by the newly incorporated Findley Lake and State Line Street Railway Company, which has a capital of $130,000. The directors are E. A. Austin of Cutting, N. Y.; F. R. Nichols of Titusville and I. A. Pond of Corry.

A syndicate, says the New York Times, has purchased the trolley line from Seneca Falls to Waterloo, N. Y. It is proposed to double-track this road and extend it to Auburn so that ultimately there will be a thorough connection with Syracuse and a complete trolley system right across the middle of the state.

The South Side Elevated Railway Company of Chicago has contracted for complete equipments for 70 cars, which includes 140 75-horsepower Westinghouse motors, and multiple-control apparatus. The motors are of special design and are in line with the re-equipment of this system. The cars will be operated in trains of five, three of which will be motor cars.

Officials of the Big Four railroad have authorized the statement that the road is considering a plan to equip as an electric line the branch between Alton and East Alton, Ill., as a means of reducing operating expenses. Trolley cars would be put on to handle all passengers, mail, baggage and express between Alton and East Alton, making connection with main-line trains.

The Public Service Company of New Jersey has recently received in Jersey City what is said to be the most elegantly appointed trolley touring car in the country. It is mostly of plate glass above the trucks, like an observation car. The car was built as an experiment and others will be built if the company's belief, that such a car will be much desired for long trips into the country, proves correct.

A change in the board of directors of the Philadelphia Rapid Transit Company has been made whereby Henry W. Phipps of Pittsburg succeeds Michael Murphy. It has been intimated that Mr. Phipps was added to the board in order successfully to float the recent $10,000,000 bond issue on the Market Street elevated and subway lines. It is said that local capital has not been very responsive to the securities of the Rapid Transit Company since it succeeded the Union Traction Company.

On June 30, 1904, the total mileage of electric railways in Illinois was 794. During the year the extensions of main lines and branches was no less than 221 miles. The capitalization is $82,964 a mile for surface roads and $1,981,148 a mile for elevated roads. The total income was $9,722,176 and net income $1,277,209. Of this $497,952 was paid in dividends—a decrease from the previous year of $214,419. Total assets are placed at $145,270,381. The number of paying passengers carried was 151,308,786 and the number of tons of freight hauled 660,530, showing increases of 16,145,416 passengers and 310,611 tons. The total number of cars in use was 2,283 and the amount of taxes paid $586,854.

The Little Rock and Hot Springs Electric Railway Company, which proposes to build a line to connect Little Rock and Hot Springs, Ark., has filed its charter at the first-named city, and Secretary George R. Brown of the Little Rock Board of Trade says that the proposed road will be about 60 miles long, and that the company is capitalized at $2,000,000. The directors have chosen the following-named officers: President, C. J. Kramer of Little Rock; first vice-president and general manager, L. Garrett of Springfield, Mo.; second vice-president, A. S. Blodgett of Springfield; secretary, J. C. Marshall; treasurer, G. W. Rogers of Little Rock. It is the intention of the company to build the line without a bond issue, and the stock will be owned principally by railway employes throughout the Southwest. Mr. Garrett has resigned his position as trainmaster with the Frisco to handle the enterprise.

## POWER TRANSMISSION.

The Assembly at Albany, N. Y., has received a favorable report on the bill of the Lockport, Ontario and Niagara Power Company. The bill, if passed, will allow the company to take 400,000 horsepower from Niagara Falls.

C. L. Adams, high-tension constructing engineer, has completed the Lilly Mill and Power Company's aluminum transmission line from Stice's Shoals on Broad River, to Lilly Mill, Shelby, N. C. The mill is equipped throughout with motors and has arc and incandescent lights.

The Merchants' Association of New York city has passed a strongly worded resolution protesting against any further diversion of the waters of the Niagara River for power purposes and calling for a constitutional amendment and a treaty with Great Britain in the matter. It has been estimated that the total commercial value of all the waterpower of the Falls is $50,000,000 per annum, the total horsepower being taken as 2,000,000.

The Shoshone Power Company has been incorporated at Salt Lake City, Utah, by John A. Bagley, Francis M. Lyman, Lyman R. Martineau and others, with a capital stock of $5,000,000. The company states that it will be prepared to bring into Salt Lake City 45,000 horsepower within two years, the transmission line being 200 miles in length, with branches to Albion, Oakley, Malad, Ida., and running into Utah, Cache Junction, Collinston, Brigham and other towns.

The Turner Falls Company of Turner Falls, Mass., is to erect a power plant consisting of four 1,000-kilowatt generator units, two 300-kilowatt generators for light loads, and one 75-kilowatt exciter generator, all waterwheel driven and direct connected to waterwheel shafts, together with one motor-driven exciter of 75 kilowatts. The generators will all be alternating current, three phase, 60 cycles and 2,300 volts. One 1,000-kilowatt Bullock generator and the 75-kilowatt exciter are to be installed soon.

The Harrisonburg (Va.) Electric Company has now in process of construction an interesting and complete power-transmission and lighting plant with sub-stations. The Allis-Chalmers Company is said to have the contract for the complete electrical equipment, which will include two 250-kilowatt Bullock generators and three 1,000-kilowatt Bullock transformers. This is a development of waterpower nine miles from the city of Harrisonburg, for which it will supply lighting at night and power to operate manufacturing enterprises by day.

## PUBLICATIONS.

The American Steel and Wire Company of Chicago has issued a pamphlet entitled "Sulphate of Iron in Agriculture," which contains some valuable information concerning the effect which this compound of iron has upon various agricultural products.

The new catalogue, No. 90, of the Wilmarth & Morman Company, Grand Rapids, Mich., devoted to the New Yankee drill grinder and other tools, is an illustration of a neatly designed trade publication. The grinders described are built on scientific principles and the catalogue gives some valuable information about drills in general and about the grinders in particular.

The "Soo Line" railroad issues "The Magic Color Book" for children, to illustrate "The Wonderful Trip that Soo Took." Incidentally, all interested in outdoor life will note the summering possibilities indicated by the little book. W. R. Callaway of Minneapolis is general passenger agent of this railroad, which is known officially as the Minneapolis, St. Paul and Sault Sainte Marie.

Condensers and self-induction apparatus are an important product of Queen & Co. of Philadelphia, makers of electrical-testing instruments. The company is distributing a new circular, No. 1204, on this apparatus, showing a wide variety of condensers from the most elaborate standards down to the small tin-case condensers used extensively in telephone work. Standards of self-induction, both fixed and variable types, are illustrated and described. Curves are also given showing the absorption and leakage in the company's standard condensers. Copies of this circular will be sent to those interested.

By no means an unimportant product of the Cutler-Hammer Manufacturing Company of Milwaukee is its Simplicity theater dimmers. To advertise these dimmers an uncommonly tasteful catalogue has just been issued. The front cover is of a deep rich tint and represents the stage of a theater. The pages of the catalogue are plentifully sprinkled with fine illustrations of various types of dimmer apparatus with their controlling devices. The first part of the reading matter is of a general nature and explains the development of dimmer apparatus to keep step with the ever-increasing demands of stage lighting until the latest types represent an installation of great importance to the design of an up-to-date theater.

An interesting publication on "Church Lighting by Electricity" has been issued by the Nernst Lamp Company of Pittsburg. Beautiful interior views of churches lighted in this manner are shown and also some ceiling clusters and mountings for the lamps adapting themselves especially to this class of service. These sentences are interesting: "Efficiency is not solely dependent upon the actual economy of the illuminant itself; the location of the light source and the general scheme of lighting have far more influence upon the ultimate efficiency or economy of the complete system than one would ordinarily suppose. No matter how efficient a lamp may be in current consumed per candlepower, if it is so placed that its rays shine into the eyes of the congregation, not only is discomfort occasioned by the resulting eyestrain, but the blinding effect produced on the retina causes surrounding objects to appear dimly lighted in comparison and leaves the impression of inadequate illumination."

## SOCIETIES AND SCHOOLS.

Homer E. Niesz of Chicago, editor of the Question Box for the next National Electric Light convention, has sent out a circular letter requesting the members not to falter in the good work of answering questions contained in the first list sent out. Accompanying the letter is the final list of questions. The list is a generous one, and now all that remains to complete the data sought is a good array of answers. All answers must be in by April 17th.

The number of students in attendance in the year 1904-05 at Purdue University was 1,528. Of the total enrollment, 410 were students of electrical engineering. The freshman class, by far the largest in the history of the university, numbered 461 students, the sophomore 389, junior 261, and senior 203; post-graduates 28, students of pharmacy and special students 81. The number of graduates in electrical engineering in June, 1904, was 56, and the number of electrical engineers to be graduated in June of this year will be 65.

A meeting of the National Conference on Standard Electrical Rules will be held on Friday, April 21st, at 55 Kilby Street, Boston. The purpose of this meeting is to consider the relations of this conference to the National Electrical Code, which is the result of the meeting of this conference held at New York city on March 18 and 19, 1896. William J. Hammer of New York is chairman of the conference and C. J. H. Woodbury of 45 Milk Street, Boston, is the secretary. The committee on code consists of Prof. Francis B. Crocker, chairman; Frank R. Ford, secretary; William H. Merrill, Jr., Alfred Stone, E. A. Fitzgerald, William Brophy, E. V. French and William J. Hammer.

## TELEGRAPH.

Members of the Chicago Chess and Checker Club and the Franklin Club of Philadelphia contested a 16-board chess match last week by telegraph.

The telegraph lines in Egypt belong to the state and have a total length of 2,600 miles, with 11,000 miles of wire. The tariff is 10 cents for the first eight words and one cent for each two succeeding words. The number of telegrams (excluding state messages) sent per annum is 1,600,000. The Eastern Telegraph Company has land lines across Egypt connecting with the cables to the east and west. Cable messages to New York cost 53½ cents a word and the time of transmission is 2½ hours.

## SPACE TELEGRAPHY.

It is announced that the space-telegraph conference, which was to have been held in Germany this year, has been abandoned for the present.

A dispatch from Glenwood Springs, Colo., says that during his hunting trip in Colorado President Roosevelt will keep in touch with his official staff at Glenwood by means of space telegraphy. Expert Signal Service Corps telegraph operators have been detailed to send and receive the president's messages. An army automobile will convey the field outfit as far as roads will permit, after which the machinery will be transferred to the backs of horses. At Glenwood, it is said, the sending station will be located on the summit of Lookout Mountain. The local lighting system will furnish current. The messages will be telephoned to and from the operator at the Hotel Colorado, where Secretary Loeb will be located.

## TRADE NEWS.

The Lyons Electric and Manufacturing Company of Lyons, Kan., has been incorporated with a capital stock of $10,000.

The Interstate Electric Company of New Orleans, La., has sold out its construction department to the Marks Electric Construction Company.

Exports from the United States to Cuba in the eight months ended with February, 1905, amounted to $24,126,687 and are larger than in the corresponding period of any fiscal year. Compared with the corresponding period of last year they show an increase of over 42 per cent., while the imports from Cuba in the same time show an increase of only 16 per cent. Electrical machinery exported to Cuba for the period mentioned amounted to $35,502 as compared with $26,623 for the eight months ended with February, 1904.

The Haberkorn Engine Company of Fort Wayne, Ind., announces that it has closed a contract with the Litchfield Foundry and Machine Company of Litchfield, Ill., granting to it the right to manufacture stationary engines with the Haberkorn patent valve and valve gear. Negotiations for an eastern lease may be closed soon.

Benjamin Kauffman, recently representative of the Thomas Acme Air Purifying System Company of Chicago and formerly Cincinnati and St. Louis representative of the Paul System Company, is now associated with Evans, Almirall & Co. as assistant western manager for the sale of its well-known system of hot-water heating for central-station and scattered buildings. His offices are at 1057 Monadnock Block, Chicago.

## BUSINESS.

It is reported that 28 firms belonging to the Union of Electrical Manufacturers, whose membership comprises over 200 European firms, recently met in convention at Munich, Germany, and organized a co-operative society for the purpose of purchasing supplies for their manufactures.

The Westinghouse Electric and Manufacturing Company of Pittsburg reports orders from the Alliance Machine Company and the Morgan Engineering Company, both of Alliance, Ohio, for a total of 120 crane motors, aggregating 2,000 horsepower. The Pennsylvania Railroad Company also contracted for 20 induction motors.

Now that the underwriters are requiring porcelain sockets in cellars, breweries, packing houses, tanneries, etc., Pass & Seymour of Solvay, N. Y., with pardonable satisfaction, announce to the trade that their porcelain fixture sockets are excelled by none. Another of their products in which they take pride is a temporary socket or receptacle for decorative wiring, which can be installed before or after the wires are in place.

The Lamb Electric Company of Grand Rapids, Mich., has on the market a line of electrically driven grinding and buffing machines adapted for direct-current work. The buffer is mounted on one end of the motor shaft and the grinder on the other. These machines are of one-fourth-horsepower size, and have been built to meet the demand for a portable machine of small size. Great torque is the cardinal point about these grinders, and smooth running is obtained through a careful balancing of the parts.

Toledo, Ohio, enjoys close relations with a large number of the best pole yards. A number of nearby stocks enables Toledo promptly to secure a good assortment. Advantage of this situation has been taken by the F. Bissell Company of Toledo and some good-sized sales are already recorded this spring. This work is cared for by the company's regular staff of salesmen and is particularly in charge of Mr. J. Alex. Navarre. Idaho cedar is also handled for customers requiring the larger sizes. Shipments are reported prompt and the market is strong, with a tendency to advance. The company suggests that prospective buyers make their wants known early and place their contracts to the best advantage.

The Mineral Point Zinc Company of Chicago has ordered from the Allis-Chalmers Company the complete power equipment for its remodeled plant at Depue, Ill., consisting of two heavy-duty cross-compound Reynolds-Corliss engines, each with cylinders 21 and 42 inches in diameter and a 48-inch stroke; two 500-kilowatt Bullock generators, to which the engines will be direct connected; one 100-kilowatt generator and 24 motors, ranging in size from 10 to 75 horsepower, with starters, rheostats, etc. The two power units are designed for operation at 90 revolutions a minute, the engines being especially constructed to meet that condition, but the smaller generator will develop a normal speed of 250 revolutions a minute.

The co-operative plan adopted by Hamilton Carhartt of Detroit is proving satisfactory, according to the Detroit papers. His plan takes in anyone who Detroit papers. His plan takes in anyone who works in his shop, anyone who sells his goods, or anyone who wears the overalls and jumpers his 800 employes make. The business being now at the zenith of its prosperity and incorporated, Mr. Carhartt thinks a stock company would give it an assurance of continuance at its present high average by increasing the circle of those directly interested. It is proof of Mr. Carhartt's belief in his plan that his very first step was to give free of cost to those of his employes who have rendered faithful service for a certain time thousands of dollars worth of non-assessable, paid-up preferred stock in the now incorporated company. Mr. Carhartt says that he does not wish to pose as a philanthropist, as he is simply carrying out a long-cherished idea, viz., to make those who have helped to build up this business partners in it and sharers of its profits.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued (United States Patent Office) April 4, 1905.*

786,257. Electric Heater and Method of Manufacturing Same. Murray C. Beebe, Pittsburg, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed May 14, 1900.

The method of constructing electric heaters consists in winding a conductor around a flexible core, applying plastic, refractory material to form a tubular, inclosing sheath, bending the article thus formed into the desired shape and then hardening the sheath.

786,316. Signal System for Railways. William G. Roome, Los Angeles, Cal. Application filed December 19, 1904.

A signaling system comprises a source of alternating current, a source of direct current, a common return for both currents, motor vehicles actuated by the alternating current, signaling devices actuated by the direct current and means controlled by the movement of the motor vehicle for controlling the movement of the signaling devices.

786,320. Means for Rectifying Alternating Currents. Robert Siegfried, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed February 12, 1904.

A commutator for rectifying alternating currents comprises two rings having spaced, peripheral contact plates, which project laterally in opposite directions from the respective rings and inwardly projecting supporting lugs.

786,323. Electric-motor Control. William D. Stivers, Jersey City, N. J., assignor to the C. W. Hunt Company, West New Brighton, N. Y. Application filed November 12, 1904.

Combined with a motor are a controller, means actuated by the controller to regulate the driving ahead of the motor and means actuated by the controller to impose the maximum dynamical braking resistance to the movement of the motor in backward rotation upon the movement of the controller to the first point for backward running. The resistance is gradually decreased to zero by further movement of the controller, and upon still further movement current is supplied for the backward rotation of the motor and for speed regulation.

786,325. Electrical Condenser. Percy H. Thomas, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed July 16, 1903.

An electric condenser comprises a series of non-conducting supporting plates, a series of conducting plates of less area having turned-over edges. Each of the latter is fastened to an adjacent non-conducting plate at its corners and spaced non-conducting strips have their ends fastened to the edges of the supporting plates.

786,338. Transformer Receptacle or Case. John H. Zimmermann, Newark, N. J., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed April 18, 1903.

A corrugated sheet-steel receptacle for encasing transformers is described.

786,366. Bearing for Electric Meters. Darragh de Lancey and Herbert M. Smith, Great Barrington, Mass., assignors to the Stanley Instrument Company, Great Barrington, Mass. Application filed September 17, 1903.

In a thrust bearing for electric measuring instruments are a bearing-surface holder having a depending tapered projection thereon with a groove at the enlarged end, a support for the holder having a tapered projection with a groove at the enlarged end and a spring engaging the grooves and holding the support and bearing-surface holder together.

786,368. Railway Signaling System. Joseph Lemire, Drummondville, Canada, assignor to the Automatic Railway Signal Company. Application filed October 3, 1904.

In a semaphore railway-signaling system adapted for connection with a railway track are several track contacts and semaphores, semaphore circuits, duplicate banks of electromagnets, circuit connection between contiguous banks, and means for successively locking some of the individual armatures of a single bank of the magnets. The electromagnets in their turn operate the releasing devices.

786,376. Electrogasoline Vehicle. Lars G. Nilson, New York, N. Y., assignor to the Fischer Motor Vehicle Company. Application filed May 15, 1902.

Associated with a storage battery are a motor and a dynamo connected in multiple, an engine driving the dynamo, and means, responsive to variations of current in the motor circuit, for controlling the output of current from the dynamo.

786,378. Mechanical Power Brake. Louis Pfingst, Boston, Mass., assignor to the Pfingst Electric Manufacturing Company, Kittery, Maine. Application filed January 23, 1904.

A brake spindle is surrounded by a hollow shaft of a revoluble electric motor armature. Clutch mechanism is interposed to transmit the revolving motion to the spindle for the application of car-brake mechanism. The electric brake, however, may be discontinued from service and the spindle revolved by hand at will.

786,379. Power Brake. Louis Pfingst, Boston, Mass., assignor to the Pfingst Electric Manufacturing Company, Kittery, Maine. Application filed July 13, 1904.

The apparatus embodies a rotating hand-power brake spindle or a shaft motor geared and capable of being rotated by a revoluble electric motor transmitting power through clutch-and-gear mechanism to apply the car brakes. Hand power and spindle mechanism independent of the motor mechanism, the motor shaft and spindle having independent alinement centers, is supplied.

786,396. Induction Coil. Charles Adams-Randall, New York, N. Y. Application filed December 22, 1903.

An induction coil has a single core in the form of a tube, which incloses a [illegible] coil and is [illegible] by a primary coil [illegible], the latter being [illegible] closed by a [illegible] secondary coil. The [illegible] approximately equal resistances.

786,401. Controller for Electric Motor. Thomas E. Barnum, Milwaukee, Wis., assignor to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Application filed January 31, 1902.

Controlling mechanism for a motor embraces a magnetically operated switch controlling the continuity of the motor circuit and means for preventing the operation of the switch when the movable element of the mechanism is in certain predetermined position. The means are rendered effective independently of the movable element to prevent the operation of the switch.

786,411. Magnetic Clutch or Speed Accelerator. Henry H. Cutler, Milwaukee, Wis., assignor to the Arnold Magnetic Clutch Company, Milwaukee, Wis. Application filed August 5, 1903.

Combined with a primary member having suitable energized windings is a secondary member adapted to be inductively influenced thereby to create torque-producing currents in the secondary member. Relative movement between the primary and secondary members results in the members being axially movable relatively. (See cut.)

NO. 786,411. —MAGNETIC CLUTCH.

NO. 786,595.—APPARATUS FOR TREATING CHLORINE.

786,412. Magnetic Clutch or Speed Accelerator. Henry H. Cutler, Milwaukee, Wis., assignor to the Arnold Magnetic Clutch Company, Milwaukee, Wis. Application filed March 2, 1904.

A primary member has suitable energizing windings, while the secondary member is adapted to be inductively influenced thereby and has special paths for the induced currents set up therein. The driven member is accelerated through the combined and continuously imposed effects of induction and friction.

786,413. Magnetic Clutch. Henry H. Cutler, Milwaukee, Wis., assignor to the Arnold Magnetic Clutch Company, Milwaukee, Wis. Application filed July 2, 1904.

A primary clutch member and a secondary clutch member are associated with a main winding for exerting a force to connect the primary and secondary members. There is a supplemental winding and means operated by the force of the supplemental winding when it is energized to counterbalance the frictional effect between the primary and secondary members by producing repulsion between the members during the operation of the clutch.

786,415. Alternating-current Power-transmitting Apparatus. Henry H. Cutler, Milwaukee, Wis., assignor to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Application filed October 22, 1903.

In an alternating-current-supply circuit are a motor and a suitable starting device. A magnetic clutch or accelerator is associated with the motor and a retaining magnet operates elements of the starting device. Suitable means convert the current from the supply circuit into a current suitable for the retaining magnet and the clutch.

786,416. Alternating-current Power-transmitting Apparatus. Henry H. Cutler, Milwaukee, Wis., assignor to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Application filed January 28, 1904.

In an alternating-current motor are a clutch whose torque-producing power normally decreases as the driven member is accelerated, controllable means for increasing the torque and an exciter operated by the motor for supplying current to the clutch.

786,417. Synchronous Motor with Clutch. Henry H. Cutler, Milwaukee, Wis., assignor to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Application filed January 22, 1904.

Means for improving the power factor and efficiency of a loaded synchronous alternating-current motor consist in combining with a rotating part of the motor and its load a provision for a slip between the motor and its load, whose torque gradually decreases as the speed of the load accelerates. Means are also provided for increasing the torque at will.

786,418. Method of Varying the Speed of the Load Driven by an Alternating-current Motor. Henry H. Cutler, Milwaukee, Wis., assignor to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Application filed [illegible] 1904.

[illegible]

786,41[illegible]. [illegible] Henry H. Cutler, Milwaukee, Wis., assignor to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Application filed [illegible] 14, 1904.

[illegible]

786,420. Electric Speed Accelerator. Henry H. Cutler, Milwaukee, Wis., assignor to the Arnold Magnetic Clutch Company, Milwaukee, Wis. Application filed April 22, 1901.

[illegible] film interposed between the [illegible].

786,421. System and Apparatus for Motor Control. Henry H. Cutler, Milwaukee, Wis., assignor to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Application filed March 31, 1902.

On a suitable base is mounted a large motor connected with the machinery to be operated. A clutch is mounted upon the shaft of the motor and a [illegible] is located beneath the shaft of the motor and connected with the clutch by gears. A small motor is located beneath the motor shaft and connected with it by means of intermediate gearing.

786,422. System of Controlling One or More Electric Motors. Henry H. Cutler, Milwaukee, Wis., assignor to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Application filed July 6, 1903.

Connected with a controlling circuit are a generator for supplying current, electromagnetic windings connected in the circuit, and wound to respond to variations in voltage, a series-parallel switch and means for varying at will the speed of the armature of the generator. Thus the voltage impressed upon the controlling circuit may be increased or decreased, as desired.

786,423. System for Controlling Electric Motors. Henry H. Cutler, Milwaukee, Wis., assignor to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Application filed July 6, 1903.

In a suitable supply circuit are a controlling circuit, electromagnetic windings arranged in the circuit and wound to respond to variations in voltage, suitable devices controlled by the windings and conductive means for transforming the voltage and polarity of the current delivered by the supply circuit to the controlling circuit.

786,424. System for Controlling Electric Motors. Henry H. Cutler, Milwaukee, Wis., assignor to the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. Application filed July 6, 1903.

Electromagnetic windings are connected in series with the controlling circuit. Means vary the polarity and strength of the current upon the controlling circuit to selectively actuate the electromagnetic windings, and the elements of an electric motor controller operated by the windings.

786,425. Magnetic Clutch or Speed Accelerator. Henry H. Cutler, Milwaukee, Wis., assignor to the Arnold Magnetic Clutch Company, Milwaukee, Wis. Application filed July 23, 1903.

The clutch consists of a primary member having a pair of suitable polar surfaces and a pair of energizing windings. A secondary member has a suitable part subjected to the inductive influence of the windings and means whereby the armature part may be caused to move in frictional contact with one of the polar surfaces, the inductive influence of the windings being adapted to reduce the frictional effect of the primary member upon the secondary member.

786,428. Selective Signaling System. Rudolph C. Deuben, Chicago, Ill., assignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed May 18, 1903.

The device embodies a shaft, a crank mounted thereon, a crank handle of insulating material, a cover plate of insulating material adapted to prevent direct electrical

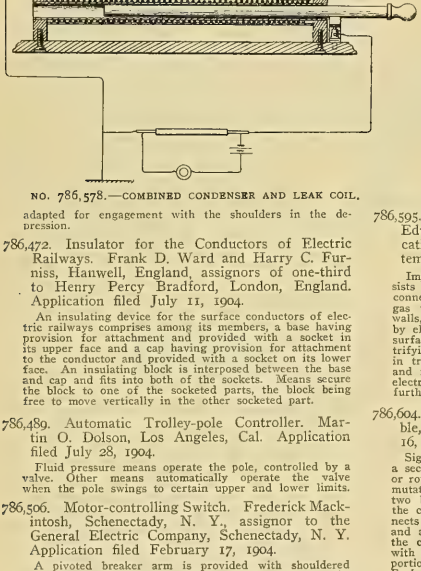
contact with the crank and means adapted to actuate the locking mechanism to stop the rotation of the switcharm upon reaching its normal position.

786,429. Selective Signaling System. Rudolph C. Deuben, Chicago, Ill., assignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed October 2, 1903.

The step-by-step mechanism of the system is actuated by a pawl and ratchet in turn operated by an electro-magnet.

786,444. Telephone Transmitter. William Kaisling, Chicago, Ill., assignor to the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y. Application filed November 23, 1903.

In a telephone transmitter are combined a front supporting frame, a rear inclosing frame engaging the supporting frame, an annular depression in the front face of the supporting frame, an inner and outer raised shoulder in the depression and interchangeable annular name plates provided with inner and outer shoulders adapted for engagement with the shoulders in the depression.



NO. 786,578.—COMBINED CONDENSER AND LEAK COIL.

786,472. Insulator for the Conductors of Electric Railways. Frank D. Ward and Harry C. Furniss, Hanwell, England, assignors of one-third to Henry Percy Bradford, London, England. Application filed July 11, 1904.

An insulating device for the surface conductors of electric railways comprises among its members, a base having provision for attachment and provided with a socket in its upper face and a cap having provision for attachment to the conductor and provided with a socket on its lower face. An insulating block is interposed between the base and cap and fits into both of the sockets. Means secure the block to one of the socketed parts, the block being free to move vertically in the other socketed part.

786,489. Automatic Trolley-pole Controller. Martin O. Dolson, Los Angeles, Cal. Application filed July 28, 1904.

Fluid pressure means operate the pole, controlled by a valve. Other means automatically operate the valve when the pole swings to certain upper and lower limits.

786,506. Motor-controlling Switch. Frederick Mackintosh, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 17, 1904.

A pivoted breaker arm is provided with shouldered projections and two coaxially pivoted arms engage the projections. Springs are arranged to exert tension on the arms and means adjust the relative tension of the springs. Means hold the arms from movement under the tension of the springs, and current-controlled means release the holding means.

786,518. Electrode for Arc Lamps and Method of Making Same. Isaiah L. Roberts, New York, N. Y. Application filed March 25, 1903.

The method of making arc-lamp electrodes consists in inserting in a metal tube a rod or cylinder of wire gauze, filling the interstices of the gauze with a pulverized refractory material, and binding together the particles of the refractory material.

786,523. Telephone-receiver Holder. Kate C. Seaman, New Orleans, La. Application filed April 9, 1904.

Mechanical details are set forth.

786,533. Electric Exercising Appliance. Wesley Sutton and Samuel Lord, Liverpool, and William S. Kerr, Southport, England. Application filed July 11, 1904.

A pair of handles are supplied with spiral springs having one end fixed and the other end attached to the handles. The springs are insulated from each other and a source of electricity is connected with the springs. The springs are also electrically connected with the handles.

786,542. Electric Heater. Louis P. Brown and Frank J. Holmes, Chicago, Ill. Application filed October 17, 1904.

An electric soldering iron has a heating coil wound in a double spiral, with its turns closer together near its loop than at a point more remote from the loop.

786,577. Thermoelectric Couple. Albert L. Marsh, Lake Bluff, Ill., assignor to William A. Spinks & Co., Chicago, Ill. Application filed October 18, 1904.

One element of a thermo-electric couple consists in whole or in part of cobalt and the other element of one of the metals of the chromium group.

786,578. Combined Condenser and Leak Coil. Walter W. Massie, Providence, R. I. Application filed June 18, 1904.

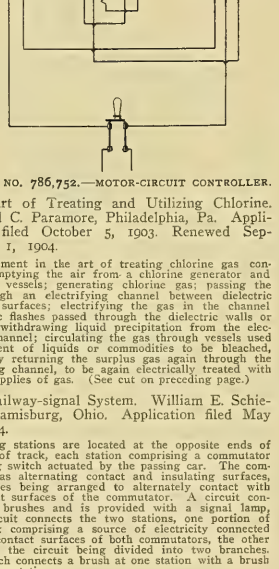
A combined condenser and leak coil for space-telegraph apparatus consists of a coil, one terminal of which is connected to the vertical wire and the other to ground, and a metal tube associated with the coil and having operative connection with the receiving instrument and ground. (See cut.)

786,588. Telephone Receiver. William J. Murdock, Boston, Mass. Application filed July 21, 1904.

A telephone receiver comprises a diaphragm-operating magnet, a continuous inner case section of insulating material having integral retaining portions engaged with the magnet and a continuous outer case section or shell closely conforming internally to the exterior of the inner section and secured to the latter and extending beyond both ends.

786,589. Circuit-closing and Breaking Device. William J. Murdock, Boston, Mass. Application filed July 21, 1904.

A push button is described.



NO. 786,752.—MOTOR-CIRCUIT CONTROLLER.

786,595. Art of Treating and Utilizing Chlorine. Edward C. Paramore, Philadelphia, Pa. Application filed October 5, 1903. Renewed September 1, 1904.

Improvement in the art of treating chlorine gas consists in emptying the air from a chlorine generator and connected vessels; generating chlorine gas; passing the gas through an electrifying channel between dielectric walls, or surfaces; electrifying the gas in the channel by electric flashes passed through the dielectric walls or surfaces; withdrawing liquid precipitation from the electrifying channel; circulating the gas through vessels used in treatment of liquids or commodities to be bleached, and finally returning the surplus gas again through the electrifying channel, to be again electrically treated with further supplies of gas. (See cut on preceding page.)

786,604. Railway-signal System. William E. Schieble, Miamisburg, Ohio. Application filed May 16, 1904.

Signaling stations are located at the opposite ends of a section of track, each station comprising a commutator or rotating switch actuated by the passing car. The commutator has alternate contact and insulating surfaces, two brushes being arranged to alternately contact with the contact surfaces of the commutator. A circuit connects the brushes and is provided with a signal lamp, and a circuit connects the two stations, one portion of the circuit comprising a source of electricity connected with the contact surfaces of both commutators, the other portion of the circuit being divided into two branches. Each branch connects a brush at one station with a brush at the other station.

786,628. Electric Indicator for Railways. Pierre I. Chandeysson, North Judson, Ind., assignor to Robert D. Peters, Knox, Ind. Application filed February 13, 1904.

A circuit, including indicators, is connected to a source of electricity. An armature and oppositely disposed contacts are connected to the indicators respectively. The other essentials are a magnet, a source of electricity connected thereto, a relay for closing the circuit between the magnet and its source of electricity, electrical connections between the relay and the rails, and a source of electricity connected to the rails.

786,635. System of Control for Electric Motors. Arthur C. Eastwood, Cleveland, Ohio. Application filed March 21, 1904.

Reversing mechanism for motors comprises a magnetically operated switch in the circuit, a conductor containing a resistance and arranged to short-circuit the motor armature, and a magnetically operated switch controlled by the motor and arranged to cut the conductor into or out of its circuit, the two switches being interdependent whereby the closure of either is prohibited while the other is closed.

786,688. Automatic Street-railway Switch. William S. Snyder and William H. Barker, Pittsburg, Pa. Application filed April 25, 1904.

Apparatus for operating street-railway switches consists of magnets having a moving core common to each and lever connections joining the core to switchbar. A contact bar, pivoted on a vertical axis, is arranged to swing in a horizontal plane and contact with the trolley pole of a moving car. Suitable conductors connect the arms with the magnets, and with the trolley wire.

786,690. Multiple-hood Insulator. Louis Steinberger, New York, N. Y. Application filed March 25, 1903.

A multiple-hood insulator comprises separate hoods of insulating material and a hollow metallic locking member for connecting them together, the hollow member being provided internally with a thread for securing it upon a pin support.

786,696. Signal Relay. Frederick K. Vreeland, Montclair, N. J., assignor to the Wireless Telegraph Exploitation Company, New York, N. Y. Application filed November 14, 1904.

A relay for variable currents embodies means responsive to the sudden variations which are superimposed upon a comparatively steady current and neglecting gradual variations in the current.

786,704. Galvanic Battery. David L. Winters, Chicago, Ill. Application filed January 3, 1905.

The galvanic battery here described combines a negative electrode and a frame for supporting it and has a pair of vertical and a pair of horizontal members connected together. A holder or clip forms a plate or bar of resilient material bent into an open-sided flat loop adapted to embrace the horizontal members of the frame. One end is fastened to one of the horizontal members and the other end is left free to constitute a spring tongue.

786,709. Illuminating Device. Charles F. Alline, Fort Dodge, Iowa, assignor to the Alline Photocycle Company, Washington, D. C. Application filed May 23, 1904.

Incandescent lamps are carried on arms mounted so as to revolve on a post or stands, the arms turning in various directions.

786,727. Apparatus for the Manufacture of Glowers for Electric Lamps. Francis M. F. Cazin, Hoboken, N. J. Application filed February 2, 1903.

A bell jar carries a receptacle and a holder is mounted in the receptacle and insulated therefrom and adapted to hold the prospective filaments. Means are provided for exhausting the bell jar.

786,752. Circuit-controlling Device for Motors. George W. Gilmore, Alliance, Ohio, assignor to the Alliance Machine Company, Alliance, Ohio. Application filed September 15, 1904.

In a system including an electric motor are a switch constructed to be operated thereby at predetermined times, a second switch in circuit with the motor, including means for short-circuiting the motor armature independently of supply mains and mechanism controlled by the first switch for causing operations of the second switch. (See cut.)

786,754. Telephonic Apparatus. Alfred Graham, Denmark Hill, England. Application filed January 11, 1904.

Telephonic apparatus comprises a casing having a speaking aperture in its periphery, a sound tube about which the casing is mounted to turn, a transmitter arranged within the casing to come opposite the aperture, a receiver located within the casing and having its diaphragm opposite a passage communicating with the sound tube and means for controlling the circuits of the transmitter and receiver by movement of the casing.

786,775. Electric Motor-controlling Apparatus. Lars G. Nilson, Hoboken, N. J., assignor to the Fisher Motor Vehicle Company. Original application filed May 15, 1902. Divided and this application filed June 10, 1904.

In the vehicle are an accumulator and a motor. A main and an auxiliary controller are provided, the main controller controlling the speed of the motor, and the auxiliary controller the charging of the accumulator. Means prevent the auxiliary controller from being operated to charge the accumulator except when the main controller is in a certain position.

786,776. Electroplating Apparatus. Louis Potthoff, Flushing, N. Y. Application filed December 1, 1904.

Combined with means for moving material through an electroplating solution are a conductor connected with the material, and means for automatically changing the point of connection between the material and the conductor.

## EXPIRING PATENTS.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on April 10, 1905:

380,752. Telephone Transmitter. I. H. Farnham, Malden, Mass.
380,757. System of Electrical Distribution. W. H. Hart, Brooklyn, and J. T. Goodfellow, Troy, N. Y.
380,765. Electric Accumulator. J. M. Pendleton, New Brighton, N. Y.
380,766. Electric Cut-out. C. G. Perkins and J. Tregoning, Hartford, Conn.
380,778. Municipal Telegraph Apparatus. J. C. Wilson, Boston, Mass.
380,779. Municipal Telegraph. J. C. Wilson, Boston, Mass.
380,780. Telephone and Signaling Circuit. J. C. Wilson, Boston, Mass.
380,817. Electrical Governor. F. E. Prichard, Cedar Falls, Iowa.
380,824. Electrical Speed Indicator. F. W. Schlepegrell, Charleston, S. C.
380,829. Electrical Hand-cord Tip. H. J. Swarts, Detroit, Mich.
380,845. System of Electrical Translation. R. Belfield, Pittsburg, Pa.
380,846. System of Electrical Translation. R. Belfield, Pittsburg, Pa.
380,855. Galvanic Battery. H. J. Brewer, New York, N. Y.
380,856. Galvanic Battery. H. J. Brewer, New York, N. Y.
380,879. Electric Locomotor. S. D. Field, Yonkers, N. Y.
380,880. Electric Locomotive. S. D. Field, Yonkers, N. Y.
380,905. Electrical Telephone. F. DuPont Marston, Philadelphia, Pa.
380,912. Burglar Alarm. W. E. McIntosh, Keene, N. H.
380,922. Electrode for Secondary Batteries. R. Packer, Chester, Pa.
380,942. Electric Indicator. O. B. Shallenberger, Rochester, Pa.
380,943. Volt Ammeter. O. B. Shallenberger, Rochester, Pa.
380,944. Electrical Pressure Indicator. O. B. Shallenberger, Rochester, Pa.
380,945. Adjustable Inductive Resistance. O. B. Shallenberger, Rochester, Pa.
380,946. Central Station for Alternate-current Systems of Electrical Distribution. O. B. Shallenberger, Rochester, Pa.
380,947. Electrical Indicator. O. B. Shallenberger, Rochester, Pa.
380,971. Construction of Stationary and Itinerant Electrical Batteries. J. T. Armstrong, London, England.
380,989. Secondary Battery. H. H. Carpenter, New York, N. Y.
381,048. Contact-making Device for Electric Railways. F. Wynne, Westminster, County of Middlesex, England.

# WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXVI.

## Antwerp's Street-railway System.

By C. Satrin.

The Compagnie Generale de Tramways d'Anvers was formed in 1900 to unify under one head the various small companies which up to that time had operated horse cars in the city of Antwerp (Belgium), and a little later it was decided to install an electric tramway system.

In view of the difficulty of installing a central station in the city, it was considered advisable to locate it in the suburbs and to use an alternating current of high frequency, transforming the current at sub-stations suitably located for the purpose.

The Merxem dock was finally chosen as the site, since coal could easily be conveyed there, being fed to large bins which have a capacity of from 500 to 600 tons. These bins are placed conveniently near the boiler room and by means of an endless screw and a chain of buckets which are operated by electric motors the coal is conveyed directly from them to the boilers.

The boiler room (Fig. 3), which is 16.5 meters wide and 50 meters long, contains six boilers of the Cornwall-Galloway type, with two fireboxes of 70 square meters heating surface. Room is also provided for four additional boilers. Each boiler is furnished with a Buttner superheater of 40 square meters heating surface, which raises the temperature of the steam to 350 or 360 degrees Fahrenheit. A Green economizer with two sets of 192 tubes each is also used in connection with the boilers.

Above the bins previously mentioned is located the pump room, which contains a Worthington pump having an output of 10,000 liters an hour, and two electric pumps of equal output, run by one-half-horsepower motors operating at a pressure of 110 volts.

Fig. 2 shows the engine room, which is 50 meters long and 20 meters wide. It has three 700-kilowatt generating sets, foundations having already been laid for a fourth group of the same capacity. Compound tandem engines of the Sulzer type, developing 1,000 horsepower each, are used, and under certain conditions they can develop 1,650 horsepower. The small cylinder has a diameter of 675 millimeters, the large cylinder 1,100 millimeters, while the stroke is 1,150 millimeters. At a test, one of these engines, developing 1,055 indicated horsepower, had a steam consumption, at 294 degrees, of 4.655 kilograms a horsepower hour, the average speed being 92 revolutions a minute.

The 700-kilowatt alternators are of the flywheel type and supply a three-phase current at a tension of 6,300 volts at the terminals, the frequency being 25 cycles a second. The field rings are of cast iron and are 3.35 meters in external diameter, their width being 0.5 meter. The 32 poles are each fastened by two bolts to the inner rim of the field ring and are connected in series. The flywheel weighs 11,500 kilograms.

Excitation is secured in three separate ways—by a Tudor storage battery of 60 elements, with a capacity of [illegible] which amounts to about 30 kilowatts, is utilized to [illegible] electric pumps, the coal carriers, etc.

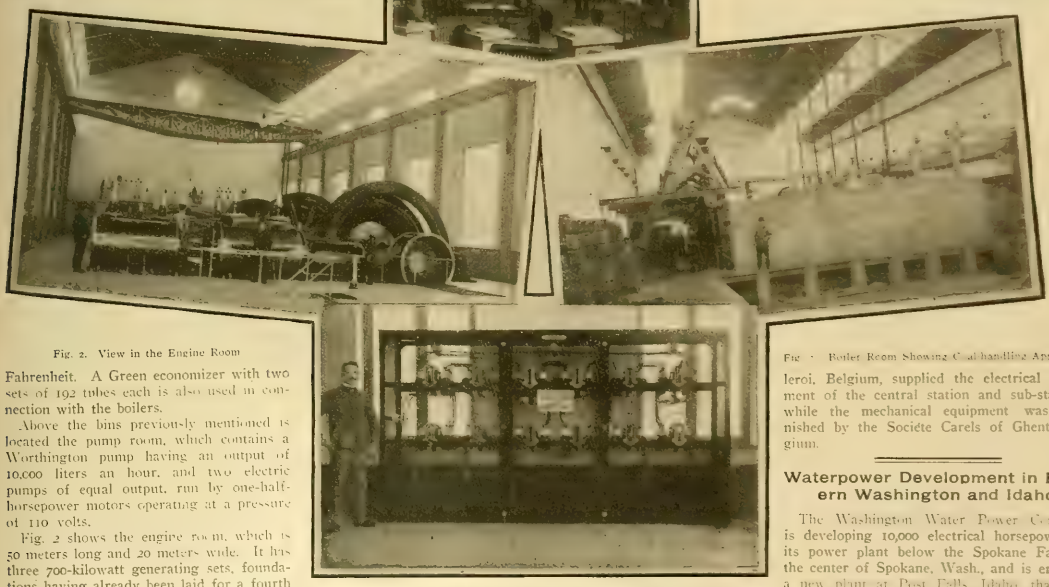


Fig. 2. View in the Engine Room.

Fig. 3. Boiler Room Showing Coal-handling Apparatus.



Fig. 1. Street Scene in Antwerp.

Fig. 4. High-tension Switchboard in Sub-station No. 1.

ANTWERP'S STREET-RAILWAY SYSTEM.

The switchboard is mounted on a gallery running the entire width of the room and contains the low-tension apparatus necessary for the control of the electrical installation, the high-tension apparatus being underground. It is made of white marble and consists of one movable panel and 14 fixed ones.

A traveling crane of 20 tons capacity completes the equipment of the engine room. A repair shop is also connected with the station, for use more especially in case of emergency.

Feeder cables conduct the current to two sub-stations, one at the Avenue du Commerce, the other at the Rue Baudewyns, located respectively four and seven kilometers from the central station. The four feeder cables which enter sub-station No. 1 are conducted to a high-tension switchboard (Fig. 4), from which two of the cables are led to sub-station No. 2. Referring to Fig. 4, it [illegible] for low-tension, are used to distribute the current, [illegible] depending on the connections. The converters have [illegible] change the alternating current at 340 volts to a direct current of 1,000 amperes at 550 volts. They are six-pole machines and have a speed of 500 revolutions a minute.

Two cables lead from sub-station No. 1 to the sub-station located on the Rue Baudewyns, which is equipped in the same way except for the storage batteries, which have a capacity of only 800 ampere-hours with a discharge rate of three hours.

The current is distributed from these two sub-stations by feeders placed underground in conduits. There is in all nearly 52 kilometers of double track and 170 cars are in operation. Fig. 1 is a street scene in Antwerp showing several of the cars.

The Societe Electricite et Hydraulique of Charleroi, Belgium, supplied the electrical equipment of the central station and sub-stations, while the mechanical equipment was furnished by the Societe Carels of Ghent, Belgium.

## Waterpower Development in Eastern Washington and Idaho.

The Washington Water Power Company is developing 10,000 electrical horsepower at its power plant below the Spokane Falls in the center of Spokane, Wash., and is erecting a new plant at Post Falls, Idaho, that will furnish 18,000 horsepower. Still the demand for power is increasing, and by the time the Post Falls plant is completed the company will begin to figure upon an increase of its facilities in Spokane.

According to the Portland (Ore.) Telegram, the company itself uses about 3,000 horsepower in the operation of its street-car lines in Spokane. In addition, it lights a large number of homes of the city, the city thoroughfares, many of the surrounding towns, and furnishes power to many factories in the city: to the mills and mines of the Cœur d'Alenes, around Wallace, Gem, Wardner and Burke in Idaho, over 160 miles away, it furnishes 3,000 horsepower at $50 a horsepower a year. When its own Medical Lake line is completed in July that will require about 600 horsepower more.

In addition, the company has just closed a big contract with the Graves syndicate of electric roads to furnish power at $20 per horsepower a year for 10 years. The Spokane Traction Company has contracted for a minimum of 800 horsepower and a maximum of 1,200 horsepower. The Cœur d'Alene and Spokane electric line takes a minimum of 500 horsepower and a maximum of 1,000 horsepower.

## Steinmetz's Control of Compensated Railway Motors.

In the operation of single-phase railways, one of the problems demanding solution is the operation of the cars within the limits of cities where the utilization of the high-tension alternating current is impracticable. Certain types of motors have been evolved which are able to operate on either alternating or direct current. What is known as the "compensated" motor is one of these. For the control of railway motors of this class Charles P. Steinmetz of Schenectady, N. Y., recently invented a system of control upon which he was awarded a patent (No. 784,814) March 14, 1905, the assignee being the General Electric Company.

Fig. 1 shows diagrammatically a control system arranged in accordance with the invention; Fig. 2 shows a diagram of connections for the control of a single motor, and Figs. 3 and 4 show the connections for four motors produced by the control system of Fig. 1.

Four of the compensated motors are shown in Fig. 1, indicated by (M') (M²) (M³) and (M⁴). The motor (M') is provided with three sets of windings, the armature winding indicated by (A'), a winding called the "field" indicated by (F'F') and a winding called the "compensating" winding indicated by (C'C'). If all these windings are connected in series, it will be seen that the current in the field windings (F'F') produces a magnetization at right angles to that produced by the armature winding (A'), and consequently produces a torque therewith. The windings (C'C'), on the other hand, produce a magnetization parallel to that produced by the armature winding (A'), and consequently can exert no torque therewith. But if this winding is so connected that the current in each conductor is in the opposite direction to that in the adjacent conductor of the armature winding (A') the windings (C'C') will act to neutralize the armature reaction, and for this reason are termed "compensating" windings. The neutralization of the armature reaction enables the motor to operate on direct current sparklessly with a weaker field than would be otherwise possible. This ability to operate on a weak field is of importance when the motor is operated on alternating current, since the number of field turns, and consequently the self-induction of the field, may be reduced and the power factor correspondingly increased. Furthermore, when the motor is operated on alternating current the compensating windings (C'C'), if connected in series with the armature, serve effectively to neutralize its self-induction. The motor may consequently be operated on either direct or alternating current, with the three windings connected in series. This necessitates, however, that the direct and alternating voltages from which the motor is supplied should bear a certain ratio to each other, for there are definite maximum voltages for both direct and alternating current above which sparkless operation is difficult to secure, since the voltage impressed upon the commutator cannot be indefinitely increased. If, however, the compensating windings (C'C') alone are connected to the source of alternating current, while the armature winding (A) and the field windings (F'F') are connected in series in a short-circuit, the windings (C'C') will act as the primary of a transformer to induce an electromotive force in the winding (A'), and the ratio of the electromotive force impressed upon the compensating winding and induced in the armature winding may be made anything desired by properly proportioning the relative number of turns of the two windings. Consequently greater flexibility is obtained and higher alternating voltage may be used, while the current in the windings (C'C') and in the winding (A') serve mutually each to neutralize the self induction of the other in the same manner as with the series connection.

Referring to Fig. 2, the circuit connections for a single motor will be readily understood. The lines (d d') represent a source of direct current, (a a') represent a source of alternating current, (A) represents the armature, (F) the field, and (C) the compensating winding, of a motor of the

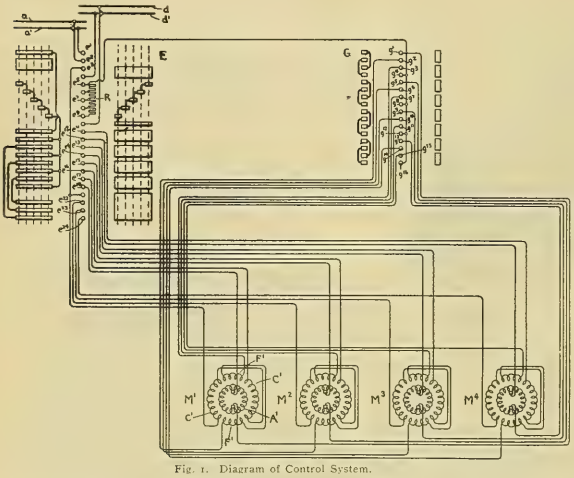


Fig. 1. Diagram of Control System.

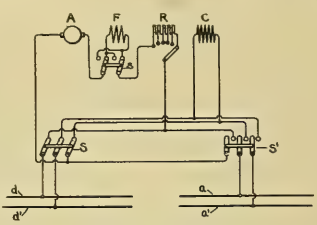
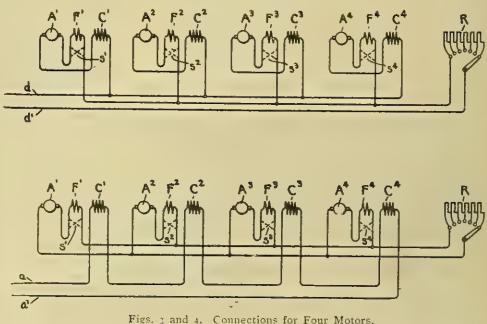


Fig. 2. Connections of Single Motor.



Figs. 3 and 4. Connections for Four Motors.

STEINMETZ'S CONTROL OF COMPENSATED RAILWAY MOTORS.

terminal of resistance (R), the three windings of each motor being connected in series. By varying the resistance (R) the speed and torque of the four motors may be simultaneously controlled.

Fig. 4 similarly shows the connections of the same four motors for operation on alternating current. The four compensating windings, (C') to (C⁴), are connected in series to the line wires (a a'). The field and armature of each motor are connected in series, and the four armature circuits are short-circuited in parallel through the resistance (R). Thus with this connection, as with the other, the speed and torque of the motors may be controlled by the one variable resistance. Reversing switches for the field windings are indicated by the dotted lines (s') to (s⁴) in both figures. By connecting the compensating windings in series the line voltage is divided among the motors.

With the above explanation the arrangement of Fig. 1 will be clear. The controlling switch is represented by (E), by means of which the four motors, (M') to (M⁴), are connected for operation on direct or alternating current, and by means of which the variable amounts of the resistance (R) are included in the motor circuit, so as to control the speed and torque of the motors. Evidently the two functions of connecting the motors for alternating or direct current and of varying the amount of resistance in the motor circuits may be separated and performed by different switches, as in the arrangement of Fig. 2. The reversing switch (G) varies the relative connections of the several field windings (F') to (F⁴), so as to vary the direction of rotation of the motors.

If the controlling switch (E) is moved to bring the left-hand set of movable contacts in engagement with the stationary contact fingers, and if the reversing switch (G) is closed in either direction—as, for instance, by bringing the left-hand movable contacts in engagement with the stationary contact fingers—the four compensating windings are connected in series to the line, as shown in Fig. 4. The upper commutator brushes, which form one terminal of the armature windings and which are connected to contacts ($e^{12}$) ($e^{14}$) ($e^{16}$) ($e^{18}$) are all connected through contact ($e^{2}$) to one terminal of resistance (R), the other terminal of which is connected, through the reversing switch, to one terminal of the field windings (F') to (F⁴), the other terminals of which are connected to the lower armature brushes through the reversing switch. The connection of the armatures and fields is consequently that shown in Fig. 4, and as controlling switch (E) is moved through its several positions and the amount of resistance (R) included in this short-circuit is varied, the speed and torque of the motors may be controlled as desired. On the other hand, if the right-hand set of movable contacts are moved into engagement with the contact fingers, the four motors are connected in the same manner as is shown in Fig. 3.

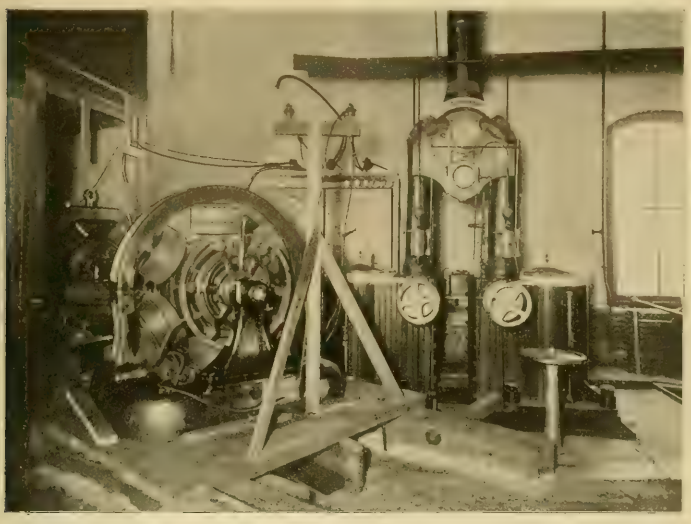
Evidently a number of motors may be controlled by a single resistance. Such an arrangement is shown in Fig. 3, in which four motors are shown connected for operation to a direct-current source, all switches being omitted. It will be seen that all four motors are connected in parallel between the line wire (d) and the left-hand type described. A variable resistance is shown at (R), and (S) and (S') represent switches, adapted, respectively, to connect the motor to the direct-current source or to the alternating-current source. A reversing switch (s) is supplied, by means of which the connections of winding (F), and consequently the motor torque, may be reversed. With the switch (S) closed, as shown, and the switch (S') open, the following circuit may be traced: From line wire (d) through switch (S), resistance (R), reversing switch (s), field winding (F), armature (A), switch (S), compensating winding (C), switch (S), line wire (d'). The three windings are consequently connected in series and the motor operates as a direct-current compensated series motor. With switch (S) open and switch (S') closed, the following circuit may be traced: From line wire (a), through switch (S'), compensating winding (C), switch (S'), line wire (a'). The compensating winding (C) is consequently connected directly across the source of alternating-current voltage. A second local circuit is closed as follows: From the right-hand brush of armature (A), through reversing switch (s), field (F), resistance (R), switch (S'), to the left-hand brush of armature (A). The armature, field winding and resistance are consequently connected in closed circuit.

It will be seen that with the motor connected either for direct or alternating current the direction of rotation may be reversed by shifting the switch (s), since the direction of torque is reversed. Furthermore, the amount of current flow and the motor speed and torque may be regulated by varying the variable resistance (R).

## Electrical Pumping Plant on the North Branch of the Chicago River.

Unknown, perhaps, to the large majority of people living in Chicago, there has been in existence for 20 years a large pumping plant delivering 24,000,000 gallons of water a day from Lake Michigan into the North Branch of the Chicago River for the purpose of creating a current of water in that tributary of the Chicago River. The North Branch, as it is commonly known, is a tributary of the Chicago River which extends through the northern part of the city and is navigable for a portion of its length. It is, however, naturally little more than a slough or lagoon, except during the spring, when a large amount of surface water finds it way through the channel. In order to clear out the waters of the North Branch and to produce a slight current, at least, during all seasons of the year, a large tunnel was built about 20 years ago, running west from the lake to the river at Fullerton Avenue. This tunnel is 12 feet in diameter and at the river end, in the mouth of the big tube, is located a centrifugal pump which as stated above draws 24,000,000 gallons of water from the lake and discharges it into the North Branch, creating a visible current.

This pump has heretofore been driven by a steam engine, but owing to a breakdown in the boiler plant the temporary motor installation shown in the accompanying picture was resorted to by City



ELECTRIC PUMPING PLANT ON THE NORTH BRANCH OF THE CHICAGO RIVER.

Electrician E. B. Ellicott as the most practicable solution of the problem.

The pump is mounted in the mouth of the tunnel with its shaft vertical. On the upper end of the shaft is a large bevel-gear wheel 10 feet in diameter which meshes with pinions on the shafts of the two motors which are mounted one on each side of the bevel gear. These motors are direct-current machines working at 500 volts pressure. They are each of about 120-horsepower capacity, running at a speed of 600 revolutions a minute, which is of course reduced by the gearing. The pump is of the disk-wheel type, and though designed many years ago, before the modern centrifugal pump came into prominence, still it does the work in a satisfactory manner.

The installation, as will be seen by the picture, is of a temporary nature, but as it operates satisfactorily it may be used for two or three years, pending the digging of a canal from the lake to the North Branch, which proposition is now under consideration by the Sanitary District of Chicago. When this has been accomplished the necessity for this pumping plant will no longer exist, though in the 20 years which it has been in operation there is no doubt that it has paid for itself many times over in the increased healthfulness of the localities contiguous to the river.

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The board of public works of Joplin, Mo., will advertise for bids for the construction of betterments and the addition of equipment to the city lighting plant; the capacity is to be more than doubled; improvements to cost $30,000.

## Increasing the Capacity of the Union Loop.

An [illegible] Boss J. Arnold, [illegible] spirit, is rather amusing. Mr. Arnold, it will be remembered, [illegible] to the committee [illegible] City Council of Chicago [illegible] ing the capacity of the Union Elevated-railway Loop in Chicago (see Western Electrician, March 18, 1905, pp. 280, 281) [illegible] question—in the mild language of Mr. Arnold's letter—"you framed one of the [illegible] made, and suggested certain other methods which to you seemed better." To this criticism Mr. Arnold makes reply. With this brief introduction the following extracts from Mr. Arnold's friendly letter to his critic will be intelligible:

"Your editorial must have been written without a clear knowledge of the physical conditions which complicate this problem, and the state of mind of the citizens of Chicago regarding the construction of additional elevated structures within the present Loop district.

"You concur with me in recommending that the platforms of the Loop stations be extended, but disagree in the method of using them. You contend that, instead of operating the trains of the different railroads separately, in five or six-car trains, they should be combined, by the adoption of the multiple-unit system, into single trains of twice the length of the present trains, and these single long trains should be operated around the Loop, your argument being that by this method the trains would be put around the Loop quicker than when operated as I suggest. It is unfortunate that you do not carry the description of your system further and outline plans for coupling up the various trains of the different roads into these long trains, and stating the length of time which in your judgment would be consumed by thus stopping all the trains outside the Loop to couple up, and then get under way so as to go around the Loop as a single train, and the congestion that will result when these trains must be stopped on the Loop to uncouple before leaving it in order that each train may be diverted to its proper road. The Metropolitan road alone operates trains of from two to six cars each, from four different roads, on to this Loop, and if these trains were coupled together in order to run around the Loop, as you suggest, they would have to be again uncoupled, separated, and sent out over the different divisions after leaving the Loop, while the trains of the other roads would have to be combined and separated after entering the Loop. I believe it is evident that the congestion to traffic on all main lines and on the Loop, while these operations were being performed, would be prohibitive, and would also consume much more time than would be gained by your method of combined train operation while passing around the Loop. . . . .

"You also say, 'There is another way out of the difficulty not mentioned in the report, which has the merit of being less expensive to carry out than the elevated-crossing scheme with through routing, which would relieve the congestion on the Loop to an even greater degree. Like Mr. Arnold's plan, it would involve the partial through routing of trains by the consolidation of all the roads, and, in addition, would require a new structure to be built on Quincy Street, between Fifth Avenue and State Street.' In the first place, it is my opinion that

[illegible]

vated track on Van Buren Street. By a suitable [illegible] the accommodations offered would be almost as good as with the present system, when the trains of all four roads pass around the entire Loop.'

"Since you do not define what the main line is, I am unable to understand your meaning, but I am very certain that you would have great difficulty in convincing the managers of the present elevated roads in Chicago that it is practicable to handle at one transfer point the great number of passengers who now have the choice of transferring at most of the 11 stations on the Loop. Furthermore, it is impracticable to build a station at Lake Street and Fifth Avenue, owing to lack of room between the tracks. Even if it could be built, it would not be practicable to operate it, for, being at a junction point, each train stopping there would not only block the track it occupied, but also the tracks of the other road entering the Loop at this point from one to three minutes, depending on the length of stop, instead of 45 seconds, as at present. Instead of increasing the capacity of the Loop, such a scheme would only decrease it. The plan of building transfer stations at the junction points was thought of by me at one time, but soon abandoned when analyzed."

---

## Steel and Wooden Cars in Subways.

Two recent accidents in the New York Rapid Transit Subway seem to have demonstrated conclusively that steel instead of wooden cars should be used in street-railway tunnels or subways. The collision of a few weeks ago showed the difference in the strength of the two types of cars. The copper-sheathed wooden cars which were built for the subway were a distinct advance in car construction for electric roads at the time they were designed, three years ago, and they are about as strong and as thoroughly protected against fire as it is possible to build a wooden car. They have steel sills, composite wood and metal platform and end-framing construction and heavy trussed side frames.

In the collision which took place a wooden car was coupled between two steel cars in the rear of the train which was standing at the station, and the rear steel car was struck by another steel car at the head of the following train. Most of the injured passengers were in the wooden car, which was crushed between the two steel cars. Neither the last car of the standing train nor the first car of the following train was seriously damaged. Similar accidents happen almost daily on steam roads in which wooden cars coupled between steel cars are badly damaged in collisions, although not actually struck, while the latter are only slightly battered.

In the more recent accident, which was followed by a fire, the wooden cars were consumed, and by their burning caused as much damage to the tunnel as the burning of the timbering and other combustible matter used by the contractors who were at work. Although the steel cars were subjected to a heat intense enough to melt the aluminum interior fittings, they were left structurally intact and were not even badly warped. Fortunately, there were no passengers on the wrecked train, for by the time the fire department arrived it was impossible to enter the tunnel from the entrance at either side of the fire. This would not have been the result if all-steel cars were used.

Commenting on the accidents the Railroad Gazette says: "Wooden cars in the tunnel are a menace, though they may be safe enough on the elevated lines where the speeds are slower, the liability of accident less and the danger from fire practically nothing. No more of them in all probability will be supplied for the underground lines, but it would be a safe move on the part of the Interborough company to replace with steel cars as fast as possible all that are at present in use and transfer them to the elevated roads. So long as they are in use in mixed trains with steel cars,

they add to the danger of collisions, and the danger from fire cannot be entirely eliminated until all are taken out."

## Electrochemists Preparing for Boston.

Whether the much-discussed merger of the scientific department of Harvard University and the Massachusetts Institute of Technology is brought about or not, there will be a union of the two institutions in the matter of extending hospitality to visiting members of the American Electrochemical Society when they hold their convention in Boston on April 25th, 26th and 27th.

"Tech" will do the honors on the opening day. The programme provides for a morning session at the Lowell Building, followed at 1 p. m. by a reception tendered by President Henry S. Pritchett at the Technology Club, and a luncheon given by the Institute of Technology. In the evening there will be the presidential address of Prof. H. S. Carhart at the Lowell Building, and a smoker at the Hotel Lenox, which has been designated as the society's headquarters during the convention.

On Wednesday Harvard will welcome the members to Cambridge. The morning session will be held in Pierce Hall, one of the fine new lecture and instruction buildings of the university. At 1 p. m. President Charles W. Eliot will hold a reception at the Harvard Union, followed by a luncheon, given by the university. The annual banquet will take place on Wednesday evening at the Hotel Lenox.

Thursday's programme provides for a morning session at the Lowell Building and a lunch at the Technology Club at 1 p. m., followed by an afternoon session.

Spare moments will be devoted to visits to the General Electric Company's plant at Lynn, the New England Gas and Coke Company's plant at Everett, Institute of Technology department buildings and other establishments of interest to the members. Attractive programmes have also been prepared for the entertainment of the ladies who come to Boston with members of the society.

Arrangements for the convention are in the hands of a local committee, comprising Dr. William H. Walker, chairman; Dr. H. P. Talbot, local secretary; N. L. Amster, G. L. Cabot, Dr. Henry Carmichael, Leonard B. Buchanan, E. H. Clapp, Dr. Louis Duncan, C. M. Goddard, Dr. H. M. Goodwin, Arthur D. Little, James Locke, F. S. Pratt, B. E. Schlesinger, H. J. Skinner, M. deK. Thompson, Jr., Henry Howard, Prof. C. A. Adams, Dr. A. E. Kennelly, E. D. Leavitt, W. O. Snelling, S. E. Whiting.

The executive committee is made up of Messrs. W. H. Walker, L. B. Buchanan, H. W. Goodwin, S. E. Whiting, H. P. Talbot.

The following titles of papers are announced:

"On the Heat of Solution of Aluminum Bromide on Ethyl Bromide."—Prof. H. E. Patten.
"The Interdependence of Atomic Weights and Electrochemical Equivalents."—Prof. A. Reuterdahl.
"An Optical Method of Observing a Diffusion in an Electrolyte."—C. Hambuechen.
"The Microstructure of Silicon and Silicon Alloys."—A. B. Albro.
"Specific Inductive Capacities."—Dr. L. Kahlenberg.
"The Rotating Diaphragm."—Dr. W. D. Bancroft.
"Notes on Economic Temperatures of Copper Refining Solutions."—Prof. C. F. Burgess.
"Electrolytic Precipitation of Chromium."—Prof. H. R. Caryeth.
"Conduction in Electrolytes."—Dr. J. W. Richards.
"Adherence of Nickel to Nickel."—R. C. Snowdon.
"Electrodeposition of Silver."—R. C. Snowdon.
"Treating Low-grade Ore and Tailings by Electrolysis."—Ernest Fahrig.
"Some Experiments with the Reduction of Titaniferous Ores into Steel and Titanate of Iron."—A. Lodyguine.
"Experiments with the Reduction of Different Oxides of Lead by Electric Current."—A. Lodyguine.
"Some Results of Experiments with the Electrodeposition of Metals on Aluminum."—A. Lodyguine.
"Billitzer's Method of Determining Absolute Potentials."—Dr. H. M. Goodwin.
"On the Utilization of Blast Furnace Gases in Connection with Electric Smelting."—A. J. Rossi.
"A Low Voltage Standard Cell."—Prof. G. A. Hulett.
"A Diaphragm Cell for Electrolysis of Brine."—C. P. Townsend.
"Colloids."—Dr. W. R. Whitney.
"Electric Arcs."—Dr. W. R. Whitney.
"Mercury Arc."—Dr. E. Winetraub.
"Reversible and Irreversible Polarization."—Prof. W. S. Franklin.
"An Electric Switch."—William Smith Horry.
"Electrostatic Method for Separating and Concentrating Ores."—Prof. Lucien Ira Blake.
"The Aluminum Electrolytic Condenser."—C. J. Zimmerman.
"Metallic Thorium."—Prof. Charles Baskerville and Fritz Zerban.

## Electrical Combines in Germany.

The seven principal electrical combines in Germany have, with their affiliated financial and construction companies, a total capital of $109,106,000. Some of them have branches in Russia, Austria-Hungary, Switzerland, Italy, Spain, the Netherlands and the Balkan States, which have given a strong impetus to Germany's electrical industries. These concerns have $34,500,000 mortgage loans standing against them, from which must be deducted $9,000,000, which represents their accumulated reserves.—Richard Guenther, consul-general, Frankfort, Germany, January 24, 1905.

## Modern Electrically Operated Pumping Plants.

By Frank C. Perkins.

Part I.

The wonderful success during the last decade of electrical power-transmission plants has made it possible for large cities located near waterpowers not only to utilize electric current generated in hydro-electric stations for street-lighting and power service but also for pumping plants to supply a satisfactory water service by the use of electrically operated pumps. A high-power electric pump is now being constructed at Schenectady, N. Y., by the General Electric Company for use at Buffalo, using Niagara power for supplementing the present

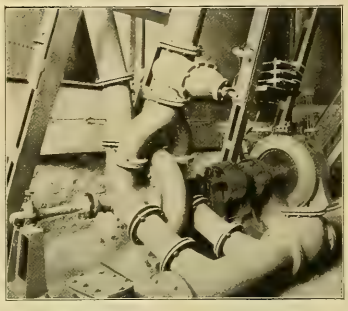

FIG. 1. GERMAN ELECTRICALLY DRIVEN PUMP USED IN COAL WASHING.

steam-driven pumping station, having a total capacity of 250,000,000 gallons of water a day.

The use of plunger pumps driven by means of electric motors requires in most cases reduction gear, and for that reason centrifugal pumps are utilized to advantage on account of their comparatively high speed, which renders them especially suitable for direct coupling to electric motors.

The electric centrifugal pump has many uses, as for instance in supplying circulation for ice machinery and its piping; also for coal washing. One of the Lahmeyer motor-driven centrifugal pumps (Fig. 1), constructed for coal washing, pumps the water and slack to a height of about 15 meters and is driven by a three-phase motor having an output of 160 horsepower.

At the central station for the canal lift at Henrichenburg (Fig. 2) the pumps are of the centrifugal type, driven by multipolar direct-current machines, and serve the purpose of pumping the water from the lower to the upper level. There are two electric pumps installed, each having an output of 15 cubic meters of water a minute and pumping to a height of 16 meters, each pump being driven by means of a 90-horsepower motor. Only one of these pumps is shown in the picture. There are also three large electrically driven centrifugal pumps at the Kiel docks in Germany which are capable of pumping out the dry docks in two and a half hours, the capacity of the docks being 60,000 cubic meters of water and the height of lift varying up to 12 meters. The motors are enclosed and completely watertight. Each of the three pumps requires a motor of 310 horsepower, operating at a speed of 160 revolutions a minute. The centrifugal pumps for the condensing plant at the Wiesbaden Electric Works operate at a speed of 730 revolutions a minute, and each has an output of 260 cubic meters an hour, a 30-horsepower, three-phase motor being used.

As the load on a centrifugal pump raising water from a mine and for general use in city waterworks is comparatively constant, the speed required being practically uniform as well as the head under which it works, alternating-current motors of the two-phase or three-phase type can be utilized to advantage and are particularly well adapted to this work. This type of motor may be readily enclosed, and, not having a commutator, can be so designed as to give little or no trouble even in comparatively damp places.

The use of electric power for city waterworks is not a new proposition. There is no reason why the 25,000,000-gallon centrifugal electrically operated pump now about completed for Buffalo's pumping station should not give a good account of itself. The city waterworks pumping station at Austin, Texas, shown in Fig. 3, is equipped with an electric pumping engine having a daily capacity of 6,000,000 gallons. It is operated by a 375-horsepower alternating-current motor operating at a speed of 100 revolutions a minute, the current being transmitted to the pumphouse, a distance of three miles, at a pressure of 2,300 volts, from a power station of 3,000-horsepower capacity, which furnishes light and power for the entire city of Austin. This city is situated on the Colorado River, which gives a practically unlimited supply of water with a fall of 60 feet, turbines being used for operating the electrical generators.

At the pumping stations Nos. 6 and 7 at New Orleans, La. (Fig. 4), there are three centrifugal pumps of the vertical-shaft type operated by three 500-horsepower alternating-current synchronous motors of the stationary-armature type operating at a maximum speed of 75 revolutions a minute, the current being supplied at a pressure of 3,000 volts.

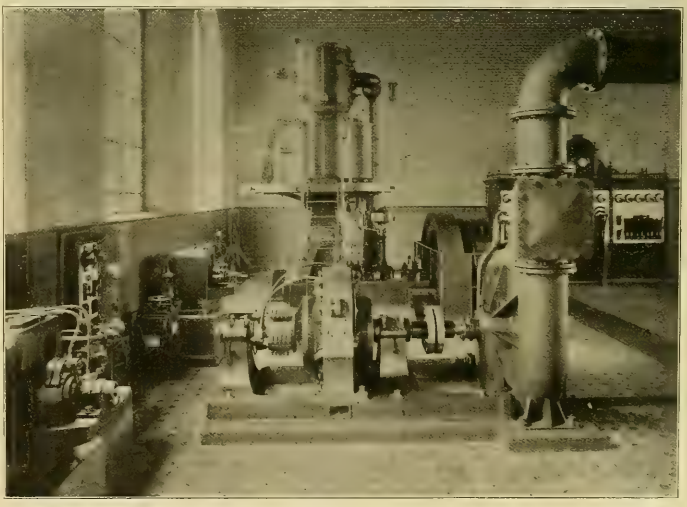

FIG. 2. ELECTRICALLY DRIVEN PUMPS IN CENTRAL STATION FOR CANAL LIFT AT HENRICHENBURG.

The picture of this station at New Orleans indicates that it resembles a hydro-electric plant very closely, but instead of the vertical machines shown on the floor level being electrical generators and the vertical hydraulic machines situated below being turbines, the arrangement is reversed, the former being electric motors and the latter centrifugal pumps directly connected to the vertical shafts of the motors.

The diagram (Fig. 5) shows the general arrangement of the pumps and electric motors in the St. Bernard pumping station at New Orleans, the centrifugal pumps being designed and built by the I. P. Morris Company, the electric motors being

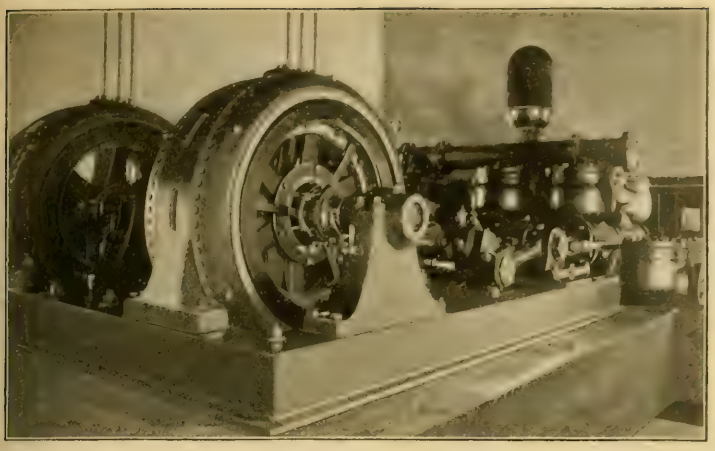

FIG. 3. ELECTRIC PUMPING PLANT AT AUSTIN, TEXAS.

built by the General Electric Company. Centrifugal pumps are also used in this station, but are direct connected by a horizontal shaft to alternating-current motors. The total capacity of this pumping station is 300,000,000 gallons a day of 24 hours. What is said to be the largest centrifugal pump ever built was installed at the Metairie pumping station at New Orleans, having a capacity of 320 cubic feet a second, the diameter of discharge being six feet and the diameter of the suction pipe being nine feet four inches. These plants alone are enough to give the Buffalo city engineers confidence in recommending an electric pumping plant for that city.

By the use of the Niagara electric current the same water which passes along the river front at Buffalo every day will be utilized for raising the pure and wholesome water from the new intake to the reservoir and for pumping it through the city mains.

By having a proper distributing system, Niagara electric power could be carried in conduits to various points in Buffalo, where high-pressure electric fire pumps could then be installed and placed in operation at a moment's notice, no expense being incurred for operation when not in use.

*[To be concluded.]*

## Cape-to-Cairo Telegraph.

German papers state that the telegraph line which is to run from the Cape to Cairo, the length of the continent of Africa, has reached, from the south, Udshidshi, on the shores of the Tanganyika Lake, in German East Africa. A survey is now to be made to find the best connecting route with the north, and the line already established is to be examined and improved. It is presumed that the communicating link will run along the east shore of the great Victoria Lake, thence in a northerly direction and reach Rosares, at present the last telegraph station in the Sudan. Considerable difficulty will have to be overcome, as a swamp 100 miles in length exists north of Udshidshi, where it will be very difficult to run a reliable air line. It was intended to run around this swamp, but now it has been determined, it is said, to utilize space telegraphy for communication across, which, however, will probably be only a temporary arrangement.

## Alameda's Experience with Municipal Ownership.

Claims that have been made in public recently of the success of Alameda's experiment in municipal ownership, and charges that have been whispered concerning the attitude of the Argus have induced us to publish the following statistics of the electric-light plant owned and operated by this city. The statistics were taken from the annual reports of the city clerk up to 1866, from which year they were collated from the records in the city hall.

FIG. 4. THREE 500-HORSEPOWER ELECTRIC CENTRIFUGAL PUMPS AT NEW ORLEANS.

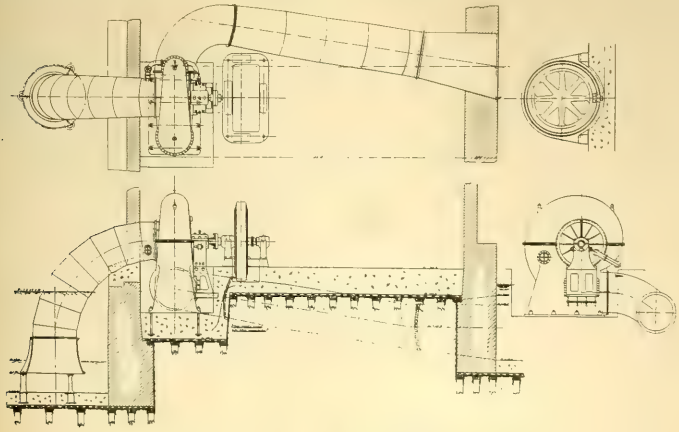

FIG. 5. TYPE OF HORIZONTAL CENTRIFUGUL PUMP IN ST. BERNARD PUMPING STATION, NEW ORLEANS.

[redacted]

Clerk Lamborn, in his annual report for 1898, [redacted] real amount, but we accept it and add it to the net expenditure and produce the amazing total of $147,892.27! [redacted] city has taxed itself to raise for light since Alameda embarked in municipal [redacted]

This is the net amount, exclusive of all income, but not inclusive of interest. In the long stretch of 17 years the interest cannot fall far short of $[redacted], which would bring the grand [redacted] round half million!

Under municipal ownership the lighting has cost Alameda an average of $26,335 a year, and this average covers the first seven years, when the enterprise was in its infancy.

In the one year of private ownership the light cost the city $5,366; in the very next year, under municipal ownership, it cost $13,565.40; and when the socialistic sentiment had egged the authorities into extending operations and engaging in the selling of commercial light, the cost more than doubled again. For nine years it fluctuated from $22,000 to $34,000 (always net, it is to be remembered), but this year the net expenditure will exceed $40,000!

It is worth while to take account of the tax rate during all these years. For the year 1884, before Alameda embarked in municipal lighting at all, the tax rate was 64 cents. In the year 1886, the first year the electric light was turned on, the rate had jumped to $1. In 1890 it was $1.15. In 1902, after 15 years of municipal ownership, the rate had crawled up to $1.25, where it remained for two years, when at the last levy it was increased to $1.38.

That increase was directly due to municipal ownership. All the money raised by the extra 13 cents is being spent upon the electric plant.

Isn't this enough? It would not seem necessary to enlarge at all upon the figures that are taken from the records. Alameda has an incubus that is sapping its life. Taxation increased from 64 cents to $1.38! A half million dollars of the tax of this small community accounted for in the one item of light alone! The town can't stand it much longer.

Some people are wondering what is the matter with Alameda; some hold that it has not the vitality of former years because it hasn't a railway like Berkeley's. The matter with Alameda is municipal ownership! And we wish no rival or sister municipality worse luck than to see it embark upon this sort of enterprise.—Alameda (Cal.) Daily Argus of March 2, 1905.

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## DATES AHEAD.

American Electrochemical Society (annual meeting), Boston and Cambridge, Mass., April 25th to 27th.

Association of Railway Telegraph Superintendents (annual meeting), Read Hotel, Chattanooga, Tenn., May 17th and 18th.

National Electric Light Association (annual convention), Denver, June 6th, 7th and 8th, and Colorado Springs, June 9th, 10th and 11th.

CURIOUS, isn't it, that while Mayor Dunne can think of no other way of beginning his "immediate municipal ownership" attempt than by requesting a conference with the tramways manager of Glasgow, the local authorities in London are sending their man to this country to acquire knowledge rather than impart it. Our London correspondent writes that the London County Council has recommended that the sum of $750 be voted to enable the chief officer of its tramways to visit the larger cities in the United States during the Easter recess. Without undue conceit, we are entitled to think that the science or art of street-railway transportation has been developed to a higher degree in this country than anywhere else. We have much to learn yet, and we trust we may do so with becoming humility; but as on the technical side the best authorities are American and as the legal and financial conditions are so radically different, it is puzzling to discover wherein Glasgow shall teach Chicago. It looks as though our estimable mayor was groping in the dark.

AS THE electric railway develops and lengthens, new subjects engage the attention of managers of interurban properties—subjects like "Tickets" and "Interchangeable Mileage Books," not new in themselves but quite recent as applied to electric-railway conditions. The Indiana Electric Railway Association, for instance, has been told by a committee that interchangeable mileage cannot be established at the present time, owing partly to the refusal of the Ohio electrics to compromise on rates and partly to the wide difference in passenger charges on the Indiana lines themselves. Again, the writer of a paper at the same meeting contends for passenger tickets on electric railways 25 miles in length or longer. Freight hauling, too, is given a large share of attention. Truly, the "broomstick train" is increasing in importance and prestige in a very satisfying degree. The steam-railroad companies, with their magnificent organization and systematic study of detail, have standardized and simplified practice to such an extent that in many respects, such as train signaling, for instance, the electric lines can do no better than to copy their best methods. But in other practical details the electric railway, now in the transition stage, must work out its own salvation as it goes along.

IMPROPER USE of the telephone on the part of the public does much to impair the efficiency of the service. A bill is pending in the New York Legislature to prevent, under penalty, the use of profane or indecent language over the telephone. The idea underlying this bill is good, and if it is properly drawn it should become a law. Among the recently enacted laws of the state of Maine is one entitled "An Act to Prevent the Improper Use of Telephones." Here it is provided that "whoever without reasonable cause or provocation shall willfully and wantonly or maliciously vex, irritate, harass, or torment any person by communications to or conversation with such person over or by means of any telephone, or shall call out any fire department, police department or other municipal department, or any portion or persons thereof, by intentionally giving a false alarm or call to such department, or to any officer or member thereof, by means of any telephone line or lines, shall be punished by imprisonment not exceeding two years or by fine not exceeding $500." This, too, seems to be a good law. But neither reaches the trouble caused by eavesdropping on party lines nor the obstruction to service by trivial and long-continued gossiping. These annoyances are principally encountered in the country, and it would perhaps be impracticable to attempt to correct them by statute. It is not to be forgotten, too, that the opportunity for social converse is one of the greatest charms of the telephone in farming and rural communities. It is the abuse of this privilege, not its reasonable exercise, which arouses resentment. But for eavesdropping, or deliberate listening to the conversations of others on party lines, there can be no excuse. The story is familiar of the telephone inspector, who, making an unexpected call at a farmhouse, found the housewife comfortably seated in a rocking-chair busily engaged at her knitting, with the telephone receiver strapped to her ear so that she could hear all the conversation of the neighborhood. A flagrant offense like this might be punished by a fine, but for a general betterment it will be necessary to rely on the development of a nicer sense of honor by ethical methods, and on the force of public opinion.

QUESTIONS of a practical or technical nature arising in electrical work are often submitted to the Western Electrician for answer, and it is a pleasure to us to use our best endeavors to meet the demands of this sort laid upon us by our subscribers. A large proportion of these questions are of general interest, and are answered through the columns of the paper. Inquirers should always sign their names in full for our own information, but these names will not be published if request to that effect is made. One thing to be remembered is that the facts should be stated clearly and exactly and with sufficient detail. Often questions are asked of such a vague, indefinite nature that a specific answer cannot be made. Sketches or drawings are welcome, but they should be made on a separate sheet of paper. If the queries are not typewritten, the handwriting should be very plain. Often considerable research is necessary to answer the questions asked, so that inquirers must be patient if the answers do not appear in the next issue. If, however, nothing appears within six weeks from the date of the communication, the letter may be repeated.

Readers of the Western Electrician will confer a general benefit, too, if they will give of their own experience as well as ask of others. If you have a "wrinkle" or a "short cut" or an interesting piece of work, send in an account of it for publication, so that others may profit by it. Knowledge is one thing that may be imparted without impoverishing the giver. Your contribution, too, may prompt another to send in his mite, which may, in turn, be useful to you. Subscribers should not forget that the technical journal is published in their interest, to disseminate useful and interesting information, and that they can help themselves as well as others by adding to the common stock of information.

FOREIGN competition in the extension of the electrical export trade of the United States must be met in a rational manner, with logical argument and demonstration, not by a lofty assumption of superiority for the American product and half-concealed contempt for machinery or apparatus made anywhere else. We Americans are prone to this failing; we are too apt to think no other people is quite so smart, so quick, so ingenious as we are, and that, in consequence, other nations' manufactures are sure to be less well adapted to the end to be accomplished than ours. This seems to be a fault common to all English-speaking countries; and an Anglo-Egyptian correspondent of a London newspaper gives his countrymen some advice on the subject which has an application to those who are seeking to sell the manufactured products of the United States abroad in competition with those of other countries. Speaking of a contract awarded by the municipality of Alexandria to an Italian firm, the writer mentioned says:

> True, it may be argued, that the municipality sacrificed quality and durability to cheapness, that what appears least costly on paper may prove to be the most costly in practice. But this reasoning is futile, presupposing, as it seems to do, that business instinct and technical intelligence are confined to the British nation alone. The Alexandria Municipal Council is certainly one of the last to sacrifice anything of its own interests, or of those entrusted to it, for the sake of a petty economy. It may indeed be remarked in passing that no good and a great amount of harm may be produced by the continual reiteration of those vague, unmeaning expressions not uncommon in England, such as "inferior foreign make," "cheap foreign materials," and the like. The lesson is one to be taken particularly to heart in a cosmopolitan country such as Egypt, where British firms are called upon to compete with rivals no less excellent than themselves, and perhaps possessing a still greater degree of enterprise.

The particular superiority of American electrical appliances should be argued by engineering salesmen on tangible points of excellence that may be demonstrated, without any reference to supposed Yankee cleverness or any allusion that might imply inferiority on the part of any other nation.

## Iowa Electrical Association.

Dubuque, Iowa, April 19. The Iowa Electrical Association is holding a successful convention in this city, with about 100 in attendance. Mayor Berg welcomed the visitors this morning and President Bowers made a short address. After routine business, L. D. Mathes of Dubuque read a paper on "Methods of Obtaining New Business." Messrs. Zahm, Burt, Bellamy and C. McGee took part in the discussion. A proposition to increase dues to members in the larger cities was introduced by W. J. Greene of Cedar Rapids. In the afternoon there were committee reports, and papers by F. H. Lankashier of Davenport and A. W. Zahm of Mason City, on "Boiler-room Economics" and "Methods of Accounting," respectively. W. E. K.

### Association Matters.

While the full report of the convention will not appear until next week, it will be well to give here, as an admirable introduction to the record of the association's work at Dubuque, the short paper of Mr. George S. Carson, general manager of the Iowa City Electric Company, and also a valued member of the executive committee of the association.

The Iowa Electrical Association was formed at an organization meeting called by Mr. H. L. J. Towner, to be held at Des Moines, June 12 and 13, 1900, at which time the following-named officers were elected: President, W. J. Green; vice-president, H. H. Caughlin; secretary, W. B. Keffer; treasurer, George S. Carson.

The first annual meeting was held at Des Moines February 20 and 21, 1901, where the association started business in earnest, with 17 members. The second annual convention was held at Cedar Rapids; the third at Davenport; the fourth at Des Moines, and this year we have again taken to the eastern side of the state, and are holding forth at Dubuque.

It is hardly necessary for me to speak of the benefits that the association has accomplished for its members. We all realize them. The fact that its membership has steadily increased is good proof. We now have over 50 central stations located in all parts of the state, some of them being small and some the largest, so that we have companies operating plants under both extremes, and can, in this way, gather information that will be of use to all central stations.

I believe that, generally speaking, the smaller stations have more to contend with and must be more economical in proportion to their gross receipts than the stations in towns of 5,000 and over, for the reason that the general business of the smaller towns will not warrant a very large expense in lighting the stores and homes. The companies, therefore, must of necessity figure very close on expense account to show even a fair rate of interest on the investment.

It is by the association of the members of this organization each year and comparison of practical tests that we are getting new ideas and saving in the management and operation of the business.

I fully believe that the phenomenal growth and advancement of the United States can largely be attributed to the knowledge gained by the mixing of all nationalities of the earth, each one of which is more advanced in its own particular range of knowledge; and by the association of all these people and getting what we may call the cream of knowledge in mechanics and arts, we have outstripped all other nations of the world in advancement and wealth. Each nation does, of its environment and government, run in certain ruts and have certain unwritten laws that become a part and parcel of the people. Trades and trade secrets have in this manner been handed down from one generation to another, so that the arts and sciences have been controlled and perfected by this endless chain. The different nations, by their different languages and customs, have isolated themselves and have not broadened out to receive and accept new methods in the things in which they were deficient. The United States, being a new country, receiving all the different nationalities as its citizens, has been the clearing house of knowledge. This unequaled resource, together with the aid of liberal laws and a public-school system that is superior to any, has enabled it to outdistance all in the race for commercial supremacy.

This may not seem to have a bearing on the Iowa Electrical Association, but I have cited it to show that it is by comparison and selection of the best methods that perfection is attained. We have, I feel sure, members in the different electrical companies of this state who are more expert in some one particular way pertaining to the operation and management of the business, which knowledge, if gathered together by means of this association, will be valuable to all and will help very materially the advancement of the business. If, on the other hand, each company continues in its own way without comparing results or associating with others, it will run in a certain rut and become "hidebound," to the detriment of itself and discontent of the public which it serves.

There is another important point which we should all consider, and that is, Have we all utilized the knowledge we have gained at each meeting and put in practice the methods [illegible] economical and practical? I [illegible] how many companies that are members of the association have meters on their switchboards and can tell each month the current [illegible] for which pay was received. Also how many there are who can tell how many pounds of steam an indicated horsepower their engines are taking; also, the wattage at switchboard [illegible] horsepower, as well as the evaporation obtained in the boiler room. These figures can be obtained without a great cost, but, even if it does cost money, we may sit here at these conventions and talk until we are gray, and unless we go home and put in practice the knowledge we have gained, it is of no value. The key to the whole situation is, What are we ourselves doing, written down in black and white? and next, Is it possible to better it, and, if so, how? Then put in practice the improvements necessary. Let us each appoint ourselves a committee of one to see how much information concerning our own stations we can report on at the next convention, and in this way get down to a system of stopping the losses, and of keeping a systematic record of each department in the manufacture and sale of electricity.

## New York City Lighting Investigation.

The third week of the official investigation into the cost of public lighting in New York city brought forth the statement on Monday, April 10th, from the New York Edison Company's general inspector, Arthur Williams, that if the city were treated not as one large customer, but with the various departments regarded as wholesale customers, the charges per kilowatt-hour would range from 7.2 cents for police headquarters up to 10 cents for the Seventh Regiment Armory. On the other hand, if the 95 buildings to which current is supplied were regarded as retail customers the charge would be 13.5 cents as against the present all-around rate of 12 cents. Mr. Williams said: "The city is a very poor customer. Take the schools for instance. There are 47 of them and the installation is very large compared with the service rendered. In one school alone there are 5,000 lights, but they are used only about two hours a day. It is recognized in the electric-light business that the charge for short-hour service must be greater than for all-day service."

Vice-president J. W. Lieb, Jr., of the Edison company, said that the cost of connecting a building to the mains varied from $50 to $400. The Edison mains were at present connected to about 45,000 meters, representing about 45,000 separate customers. The average cost of current at the lamp was 3.66 cents per kilowatt-hour and the city paid an average rate of 11.36 cents. Questioned as to the actual cost of current for arc lamps, Mr. Lieb said that it was about 2.9 cents per kilowatt-hour. He figured that the city paid 5.4 cents per kilowatt-hour for arc lamps, and that the total cost, including interest and depreciation, was 4.6 cents. In the Bronx, where overhead wiring is used, the profit per kilowatt-hour on the arc lamps is 2.44 cents, so that on 1,127 lamps the company makes an annual profit of $54,977. For generation and distribution the Bronx lamps cost $77 a year, or with interest and depreciation $124. The charge to the city was $146, the same as in Manhattan, where there is an underground service.

Henry W. Edwards, the Edison company's auditor, was questioned as to the capitalization, and testified that when the various consolidations took place no inventories were made of the plants of the merged concerns.

On Wednesday Mr. Lieb produced the following figures relating to the cost of arc lighting:

| Year. | Cost to City. | Cost to Company. | Profit. |
|---|---|---|---|
| 1902 | $523,264 | $457,304 | $65,890 |
| 1903 | 527,060 | 486,140 | 49,017 |
| 1904 | 542,828 | 447,642 | 95,185 |

Mr. Lieb went on to say that in one sense the profit for 1902 instead of being $65,899 was really $175,899; and that the profit for last year instead of being $95,185 was really $200,000.

Mr. Edwards, recalled, produced the following statements of the capitalization of the New York Edison Company:

| | |
|---|---|
| Property of Edison Illuminating Company ($15,259,162.77), less 93,680 shares turned in and canceled | $ 6,091,162.77 |
| Property of New York Gas and Electric Light, Heat and Power Company | 66,545,100.77 |
| Capital stock of power company ($36,000,000) taken on at | 9,040,000.00 |
| 406 shares of Edison Illuminating Company ($120,000) exchanged for bonds sold for | 32,986.06 |
| Total | $81,709,249.60 |
| Less Illuminating company stock, exchanged for bonds and now in treasury | 20,604.00 |
| Balance | $81,688,645.60 |

[illegible]

Mr. W[illegible] asked him:

"[illegible] because of the large amount of current used [illegible]

"What do you [illegible] kilowatt-hours?" "Three cents."

"And the charge to the city, the largest customer of all, is 12 cents per [illegible] point of view the city is not [illegible] customer."

Mr. Williams added that the total sales of current last year amounted to 32,694,720 kilowatt-hours, sold at an average [illegible] No other discounts were allowed than those shown on the various forms of contract, though there were perhaps 50 very old [illegible] special discount was allowed for power.

J. H. Cahill, secretary of the Empire City Subway, a concern which is also entirely owned by the Edison Company, asserted that [illegible] was only concerned with telephone and telegraph wires. They had only a few power [illegible] cost $200 a year per mile for maintenance.

On Friday many details were given as to the cost of gas production. It was shown that the New Amsterdam Gas Company was able to manufacture gas at less than 26 cents a thousand cubic feet. Other evidence proved that the gas companies' books showed one valuation for taxation purposes and another for dividend calculations. In regard to the Brooklyn Union Gas Company, nothing had been set aside for reserve or depreciation, but several other smaller companies had been purchased out of the profits.

Benjamin A. Whiteley, in his capacity as treasurer of the United Electric Light and Power Company, admitted that although the company had a contract with the city to pay one cent a lineal foot for conduits under pavement, the rent had never been paid for the privilege. The United company generated and distributed current at a total cost of 8.94 cents per kilowatt-hour, including interest charges.

The proceedings on Saturday concerned details of gas companies' operations and finances. W.

## Chicago Waterworks a Poor Example.

Municipal-ownership advocates in Chicago often refer to the waterworks as a bright particular example of the beneficent working of their pet theory. However, the Chicago Daily Tribune finds that the actual facts in the case do not justify the loud claims made by the public-ownership people. The situation, it says, may be summarized thus:

The water-service equipment is antiquated and inadequate.

In at least a third of the city there is difficulty in supplying water above the second floor of dwellings.

The service is mismanaged in a manner that no private concern would tolerate and to a degree which makes its profit more a matter of luck than care.

On account of diversion of the profits of the department and aldermanic complacency the service is [illegible] years behind the times.

Collections of assessments are more than [illegible] in arrears.

The improvement of the service is and has been for years hindered by political considerations.

The department is the victim of mechanical and supply contractors.

To this Mayor Dunne, according to the same newspaper, makes this answer: "O, I have no doubt the water department has been mismanaged. But, even if it has, the municipal operation of the department has been a good thing for the people. Water is cheaper in Chicago than in any other city in this country. If the municipal ownership of street cars is mismanaged with the same beneficial results as those obtained in the water department, we shall have reason to congratulate ourselves."

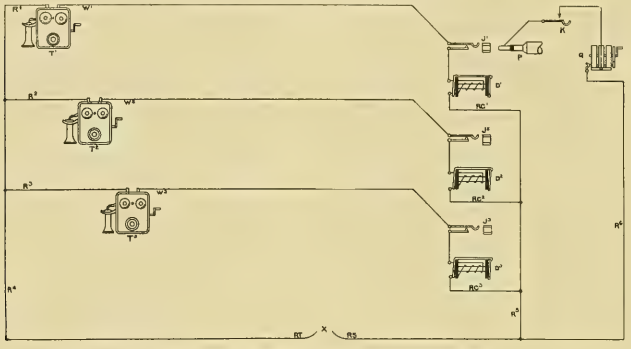
The Cairo (Egypt) electric railways now have a total length of 43 kilometers. The lines show an increasing traffic, the number of passengers last year showing an increase of 13 per cent. over the year before. The only recent improvement is a double-track line five kilometers in length.

## QUESTIONS AND ANSWERS.

### Telephone Ringing Trouble.

A reader of the Western Electrician in Wilton, Iowa, says: "We have a common-return system, and there are several of the telephones which ring together. I am sure the lines are not crossed, but the telephones all ring over that one lead every time a subscriber is called, which makes it very annoying. If you can give me any information I will be very much pleased."

Answer.—It is taken for granted that the correspondent is operating a common-return system such as is illustrated by the accompanying diagram. In this circuit it will be observed that there are three telephones connected to three lines in the switchboard. The telephones are shown by ($T^1$) ($T^2$) and ($T^3$), while the switchboard drops are marked ($D^1$) ($D^2$) and ($D^3$). Each of the telephones connects to the switchboard circuit by what is commonly called a "common-return" wire. This wire is shown extending from ($R^4$) to ($R^5$). The telephones are connected to this common-return wire by taps ($R^1$) ($R^2$) and ($R^3$), and the switchboard drops connect to the ($R^6$) wire, over conductors ($RC^1$) ($RC^2$) and ($RC^3$). The operation



TELEPHONE RINGING TROUBLE ON COMMON-RETURN SYSTEM.

of the system under perfect conditions would be as follows:

The subscriber ($T^1$), upon driving his magneto generator, would cause the projection of a current over the wire (W), spring jack ($J^1$), drop ($D^1$), common-return tap ($RC^1$), common-return wire ($R^5$), ($R^4$), and back to the telephone over ($R^1$).

It will be observed that the signaling current generated at the telephone No. 1, necessarily passes through the common-return wire, it being the lower resistance path. Should, however, for any reason, the resistance of the return wire be sufficiently high, then there would be a division of the ringing current on its passage to the central office. Not all of the current would pass over the common-return wire, but a part of it would pass through the No. 2 and No. 3 telephones, reaching the central office through the No. 2 and 3 drops and returning through the No. 1 drop. In this way the No. 1 drop would respond properly, but the No. 2 and 3 drops might also respond, depending, of course, upon the resistance present in the common-return circuit.

Now when we project the signaling current over the line from the central office, the same result is obtained. Say, we place the calling plug (P) into the spring jack ($J^1$), and, after depressing the key (K) and driving the generator (G), a ringing current is projected over the wire ($W^1$), through the telephone ($T^1$), and, with the common-return wire in good condition, the signaling current, or, at least most of the current, would return to the generator (G) over the common-return wire and wire ($R^5$).

Now it will be observed that if there is any appreciable resistance between the point ($R^5$) and (RS), say, at (X), or, perhaps even a complete break, then the signaling current projected from the central office over the wire No. 1, through telephone No. 1, would necessarily return to the central office through the telephones Nos. 1 and 2, this resulting in ringing the bells of the stations Nos. 1 and 2, as well as throwing the drops of Nos. 2 and 3.

Thus, it will be observed that the cross-ringing in the correspondent's circuit is probably due to either a complete break in the common-return wire, or a high-resistance joint in the line. Sometimes it has even been found that signaling apparatus is placed in the common-return lead; this, of course, introducing the difficulty complained of.

It may be mentioned that should we have only three telephones on a lead, together with one common-return wire, the cross-talk between the different instruments would be very considerable if the common-return lead were broken or contained a high resistance in series with it. Where the telephones on a given lead to exceed 40 or 50, then the cross-talk is not so serious, nor do we have much cross-ringing. For then, while we ring out over one wire, we have all of the remaining telephones to use as a return path, and the amount of current returning over each of the telephones is therefore very small.

In conclusion, it may be suggested that if the common-return wire is found in perfect condition, the trouble may be due to damp cables, and if we combine with this a pole changer at the central office considerable cross-ringing may be obtained.

In order to partially clear this difficulty without drying out the cables, we may reduce the voltage of the ringing current by connecting a less number of batteries to the pole changer, or connecting a higher capacity condenser across the ringing leads, it being a general rule to supply a two-microfarad condenser with the ordinary commercial pole changer.

### The Area of a Circle.

E. C. Reed of Genoa, Ill., kindly sends the following:

"In regard to the method of finding the area of a circle, shown in the last issue of the Western Electrician, I offer the following explanation:

"The only difference between the method shown and the usual method is in the manner of multiplying the square of the diameter by one-quarter $\pi$, or 0.7854. This is done by using 0.7854 in the form

.77
14
14

but as it would be difficult to multiply by 14, we may begin with the left-hand-figure, 7, placing each successive partial product one place to the right instead of to the left as in the usual method of multiplication. As the next figure is also 7, the second partial product will be the same as the first. Now, to multiply by 14 it will only be necessary to multiply the first partial product by two. The fourth partial product will be the same as the third, or twice the first. Add and point off as usual.

"The 'short cut' then is that two of the products may be copied while the third is quickly obtained by multiplying by two. The number 0.7722 is simply used to indicate the method and preserve the four decimal places."

Discussing the same subject, Mr. Joseph T. Kelly of Washington, D. C., contributes the following: "I was not a little interested in discovering the rule by which the result was obtained.

"Taking a perfectly general case where the diameter of the circle = d, we have for the area, the well-known formula, $A = \frac{\pi d^2}{4}$, or $A = 0.7854d^2$; that is, the value of $d^2$ is to be multiplied by the constant 0.7854. Now, in all so-called short cuts, the object is to multiply by the same digit, or multiples thereof, as many times as possible. Looking at the constant 0.7854, one sees at a glance that it may be divided into four multipliers, as follows: 0.7, 0.07, 0.014 and 0.0014.

"This will be more readily seen by actually performing the multiplication:

$d^2$
.7
.07
.014
.0014

.7 $d^2$
.07 $d^2$
.014 $d^2$
.0014 $d^2$

.7854 $d^2$

"Now the four multipliers above are a clumsy arrangement at best, and are replaced by the expression 0.7722, which is not, correctly speaking, a multiplier, as the third and fourth digits require to be multiplied by the first, as well as by $d^2$.

"Thus, suppose $d = 12$ inches, $d^2 = 144$ square inches, then $A = 144 \times .7854 = 113.0976$ square inches.

"Now 144
.7722

1008
1008
2016
2016

113.0976 square inches,

which is correct, and yet is obtained practically from a single multiplication, seven times $d^2$."

### Magnetic Distribution of Air Gaps.

A meeting of the Electrical Section of the Western Society of Engineers was held in Chicago on April 14th. Chairman W. B. Hale presided. The subject of the evening was "A Simple Electrical Method of Determining Flux Distribution and Magnetic Reluctance in Odd-shaped Air Gaps," which was given with lantern-slide illustrations by Mr. Charles H. Smoot of the Western Electric Company, Chicago.

Mr. Smoot described a method developed by him for ascertaining the magnetic distribution in such air gaps, which consists in cutting from some high-resistance metal a template of shape similar to that of the air gap. This plate is then fitted between two surfaces of conducting material such as copper, which correspond to the iron in a magnetic circuit in which there is an air gap. Current is then passed from one surface to the other through the template and the current density at various points on the surface of the plate is measured by means of a galvanometer or any convenient method. Connecting points of equal value, lines are plotted which are analogous to the lines of magnetic flux. If lines be drawn which are perpendicular at all points to the lines of magnetic flux the former will represent lines of equipotential.

The next meeting of the Electrical Section, which will be the last of the season, will be held May 12th and will be of a semi-social character. Mr. Albert B. Hale will give an interesting talk upon "The Isthmus of Panama," showing a number of new photographs. Further particulars concerning the place of meeting will be announced later.

### Subsidies to Electric Railways Held Invalid.

Judge R. S. Artman in the Clinton Circuit Court at Frankfort, Indiana, in an interurban subsidy case held, on April 17th, that under existing statutes no subsidy may be lawfully voted in aid of interurban railways. The decision is the first of the kind to be rendered in Indiana and was rendered on an approval from an order from the Board of Commissioners of Clinton County for an election to be held on May 18th in Center Township to vote on the question of levying a tax of $100,000 in aid of the Tipton, Frankfort and Attica Traction Company. Opposing taxpayers appealed from the order and Judge Artman holds that the commissioners had no authority to order an election to vote aid to an interurban street-railway company, and accordingly dismissed the proceeding.

Judge Artman decides that an interurban street railway is not included in the word "railroad," as set out in the statutes under which the election was ordered. The decision of Judge Artman is was ordered. If the decision is sustained by the Supreme Court it will put a stop to the building of numerous lines that are now projected throughout the state. An appeal will be taken at once with a view of securing an early decision from the higher court.

## How to Remember the Wire Table.[1]

By Charles F. Scott

The wire table for the B & S gauge copper wire has a few simple relations, such that if a few constants are carried in the memory the whole table can be constructed mentally with approximate accuracy.

Resistance.—A wire which is three sizes larger than another wire has twice the weight and half the resistance.

No. 10 wire has a resistance of 1 ohm a thousand feet; No. 7 wire, which is three sizes larger, has 0.5 of an ohm a thousand feet; No. 4 wire, which is three sizes larger than No. 7, has 0.25 of an ohm; No. 13 wire, which is three sizes smaller than No. 10, has two ohms; No. 16 wire, which is three sizes smaller than No. 13, has four ohms. It is easy, therefore, knowing the resistance of No. 10, to find the resistance of No. 7, No. 4, No. 1 and No. 000; also of No. 13, No. 16, No. 19, etc.

A wire which is 10 sizes larger than another wire has 10 times the weight and one-tenth the resistance.

As the resistance of No. 10 is one ohm a thousand feet, the resistance of No. 0 is 0.1 of an ohm, and the resistance of No. 20 wire is 10 ohms. As the resistance of No. 4 is 0.25 of an ohm, the resistance of No. 14 is 2.5 ohms and of No. 24, 25 ohms.

| Size. | Ohms. | Size. | Ohms. | Size. | Ohms. |
|---|---|---|---|---|---|
| No. 1.... | 0.125 | No. 11.... | 1.25 | | |
| No. 4.... | 0.25 | No. 14.... | 2.5 | | |
| No. 7.... | 0.5 | No. 17.... | 5 | No. 0000.... | 0.05 |
| No. 10.... | 1 | No. 20.... | 10 | No. 0.... | 0.1 |
| No. 13.... | 2 | No. 23.... | 20 | No. 3.... | 0.2 |
| No. 16.... | 4 | No. 26.... | 40 | No. 6.... | 0.4 |
| No. 19.... | 8 | No. 29.... | 80 | No. 9.... | 0.8 |
| No. 22.... | 16 | No. 32.... | 160 | No. 12.... | 1.6 |
| No. 25.... | 32 | No. 35.... | 320 | No. 15.... | 3.2 |

In the above table the first column contains the sizes of wire which differ from one another by three sizes. The resistance of each wire in this column is seen to be twice that of the next larger size and one-half that of the next smaller size. There is, therefore, no difficulty in remembering this column. In the second division of the table the wires are 10 sizes smaller than those in the first division; thus, No. 11 corresponds to No. 1 and the resistance is 10 times as great. In the third division of the table the wires are 10 sizes larger than those in the first division; thus, No. 0 corresponds with No. 10 and the resistance is one-tenth as great.

From this table several new relations may be observed.

If the wire is one size smaller the resistance is 25 per cent. greater. For example: Compare No. 11 with No. 10, No. 12 with No. 11, No. 13 with No. 12, etc.

If the wire is two sizes smaller the resistance is 60 per cent. greater. For example: Compare No. 12 with No. 10, No. 16 with No. 14, No. 15 with No. 13.

If the wire is one size larger the resistance is 80 per cent. of that of the smaller wire. For example: Compare No. 9 with No. 10, No. 10 with No. 11.

If the wire is two sizes larger the resistance is 63 per cent. of that of the smaller wire. For example: Compare No. 11 with No. 13, No. 4 with No. 6.

From the foregoing the following are the ratios of resistance between wires of consecutive sizes:

0.50, 0.63, 0.80, 1.00, 1.25, 1.60, 2.00.

Weight.—The weight of a wire is inversely proportional to its resistance. Therefore, the foregoing relations are the same for weight as for resistance, excepting that the weights increase as the size of the wire increases instead of diminishing. The weights of successive sizes of wire, therefore, bear the following relation, beginning with the smaller wire:

0.50, 0.63, 0.80, 1.00, 1.25, 1.60, 2.00.

If the weight of any size of wire is known, it is therefore seen that the weight of the next larger size is 25 per cent. greater; the weight of the second larger size is 60 per cent. and the weight of the third larger size is double; also, the weight of the sixth larger size will be four times as great, and the weight of the tenth larger size will be 10 times as great.

The weight of 1,000 feet of No. 10 copper wire is 31.4 pounds. Therefore, the weight of No. 7 wire is 62.8 pounds; the weight of No. 0 wire is 314 pounds. The weight of No. 5 wire is 100 pounds a thousand feet, which is a convenient figure to remember. The weight of No. 2 wire is, therefore, 200 pounds, and the weight of No. 00 wire is 400 pounds.

Area.—The area of No. 10 wire is approximately 10,000 circular mils (more precisely, 10,380). The area is proportional to the weight. The area of No. 7 wire is, therefore, about 20,000 circular mils, of No. 0 wire 100,000, and of No. 0000 wire 200,000. The precise area of No. 10 wire is 10,380 circular mils. Taking this figure for easy calculation as 10,400 and following the process above indicated, the area of No. 0000 wire is found to be 208,000, which is very nearly 211,600, the figure in the wire table.

Diameter.—The diameter of No. 10 wire is approximately 0.10 inch (more precisely, 0.1019 inch). The diameters follow the [illegible] mil and weight except that [illegible] alternate sizes. Therefore the [illegible] has half the diameter and the twentieth smaller size has one-tenth the diameter. [illegible] No. 10 is 0.10 inch, No. 16 [illegible] 0.01 inch; also No. 4 is 0.20 inch and [illegible] is 0.40 inch; also No. 0 [illegible] No. 0000 has 80 per cent [illegible] diameter or 0.32 inch. No. 00, lying between these sizes, may be presumed to be about 10 per cent [illegible] No. 000, or 0.36 inch, the diameter given in the wire table is 0.3648.

Reference to a complete wire table will show that the figures in the above examples and other figures which may be determined in the same way are correct within a few per cent. A little practice in mental arithmetic will enable anyone to determine the approximate weight and resistance of wire of any size.

Summary.—The things to be remembered regarding B. & S. gauge copper wire are the following:

A wire which is three sizes larger than another wire has half the resistance, twice the weight and twice the area. A wire which is 10 sizes larger than another wire has one-tenth the resistance, 10 times the weight and 10 times the area.

No. 10 wire is 0.10 inch in diameter (more precisely, 0.102); it has an area of 10,000 circular mils more precisely, 10,380); it has a resistance of one ohm a thousand feet at 20 degrees Centigrade [68 degrees Fahrenheit], and weighs 32 pounds (more precisely, 3.14 pounds) a thousand feet.

The weight of 1,000 feet of No. 5 wire is 100 pounds.

The relative values of resistance (for decreasing sizes) and of weight and area (for increasing sizes) for consecutive sizes are:

0.50, 0.63, 0.80, 1.00, 1.25, 1.60, 2.00.

The relative values of the diameters of alternate sizes of wire are:

0.50, 0.63, 0.80, 1.00, 1.25, 1.60, 2.00.

Circular Mils.—Conductors of large size are usually specified in circular mils. For example, 500,000 circular mils, 750,000 circular mils.

As No. 10 wire has approximately 10,000 circular mils and a resistance of one ohm a thousand feet and as the length of a wire which has a given resistance is proportional to its area, it follows therefore that the length in feet of a copper conductor having a resistance of one ohm may be found by dropping one cipher from the number expressing its circular mils—for example, No. 10 wire has 10,000 circular mils and a resistance of one ohm a 1,000 feet; a 300,000-circular-mil conductor has a resistance of one ohm to 30,000 feet, and a 1,000,000-circular-mil conductor has a resistance of one ohm to 100,000 feet. The weight of a given length is proportional to the area; therefore, the weight of a conductor having 500,000 circular mils is greater than that of No. 10 wire in the same ratio that its area is greater. Five hundred thousand circular mils is 50 times that of No. 10 wire, or approximately 50 times 32 pounds, which equals 1,600 pounds a thousand feet. In this way the approximate characteristics of copper conductors of all sizes may be quickly ascertained.

To find resistance, drop one cipher from the number of circular mils; the result is the number of feet an ohm.

To find weight, drop four ciphers from the number of circular mils and multiply by the weight of No. 10 wire.

1. From The Electric Club Journal.

## Chicago Street-railway Situation.

As the plans of the city administration of Chicago contemplate giving municipal ownership of street railways its first trial on the lines formerly owned by the Chicago Passenger Railway Company, the decision of Judge Grosscup which is to determine the life of the franchises of this company is being awaited with patience, the city being confident that its claims will be sustained.

Mayor Dunne has been active in securing advice in his municipalization scheme from divers sources. During the last week Tom Johnson of Cleveland, Bion J. Arnold, Corporation Counsel Tolman and Clarence S. Darrow had a conference at which the physical questions involved in the traction controversy were discussed. Mr. Arnold, as has been previously stated, is preparing plans and specifications for the construction of a street-railway system in the streets covered by the Chicago Passenger franchises, bids having already been advertised. Mr. Darrow has been appointed special counsel for the city by Mayor Dunne to treat with traction matters.

A number of individuals and corporations have written to the mayor signifying their willingness to subscribe for Mueller-law certificates—the securities with which it is intended to acquire the street-railway lines. Among those wishing to place an early order for these securities is a representative of the banking firm of W. N. Coler & Co., New York. The McGuire-Cummings Manufacturing Company is willing, it is said, to equip municipal lines and accept Mueller-law certificates in payment.

The mayor continues to receive communications from Glasgow. A recent letter from the lord provost of that city, although not made public, is [illegible] tion system, in [illegible]

## Opening of the Manila Street Railway.

One of the [illegible] electric railway, which was formally opened Monday, April 10th [illegible] have been engaged [illegible] work of reconstructing the tramways of Manila. Peculiar difficulties have been met and overcome and, where formerly a horse-car line, with eight miles of track, composed of 40-pound rail, there is now an electric system [illegible] any city of similar size in the United States.

The entire street-railway system of Manila is controlled by the same syndicate, it having purchased, in addition to the horse-car line, a steam line running to the suburbs. Forty miles of track have been laid, the rails of which are 70 pounds in the city and 94 pounds in the suburbs. Municipal lighting privileges are also controlled by the company. The power will be supplied from the new power house just completed.

Owing to climatic conditions, all rail was painted with asphaltum paint. The destructive white ant exists in such large numbers that it was necessary to use teak for ties and sleepers, except where California redwood, or Australian, or Philippine native softwood were obtainable. The latter served for the purpose only when treated with preservative. The track is all laid in concrete.

The rolling stock at the present consists of 100 cars, especially designed to meet the prevailing conditions. They are of the standard single-truck cross-bench open type for the city service, the streets being too narrow to permit of the use of double-truck cars. In the suburbs, double-truck open and combination cars are in use, as, during the rainy season, there are sudden driving showers. The company has provided convertible and semi-convertible cars, which are made by the Electric Railway and Tramway Carriage Works of Preston, England, and by the J. G. Brill company of this country.

Portable screen partitions are used to separate first and second-class passengers. The Canadian system of fare collection, by means of fare boxes, has been adopted. Protection against the ravages of the white ant is afforded by the use of teak for all woodwork in cars.

The power plant is located on an island in the center of the Pasig River, and has a generating power sufficient to supply 500 arc lights, 30,000 incandescents, and current necessary for operating 100 cars over 40 miles of track. It is interesting to note that Manila, being so far from the base of supplies, the construction company experienced considerable delay at various times. In making shipments of material for construction, it was necessary to put in the requisite number of everything, as when the work began it was not only impossible to buy boats, etc., in Manila, but there was not even a machine shop in which repair work could be conducted.

The company operates its own printing plant, which is located in the car barn, and is used in printing time tables, circulars, tickets, etc.

## Denver-Colorado Springs Convention.

As a result of the active campaign being carried on by Henry L. Doherty, committee on membership for the National Electric Light Association, several hundred names have been added to the list of members since January 1st. At the present rate of increase—if all the members attend the Denver-Colorado Springs convention in June—the predictions of the railroad men that there will be an attendance of 3,500 will be verified.

George F. Porter, master of transportation for the association, announces that Frank L. Perry, assistant business manager of the Western Electrician, 510 Marquette Building, Chicago, has been appointed assistant master of transportation, for Chicago and adjacent territory, with the particular duty of arranging for a special train from Chicago to Denver-Colorado Springs, which will be run in connection with a special train from New York for delegates to the convention to be held at Denver-Colorado Springs June 6th to 11th.

Electroplating is now applied to laces and other delicate tissues, it is said, by an improvement brought out in Europe. The metallized laces are cheap and are used for architectural decoration and in the clothing industry.

## Interurban Interchangeable Mileage Books Not Practicable at Present.

The April meeting of the Indiana Electric Railway Association was held in the auditorium of the Terminal Station Building, Indianapolis, on April 13th, and was attended by about 40 prominent interurban men of the state and a number of employes of the roads. President Charles L. Henry presided and said that the principal subject on the programme was the interchangeable-mileage question, whereupon W. R. McKowan presented an extensive report, which stated that the committee had made a thorough investigation of the conditions and was forced to the conclusion that an interchangeable mileage could not be installed at this time that would be equitable to all roads. Two causes contribute to the failure of such a plan—first, the refusal of the Ohio lines to compromise on the reduction in regard to prices that would be made in an interchangeable-mileage book, and, second, the wide difference in passenger charges on Indiana lines alone.

This report aroused quite a discussion, and, while it was accepted, with a vote of thanks, the opinion prevailed that such an interchangeable ticket or coupon arrangement between the Indiana and Ohio lines was bound to come, and for this reason a new committee headed by Will G. Irwin, president of the Indianapolis, Columbus and Southern Traction Company, and composed of 15 members, was named to continue the work. The matter of tickets for interline traffic in Indiana was also referred to Mr. Irwin's committee, as was also the handling of baggage from line to line.

The next subject was "Tickets, Their Use and Abuse," which was discussed in a paper by F. T. Norviel, general manager of the Indianapolis and Northwestern Traction Company, who said that the same conditions that make it necessary for a system of tickets on steam lines applies to electric lines of 25 miles in length or more. The paper provoked a hearty discussion, and while tickets for through service and round-trip service were generally advocated, a number of managers said their country passengers who are not accessible to a ticket office would not "stand for" an extra charge over the ticket rate. After disposing of some miscellaneous business and partaking of luncheon, the members of the association became the guests of General Manager J. W. Chipman of the Indianapolis and Eastern traction line, who took them on the "Spring Lake Special" over the 52 miles of road, stopping at Spring Lake to visit the power house and the beautiful park.

## Government Requirements in Electrical Supplies.

The Navy Department, through the bureau of supplies and accounts, is inviting sealed proposals until May 9th for furnishing the Naval Home in Philadelphia with electrical supplies during the next fiscal year. Blank proposals will be furnished on application to the bureau or to the navy pay office in Philadelphia. Applicants should call for schedule No. 168.

On May 2d the bureau will open bids for furnishing certain eastern navy yards with the following supplies: Schedule 161—panel boards, cable wire, electrical supplies; schedule 162—cable and annunciators; schedule 164—cable; schedule 165—electrical supplies. Blank proposals may be obtained at the navy pay office in New York or of the bureau. Applicants should designate the schedules desired.

Sealed proposals are being invited until May 11th for furnishing the Signal Corps with 10-drop telephone switchboards, according to specification No. 282, in lots of 10 and 20, prices to hold good until June 30, 1906. Further information will be furnished on application to Gen. A. W. Greely, chief signal officer, Washington, D. C.

The Department of Agriculture is inviting sealed proposals until May 10th for furnishing and laying 35 statute miles of one-conductor telegraph cable between Charlevoix and Beaver Island, Mich. Blanks and information for bidding will be furnished on application to the chief of the Weather Bureau, Washington, D. C.

## Coming Meetings of the Institute.

The next meeting of the Chicago branch of the American Institute of Electrical Engineers will be held on the evening of April 25th at the rooms of the Western Society of Engineers. Malcolm C. Rorty, superintendent of traffic of the Central District and Printing Telegraph Company of Pittsburg, will present a paper on "Effects of Laws of Probability on Telephone Traffic."

The New York meeting of the Institute will be held at 154 West Fifty-seventh Street on April 28th. Instruments and measurements will be discussed, the announced papers being as follows: "Polyphase Metering," by Prof. J. D. Nies of Lewis Institute, Chicago; "Notes on the Use of Instruments on Switchboards," by F. P. Cox of the General Electric Company, Lynn, Mass.; "The Oscillograph and Its Uses," by Louis T. Robinson of the General Electric Company, Schenectady, N. Y.; "Maintenance of Meters," by W. J. Mowbray of the Brooklyn Edison Company.

## Distribution and Dollars.[1]

By C. H. Williams.

When considering the several losses which are to be dealt with in distributing systems, it is but natural to start at the generating station and consider the losses in the regular order in which they are met as the current is conducted from the generating station, over the distributing system to the consumer's lamp.

On leaving the station, the question of line construction is the one which naturally first demands our consideration.

The load which is carried on the several circuits depends upon local conditions, the two most important of which are the average length of the feeders, and the operating cost of generating the current.

The copper losses in the feeders for any assumed load, figured on the operating cost of generation, compared with interest on line investment, fixes the load to be carried; for example, assume the current to be generated at 2,000 volts, and that for a load of 100 amperes a drop of 200 volts is allowable, with an average length of feeder of two miles, which would require the use of No. 0 wire; assume, further, that this load of 100 amperes for two hours per day per year represents the copper loss, which is 14,600 kilowatt-hours. This, at a generating cost of two cents per kilowatt-hour, amounts to $292. If a 200-ampere load has been allowed on the same size of wire, the copper loss would amount to $1,168.

Figuring the copper wire at 18 cents per pound strung, gives for the two sides of the circuit of two miles 21,120 feet, and allowing four per cent. for slack and tie wires, gives a total length of 21,965 feet of wire.

The weight of No. 0 wire is 400 pounds to the thousand feet, which gives a weight and total cost of 8,786 pounds and $1,581.48, respectively, while the interest at six per cent. and depreciation at three per cent., which covers the failing of the insulation for which the price of copper is paid, aggregating nine per cent., amounts to an annual cost of $142.38.

On the previous assumption that the load is equivalent to 100 amperes in the one case, and 200 amperes in the other, at 2,000 volts two hours per day, 365 days in the year, there is an annual output of 146,000 kilowatt-hours in the one case, and 292,000 kilowatt-hours in the second, which, divided into the copper losses, plus the interest and depreciation, amounts, respectively, to 0.00295 per kilowatt-hour for 100 amperes, and 0.00448 per kilowatt-hour for the 200-ampere load, which shows conclusively that the 100-ampere circuit is the more economical.

From the above example, it follows that we cannot predetermine a certain drop which shall be allowed in every case, but each must be worked out for itself.

In secondary work the practice is becoming more and more common of making an interconnected, three-wire network, which allows of close secondary regulation throughout large districts, and also does away with a large percentage of idle transformer capacity, which, consequently, reduces the iron losses, but as this question of transformer-iron loss is best taken up by itself, its discussion will not be considered at this point.

Conditions, such as active lights per 100 feet of territory fed, determine the proper sizes of transformers and feeders, and to facilitate ready interchanging, and prevent the necessity of carrying half a dozen different sizes of fuses and supplies, multiplicity of sizes of transformers and secondary feeders should be avoided.

In considering the connected load on several circuits and on different transformers, it is necessary to know not only the candlepower of the lamps, but the efficiency and voltages as well, for, should a district be designed for high-efficiency lamps of 3.1 watts per candlepower, and then be supplied with four-watt lamps, the entire system would be radically wrong, and a satisfactory service could not be given because of the substitution of four-watt lamps in the place of 3.1-watt, the capacity of the lines and transformers, as well as the generating apparatus, boilers, engines and dynamos, would have to be increased practically 30 per cent.

Herein lies one of the strongest arguments which can be advanced in favor of having the lighting company furnish free lamp renewals, for in no other way will it be possible to control the installation of proper lamps upon their lines.

Turning to the station as the source of regulation, it is found that the only way possible to accomplish it is to install sufficient feeder regulators on the various circuits, and to provide either compensating voltmeters or pressure wires, regulating each circuit separately by hand. In some stations automatic regulators may be made to take care of the changes by properly changing the excitation of the generator, but in the larger stations, where of late large polyphase-current machines are being operated, it is next to impossible to keep the load sufficiently well balanced to maintain equal secondary pressures on the different phases without the aid of circuit regulators working through a considerable range.

In Madison, Wis., the regulation is obtained by supplying two of the six circuits with feeder regulators, and, after paralleling the generators and exciters, regulating them as one unit automatically from a center of distribution of one of the remaining circuits through a pressure wire controlling an automatic regulator, and very satisfactory results are obtained in this way.

The first essential in successful electric lighting is continuity of service, and for this reason it is very important to know that the transformers which are installed are going to withstand any insulation strains to which they may be subjected.

Before placing in service, each transformer which stands between ordinary consumers' circuits and primary circuits subjected to dangerous pressures, should be subjected to a test of at least five times the normal difference of potential between the various parts to which it will be subjected, in practice, and when transformers on transmission lines are used on voltages exceeding 7,500, it is customary to subject them to a strain of twice the voltage for which they were designed.

The next important item, and a very important one, is that of the question of transformer core loss, for this represents the principal difference between the power generated at the station and the power for which the consumer pays. As this is a dead loss, and one which goes on all the time that the circuit is alive, it is very obvious that its magnitude is a matter worthy of careful consideration by the central-station manager. This matter also deserves careful consideration in determining the capacity of transformers which are selected as standards, as the percentage core loss varies as the sizes change, the core loss in a five-kilowatt transformer being nearly double that of the similar losses per kilowatt capacity which are found in a like 50-kilowatt transformer of some standard makes.

Next comes the $C^2R$ loss in both the primary and secondary windings, which, as a direct loss, is not so important, as lighting transformers are usually operated but a few hours per day at full load, but the $C^2R$ loss, together with the core loss, determines the heating in the transformer, and the rise of temperature determines the ultimate capacity, as a high temperature soon deteriorates the insulation, causing it to weaken, break down and give way eventually. Heating in the transformer also causes the iron to age, and this in turn increases the core loss.

Referring to the report of the committee on standardization, we find the actual capacity of a transformer in reality depends to a very large extent on its ability to dissipate the internal heat, and if means can be provided for getting rid of the heat and preventing high local temperatures, the actual capacity of a transformer can frequently be safely increased far beyond its rated capacity.

Another item of importance is the inherent regulation of a transformer, and by regulation is meant the ratio of the drop of secondary voltage from no load to full load. With transformers of poor regulation on the circuits, difficult problems will enter when an endeavor is made to give all consumers equal and normal voltage, which would necessitate pronounced changes in secondary feeders, or a still more objectionable change in a substitution of lamps of different voltages and efficiencies.

The insulation having been proved satisfactory, the interest on the investment for the transformer, together with the core loss in kilowatts, times 24 hours per day every day in the year, times the generating cost per kilowatt-hour, and the full-load copper loss, times the equivalent number of hours during which the transformer would operate full loaded, times the generating cost per kilowatt-hour, give the data necessary for finding the actual cost per annum of operating each type of transformer, when operating on a 24-hour lighting load, so that the other conditions being the same, the most desirable type is determined.

A very forcible example of the rapid change in transformers can be cited in the writer's experience at the plant at Madison, where 460 kilowatts capacity of transformers were purchased under quite stringent specification about five years ago. At the time at which these transformers were purchased they showed a remarkable record, so far as high efficiency, close regulation and low core loss was concerned, but when put into service the depreciation was very high, in that the iron aged very rapidly, increasing the iron loss some 200 to 250 per cent. The insulation failed to withstand the test of time, to the extent that it was finally deemed advisable to dispose of the entire equipment as junk and substitute in its place more modern transformers which were constructed upon better engineering principles, and this was done about a year ago.

Lost and unaccounted-for current assumes such large proportions in some stations that radical measures have to be taken for its reduction. The losses in different systems vary from a small per cent. in small direct-current stations, to as much as 50 per cent. of the station's output in some alternating-current stations where individual transformers are used.

The difference between the amount of electric energy sold and generated represents the loss between the switchboard and the consumers' meters.

The output is registered by the switchboard meters at the station, and the amount sold, by the consumers' meters. Some of the losses which go to make up this difference are legitimate losses, and may be calculated for any system of distribution. The amount which remains after deducting these losses is termed "unaccounted-for current," and is usually made up of faulty registration, leakage and theft of current.

1. Abstract of paper read before the Northwestern Electrical Association in Milwaukee, January 18, 1905. Mr. Williams is president of the association, and when this article was written was superintendent of the Madison (Wis.) Gas and Electric Company. Since, he has become general manager of Wisconsin Light and Power Company at La Crosse.

The power losses in alternating-current circuits may be divided as follows:

Transformer iron loss, transformer copper loss, resistance loss in primary transmission wires, resistance loss in secondary distribution wires, meter shunt loss and lost and unaccounted-for electric power.

The transformer iron losses are figured by multiplying the iron losses per transformer by the number of transfomers on the circuit, and this by the number of hours in use.

All transformers should be tested both for iron and copper losses before being placed on the line, and a careful record kept of these tests, while a check on the iron losses should be made whenever a transformer is brought in, or, if changes are infrequent, certain pilot transformers should be selected and periodic tests made upon them. If tests cannot be made, approximate results may be obtained by assuming the losses as given by the manufacturers, but the latter is not recommended unless conditions absolutely prohibit the testing by the purchaser. When tests are made, care should be exercised to see that the tests are made under running conditions, particularly with regard to voltage and frequency.

The transformer copper losses are figured by the use of previous tests made to ascertain the copper losses on each transformer on the line for one-fourth, one-half, three-fourths and full load.

These losses for all transformers on the line are added together and plotted in a curve, using amperes of load as ordinates, and watts as abscissas. Then for each ampere reading taken on the circuit during the 24-hour test run, the corresponding watts loss is found on the curve. These losses are added up for a period of 24 hours, and the loss for a month is found in the same way as the primary and secondary $C^2R$ losses, as these copper losses are strictly resistance losses.

In figuring primary resistance losses, knowing the size and length of the copper in the mains, the $C^2R$ loss is figured by assuming one ampere to be flowing to a point where the circuit divides, and then assuming that the one ampere divides in proportion to the connected load on each respective branch. The sum of all these $C^2R$ losses is taken as a constant for figuring the all-day losses, which is done by taking the station ammeter readings at intervals of 30 minutes during light load and 10 minutes during peak load. Each of these readings is then squared and multiplied by the constant, and afterward reduced to kilowatt-hours; by considering the time intervals of the readings, the sum of the results of these calculations represents the all-day $C^2R$ loss.

The station output for the period must be measured by the station wattmeter.

In order to obtain the monthly resistance loss in the primary circuit the monthly output, as shown by the station meter, is divided by the output during the test run, multiplied by the number of days in the month. This figure is squared and multiplied by the resistance loss for that of a single day as determined by the test run, and then multiplied by the number of days; this will give the resistance losses as near as it is possibile to calculate them practically, for the losses increase and decrease in proportion to the square of the increase or decrease of the output for the particular circuit under consideration.

The secondary resistance loss is figured in much the same way as is the primary, only it is necessary to use more judgment in the distribution of current in secondaries. The current distributed is determined and divided in proportion to the connected load, and the number of lamps in each block is counted and the number reduced to a basis of amperes, which gives the amount of which to figure the secondary losses.

Quite recently there has been placed upon the market an instrument designed by Mr. C. W. Humphrey, which is invaluable in determining the division of load on the several branches between transformers working on an interconnected secondary network. The instrument consists of a small series transformer, the coil of which is placed on an iron ring, so arranged that a small segment of the ring can be opened and closed over the conductor carrying the current to be measured. The transformer proper, which weighs about two pounds, is connected to 60 feet of flexible duplex cable, the free ends of the cable being fitted with terminals suitable for clamping in the binding posts of a portable ammeter. The ammeter, which in reality is a millivoltmeter properly graduated, reads direct the value of the current flowing in the conductor.

By means of this instrument a large system can be checked up in a single evening. One man takes the small coil to the top of the pole and snaps it successively on to the two outside wires of the three-wire secondaries leaving the transformer, and another man at the foot of the pole on the ground reads and records the load that each side is carrying.

At the Madison plant the first division is made up of the individual circuits—six in number—each circuit occupying one drawer of the card cabinet. Next, each circuit is divided according to the transformers connected on it, a pilot card being used for each transformer, there being but 43 transformers in all for a connected load of 42,000 lamps. Under the head of each transformer appears a minor card for each street which makes up the district fed by the transformer's network of secondaries as far as the junction point between ad[illegible] transformers, and numbered [illegible] card [illegible] each consumer [illegible] one connection [illegible] On the other card [illegible] giving the [illegible] also the equivalent number when reduced to a 16-candlepower basis, also showing whether the same are on No. 1 or No. 2 side of the [illegible] network. A cross index giving the name and street address is also kept for the purpose of easily locating any consumer.

Every lamp sent out is recorded, and once a month all changes in connected load are changed on the cards and new consumers' cards are filled in at the proper place and disconnections are removed, the removals being kept for future reference should the same or another party apply for a connection at the same number.

The next loss to be considered is the meter-shunt loss. A record is kept of all meters sent out on each circuit, their make, size and type, and a record of their test, and from these data the meter-shunt loss may be easily calculated for each month, a careful test having been made of a sufficient number of meters to obtain a constant for the shunt loss of each size and make and type of meter.

The average shunt loss for late-type alternating-current lighting meters may be considered to be about 2½ watts, and as the average loss is so small, one would naturally think that this loss could almost be neglected, but this is far from true; for instance, the station under consideration had one circuit where the meter-shunt losses aggregated more than did the transformer-core losses, being for a certain month 5.93 per cent. of the output for meter-shunt loss and 5.01 per cent. for transformer-core loss, and in many cases these items will be found to be equal.

We come now to the question of the proper selection of incandescent lamps, which is a very important one to the central-station manager. It is undesirable to have more than one voltage and more than one wattage of lamps in use, as they are sure to get exchanged and mixed up, increasing the cost of lamp renewals where the low-voltage lamp gets installed in place of the higher voltage and creating a just cause for complaint where the lamp is operated at a lower voltage than that for which it is designed.

Probably nine-tenths of our consumers, if left to purchase their own lamps, would buy a low-efficiency lamp that would burn 1,500 hours or more, without taking into consideration that fact that to secure the same candlepower they would be paying for about 30 per cent. more current.

If the matter is left to the lamp salesman he will recommend high-efficiency lamps with the corresponding shorter life, because this will naturally increase the lamp sales in his territory. The question of what efficiency lamp should be used is one which lends itself to a comparatively easy solution. For its solution it is necessary to determine:

1. Average regulation on the circuit.
2. Generating costs, which are proportional to output.
3. The investment made per kilowatt capacity.
4. The average consumption per lamp per year.

Having determined that the regulation is maintained within three per cent., we find from standard-lamp specifications, assuming that the first cost of the lamp is 17 cents and that the cost of photometering, handling and renewing costs 1½ cents each, as follows:

| Efficiency. | Life. | Lamp Cost in Cents per Kilowatt-hour. | Cost of Renewing per Kilowatt-hour in Cents. | Total Lamp Cost per Kilowatt-hour in Cents |
|---|---|---|---|---|
| 3.1 | 263 | 1.30 | 0.114 | 1.414 |
| 3.5 | 492 | 0.618 | 0.054 | 0.672 |
| 4.0 | 910 | 0.29 | 0.026 | 0.316 |

A 3.1-watt lamp burning 263 hours would consume 16x3.1 times 263, or 13,044.8 kilowatt-hours, which, divided into 17 cents and 1½ cents, gives us the cost per kilowatt-hour for the lamps and for the labor of renewing them, or, added together, a total cost per kilowatt-hour for lamp renewals.

As a simple proposition, let it be considered that the plant is selling light to itself, which will bring the interest of the producer and consumer to a common ground in considering the best efficiency to be selected. It must be considered that it is light which is being sold and not kilowatt-hours, for it is light which the consumer wants, and other things being equal he does not care whether he obtains that light through a 3.1-watt lamp or a four-watt lamp.

If light is being supplied through a 3.5-watt lamp and a change is made to a four-watt lamp, the station will be called upon to increase its expense under two different heads.

In the first place it will have to increase its capacity throughout in direct proportion to the increased wattage of the lower-efficiency lamp, which, in the case under consideration, will amount to an increase of 14.3 per cent.

The investment per lamp installed can be easily figured for any station knowing the total investment and the connected load, and in this case we will assume that the station investment is $10 per lamp, which will probably be a close average. If interest is taken at six per cent. and depreciation covering the general equipment is taken at six per cent., we have an additional cost per lamp of 12 per cent. on the 14.3 per cent. of the $10 per lamp investment, or $0.1716 per lamp per year.

[illegible] should be placed in the junk pile.

With a station having a very pronounced peak load for a very few weeks during the holiday season a material saving may be found by the substitution of a high-efficiency lamp for the short interval of time during which the peak load lasts. For instance, at Madison, just previous to the holiday season, there are about three weeks when the peak load on the commercial districts overlaps the peak load on the University districts, so that the combined peak is very high and sharp and lasting but a few weeks out of the year, it is very narrow when plotted with months of the year as abscissas.

Suppose the station is fully loaded so that any and distributing equipment; it is perfectly proper, additional load will require additional generating then, to credit on one side of the balance the interest and depreciation of the investment which will be saved by the substitution of 3.1-watt for a 3.5-watt lamp, for with the same equipment of station and line it will be possible to furnish current for 11.4 per cent. more lamps, and against this must be charged, on the other hand, the additional expense which will be incurred by the increased lamp renewals of the higher-efficiency lamp and the cost of making the changes.

As shown above, with a three-per cent. regulation the 3.1-watt lamp gives a life of 263 hours against 492 hours for the 3.5-watt, or there is a loss of lamp life of 229 hours per lamp for each substitution so made, and where the 42,000 lamps are exchanged this means a loss of 9,618,000 lamp-hours of lamp life, and, as lamp-renewal costs are made up of the cost of the lamp plus the labor changing and photometering, the cost of per lamp-hour would equal

$$\frac{17 - 1.5}{492} \text{ equals } \$0.0037 \text{ for}$$

renewing alone, and having lost 9,618,000 lamp-hours by this change, the expense incurred, due to additional lamp renewals, would amount to $3,558.66, provided all of the useful life of each lamp was used up, or the lamps each burned 263 hours.

During this month the actual burning of each lamp averaged about 45 hours, so instead of having expense of $3,558.66 for the increased lamp renewals which would be occasioned should all the lamps burn 263 hours, the expense would be

$$\frac{45}{263} \text{ equals } 17.1 \text{ per cent. of } \$3,558.66, \text{ or } \$622.76,$$

and to bank against this expense there would be saved the interest and depreciation at 12 per cent. on 11.4 per cent. of 42,000 lamps at an investment of $10 per lamp, or $5,745.60, or by such a substitution a saving of $5,122.84 would be effected per annum.

## Discussion (in Abstract).

H. Almert, Oak Park, Ill.: I would like to ask Mr. Williams what instruments he finds necessary; I do not mean the makers' names, but what kind of instruments he uses in collecting these data.

The question of standardizing the sizes of transformers is new to me, but it is an ideal result. Mr. Williams seems to be able to do that in his community. I doubt very much whether the same result can be accomplished in any of the properties with which I am connected. I would be only too glad if we could, but in the outlying districts, which are not necessarily very distant in small towns, the work becomes scattered and feeder capacity and secondary distribution become a serious question very early and we are not far from the station or sub-station before individual transformers are necessary.

Mr. Williams: In regard to the labor that is saved in getting up the records and maintaining them, for instance, in the determination of resistance losses on our circuits, I think there is more labor put into the collection of those data than anything else. We worked about three months, using one man's entire time, getting that information. After the information was once recorded it required only a small amount of labor to keep it up. Any additions or changes to our lines are recorded and the corresponding resistance changes in our circuits are recorded at the same time. For instance, in the loss in our meters and transformers those records are taken. The meter man makes records of the losses in every meter that goes out, and it is part of his regular work. On our transformers our su-

perintendent of distribution looks after the testing. All this work has been done by men whose salaries are not very high, who have started in at $50 a month.

In regard to the instruments used in getting the data, our division of load between the different sides on three-wire secondary networks and the division between transformers, is determined almost entirely by means of the instrument spoken of, gotten out by Mr. Humphrey of Denver; and we find that invaluable in checking up the balancing of our system. We find that in a very short time our systems become unbalanced on the different sides of circuits and that poor regulation will result if the thing is not watched very closely.

During this time of heavy load in the fall we take some readings every night on certain transformers, and that work is carried on by the superintendent of distribution.

In regard to the different sizes of transformers used and the adopting of certain standard sizes at Madison, we find that the five and 15-kilowatt capacities suit our cases almost exactly. It may not be possible to limit the two sizes, but the way we do, if we have a district that is heavily loaded, for instance, a commercial district, we may have three 15-kilowatt transformers in one block. During the time of heavy load we figure on systematically overloading all of those transformers. They are all tied together and we are able to get better distribution between the three transformers than we would by the use of one transformer. The losses on the three transformers might be higher than the losses on one transformer, but in all times of the year, except during peak load, we cut out whatever transformers are not overloaded on the peak. We figure on running them up to their practical limit and we do not have any regard to their rated capacity. For instance, we get a 15-kilowatt transformer in the commercial district overloaded and we put in a five-kilowatt with it for the time it is necessary to help it out. In a light commercial district we might start in with a five-kilowatt transformer and make a jump at the time when that five-kilowatt transformer became 100 per cent. overloaded to the 15-kilowatt transformer, and so far we have found it very satisfactory to only make use of the two sizes.

Mr. Almert: How do you go at it to get your resistance losses?

Mr. Williams: We first map out our circuits, giving on the map the exact length and size of the feeders. Then we figure the exact resistance, which is determined when you know the size and length of the wire, and we figure one ampere flowing from the station to the point where the first division occurs, and we consider that that one ampere divides in direct ratio to the capacity on the different divisions from the point where the circuit first divides.

W. D. Kurz, Marinette, Wis.: I want to ask some of the members if they have any experience in the way of gasoline plants. In our particular city, Marinette, we are getting quite a little competition in that line, in the lighting, of course. Our company is fortunate enough to control both the gas and electric plants, but within the last six months we have had about 20 gas lamps installed in different business places. Of course, the insurance people tell us that it is not the thing, but it seems that they go right on and put them in. Now, the question is, is there any way that can be brought about to prevent that? I suppose there are similar cases in different places.

T. F. Grover, Fond du Lac, Wis.: I would like to hear from any other plants in reference to this matter. I think the way to remedy this trouble principally is to stay on our own grounds and meet it.

Mr. Williams: We have no competition at present; that is, we have no gasoline lamps in use at Madison. We try to show the people that we can give them either gas or electric lamps cheaper than they can furnish the gasoline lamps and maintain them, and we keep constantly before the public the fact of the danger of gasoline installations. In the last six months we have not had a gasoline installation working in Madison.

R. N. Kimball, Kenosha: I do not see how it is practicable in the residence district to keep down to two sizes of transformers. In many places business is small and if you limited yourself to two sizes your core losses would be out of proportion to the kilowatts used. We have had the same experience as Mr. Williams has had in checking transformers. We have found in some cases losses five to 10 times as much as they would be in putting in new and modern transformers, and in some places we have made a rough check with a recording wattmeter, checking the core losses in that way, which is very simple, where people have not got proper instruments to do it.

Mr. Williams: We only use one size of residence transformer and we find when we bank our cost of copper against cost of transformer and cost of loss in the copper it figures out that in no place do we want to put in more than a five-kilowatt transformer. Of course our town is limited geographically in a way that most towns are not, for we have lakes on two sides of our city, and the expansion can only be in two directions and it congests the district.

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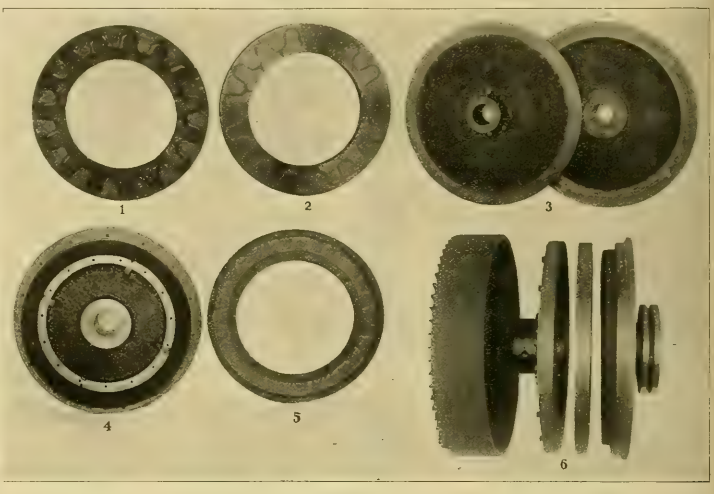
The proposition to issue $6,000 in bonds for a lighting and heating plant was carried in Ponca, Neb.

## Cutler-Hammer Magnetic Coupling.

The Cutler-Hammer Manufacturing Company, Milwaukee, Wis., has been carrying on experiments for several years in the development of magnetic couplings and accelerators. The Cutler-Hammer Clutch Company has now been organized for the manufacture and sale of this apparatus, and it announces that it has designs and equipment for the manufacture of a complete line of these couplings and accelerators.

The magnetic couplings are of the simplest possible form for a device of this nature. They consist of two cast-steel rings mounted concentric with the shafts to be coupled. One of these rings has an annular groove, in which the magnetizing coil is securely fastened, the other ring acting as the armature or keeper. A cross-section of the two members shows the well-known form of a horseshoe magnet and its keeper.

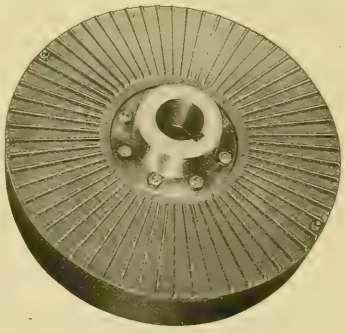



1. Field in the Rough. 2. Field Babbitted. 3. Parts of Magnetic Coupling.
4. Back Plate with Coil. 5. Back of Field. 6. Parts Before Being Assembled.

DETAILS OF CUTLER-HAMMER MAGNETIC COUPLING.

This device is applicable wherever the shafts to be coupled are at rest or both running at the same speed when the coupling takes place. It can also be used to cut out a machine or section of shaft when in rotation, giving a prompt and absolute release regardless of load.

The magnetic speed accelerators are used for the same purpose as the ordinary friction clutch, except that they have a much wider range of application. The torque in these clutches is the sum of two components, one due to friction and



CUTLER-HAMMER MAGNETIC COUPLING ASSEMBLED.

one due to eddy currents induced in the armature plates, by the magnetism of the field, which is specially constructed to secure this result. At the moment of starting the induction component of torque is a maximum, dropping off as the driven member attains speed.

In starting up a load with the ordinary friction clutch it is a noticeable fact that the pressure on the operating lever is eased the moment the load begins to move, in order to obtain a smooth start. In the accelerator this is accomplished automatically by the dropping off of one component of the torque, the result being a remarkably smooth acceleration, which can be controlled, if desired, by means of a rheostat.

In practice these accelerators find their readiest application to that class of service where it is desired to control moderate or large-sized units by some form of automatic device, such as a float switch, relay or electrical contact of any kind. For most work they can be thrown directly across the line without danger from shock or jar, as it is practically impossible to produce a sudden jerk with them.

The simplicity of their construction renders them easily balanced for speeds much higher than that for which the ordinary clutch is available. The small currents used in the magnetizing coil results in a simple and cheap controlling apparatus, two amperes being sufficient to control a 100-horsepower unit at the ordinary speed.

They are designed and built for heavy service, and ample wearing surface is provided, so that no adjustment for wear is necessary. One of these clutches now in operation in the steel-plate mill of the Riter Conley Company at Leetsdale, Pa., has been starting a 100-horsepower load 200 to 250 times a day for the last three months, not having had any adjustment whatever, and is still operating as satisfactorily as when first installed.

In connection with gear trains this device is also used to operate a machine at different speeds, and this arrangement has proved very satisfactory in practice.

The principles of design and construction, as well as many applications of these accelerators, are well protected by patents, a number of patents having been issued on April 4th to the Cutler-Hammer Manufacturing Company, covering several inventions of Mr. H. H. Cutler, chief engineer of the company. These patents cover three distinct inventions which are radically new to the electrical art.

No. 761,411 discloses the magnetic speed accelerator, to which allusion has already been made. The patent shows the accelerator running in a bath of oil, and provided with large composite surfaces for resisting the frictional wear between the two members of the accelerator.

No. 786,425 discloses a magnetic speed accelerator which utilizes solely the principle of induction for creating a torque during acceleration, this being supplemented by friction only when desiring to operate the load at full speed. This device will not be placed on the market at present. No. 786,420 illustrates another form of accelerator similar to that described in the preceding patent, but differing in construction. No. 786,412 discloses a modified form of the type of accelerator described in patent No. 761,411. No. 786,413 covers a method of control for the types covered by patents Nos. 786,425 and 786,420. No. 786,414 covers a method of power transmission using a magnetic speed accelerator which possesses the inherent property of gradual acceleration. No. 786,415 discloses means for starting single or polyphase motors under load without disturbing the power factor on the lines, and covers means for producing a suitable current for energizing the accelerators. No. 786,416 discloses a modification of the above, using small direct-current generators for producing magnetizing current for the accelerators. No. 786,417 illustrates and covers a method of starting synchronous motors under load. No. 786,418 covers a method of improving the power factor on the line in starting alternating-current motors under load, utilizing the controllable, joint inductive and frictional slip of a magnetic accelerator mounted between the motor and its driven load.

No. 780,419 discloses a method of operating trains of cars driven by alternating-current motors, arranged on the multiple-unit plan, so that all the motors may be started, stopped and reversed from any car on the train. The preferred system here is single-phase induction motors, provided with accelerators.

Patent No. 780,421 illustrates a system of apparatus for motor control especially adapted for the operation of large newspaper presses. The system utilizes a large motor and a small motor designed to operate the press at full speed and at low speed, respectively. The magnetic clutch connects either motor to the driving shaft at will, and the speed of both motors is varied by one controller.

Nos. 780,422, 780,423 and 780,424 illustrate modified forms of a multiple-unit system of controlling trains of cars using direct-current generators. The basic patents covering this system of control have been issued and are numbered 776,220 and 777,778. The detail patents covering the practical application of this system have not as yet been issued, but show a much simpler form of control.

## New Alternating-current Apparatus.

In view of the extensive and increasing use of induction motors, the American Electric and Controller Company of New York has added to its

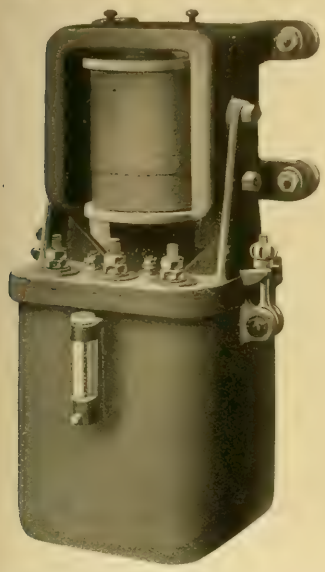


FIG. 1. NEW ALTERNATING-CURRENT APPARATUS.—THREE-PHASE, 100-AMPERE SWITCH.

direct-current work a department devoted entirely to the manufacture of alternating-current apparatus. Simplicity and reliability have been the keynotes in this work, with the result that the starters, solenoids and electrically operated switches are of high grade.

A switch that can be operated from any point on an alternating-current system of distribution is one of the problems that has been successfully solved, it is said. Fig. 1 illustrates one type of this switch designed for 100 amperes capacity, three-phase. The solenoid is actuated by a pushbutton or small snap-switch, which can be located at any distance from the point where the switch is installed. The switch is so designed as to take advantage of the peculiarities of alternating-current solenoids, at the same time combining simple construction in a small space. To users of small induction motors in connection with cistern pumps in hotels, apartments and office buildings, as well as for ventilating systems, etc., this switch is destined to be useful.

Another important field for this apparatus is its use in throwing in and out of commission one or more transformers, where, in accordance with the latest practice, the heavy circuits are supplied from a bank of transformers connected in parallel. These, during certain periods of the day, when the load drops off, can be successively thrown out of service by the electrically operated switch controlled from the central station, or can be arranged to operate entirely automatically with the rise and fall of the load.

Still another application of this switch is in connection with auto-starters or grid-resistance starters for motors of large size used in connection with ventilating systems, plunger elevator systems, pneumatic-tool equipments, and, in brief, wherever it is desirable to stop and start a motor either automatically or from some distant point. In central stations these switches may also be used as synchronizers, due to the fact that they can be operated [illegible] grades of the [illegible]

[illegible] of distribution for both [illegible] a few of the apparatus [illegible]

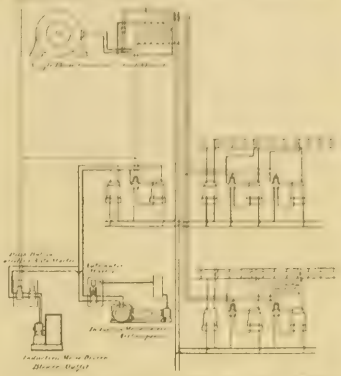


FIG. 2. NEW ALTERNATING-CURRENT APPARATUS.—SYSTEM OF DISTRIBUTION FOR BOTH POWER AND LIGHTING.

shown worked out. By reference to the cut it will be seen that in this particular case all solenoids connected with the control of the apparatus work on the low-potential side of the transformers.

## Choke Coils for the Protection of Power Circuits.

The lightning arrester and choke coil for the protection of power circuits against the destructive effect of lightning and heavy static strains and searching effects, originating in the circuits themselves are an important part of an installation. This apparatus as a consequence is given much attention by manufacturers. A carefully prepared article upon this general subject by Mr. R. Scott appeared in the issues of April 8th and 15th of the Western Electrician, in which some valuable hints were given concerning the construction and application of these devices.

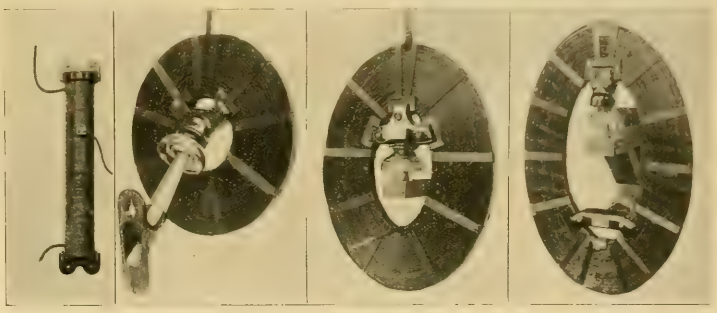


Fig. 1. Fig. 2 Fig. 3. Fig. 4

CHOKE COILS FOR THE PROTECTION OF POWER CIRCUITS.

The choke coil operates on the principle that a coiled conductor presents a greater resistance to the passage of an electric current of high frequency than to one of relatively low frequency. Therefore, though a coil may have a very slight resistance to direct current or to alternating current of from 3,000 to 7,200 alternations, its resistance to lightning discharges or other static disturbances, which always occur very suddenly, may be very great.

In order that the choke coil may perform its duty successfully, very great care must be exercised, both in its construction and in its installation. The Westinghouse Electric and Manufacturing Company, which was a pioneer in the use of these devices as a means of protecting electrical apparatus, has for the last 12 years been engaged in the manufacture of choke coils and the development of protective appliances for circuits of both high and low potentials, and good apparatus has been evolved by its researches in this direction.

For low-voltage circuits, such as railway work, the form illustrated by Fig. 1 has been developed. The conductor is coiled in the form of a cylinder and is mounted on a wooden spool, each turn being insulated from its neighbor, and the completed coil being skillfully protected from moisture and dampness. The lightning arrester is connected to a terminal plate laid across a few turns of the line end, to provide a selective path to earth.

In alternating-current work, a disk-form of coil has been found to give the best protection. Three forms of this coil are illustrated in Figs 2, 3 and

[illegible] oped. It is very strong and the insulator which accompanies it has given excellent service at the [illegible]

Coils of this type vary in the size of the conductor and in the number of turns, depending upon the current and voltage of the apparatus which they are intended to protect. They are manufactured in a great many different capacities, ranging [illegible] 000 volts, inclusive. Coils of the same type have been successfully used for the protection of apparatus with a potential lower than 2,500 volts, where the conditions are such as to require protective devices of this form.

For apparatus with potentials higher than 25,000 volts, two forms of choke coils have been developed, viz., the oil-immersed choke coil and the static interrupter. Oil immersion improves the insulation, while the addition of a condenser, such as is used in the static interrupter, makes it possible to reduce the relative size of the coil, at the same time providing increased protection. Either of these devices can be made to afford effective protection against powerful disturbances. Both are immersed in oil and can be either of the self-cooling or water-cooled type. The oil-immersed choke coil is mounted on a wooden frame and is ventilated in such a way as to maintain a temperature uniform

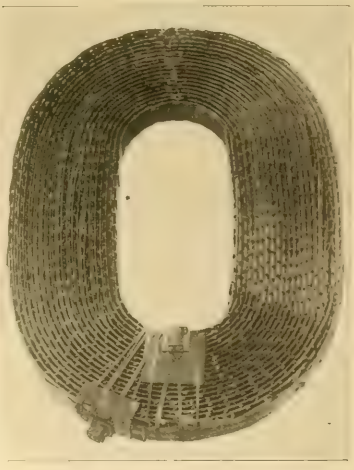


FIG. 5. CHOKE COIL FOR STATIC INTERRUPTER.

in every part. Fig. 5 illustrates a coil of this type. The ventilating ducts, which are readily seen in the illustration, when filled with oil, add greatly to the insulation between layers, and they are so arranged as to promote a natural circulation of

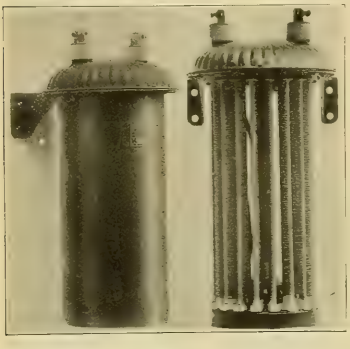
oil around the coil. The cases in which these coils are mounted in general resemble those standard for Westinghouse transformers. They are constructed with the greatest care and include fiber tubes designed to protect and insulate the leads.

Many designers of electric plants seem to believe that the number of lightning arresters determines the number of choke coils which should be used, but such is not the case. As has been said, lightning arresters relieve the outside lines of static disturbances, while the choke coils protect the inside apparatus from static disturbances, not only those which occur on the line, but also those which are set up by switching. Consequently, in general, there should be but one arrester connected with each outside line and one choke coil or static interrupter connected to each motor, generator or transformer switchboard lead.

## Resistance for Direct-current Arc Lamps.

When a group of arc lamps is connected in series across a circuit, the drop across the lamps seldom equals the difference of potential between the lines, and it is therefore necessary to introduce a regulating resistance. The accompanying illustration shows the resistance, with and without casing, which the Westinghouse company uses with its direct-current multiple and series-multiple lamps. One resistance is used with two lamps in series on circuits of 220-250 volts, and with five lamps in series on 550-600-volt circuits two resistances are used.

The resistance may be suited to a varying range



RESISTANCE FOR DIRECT-CURRENT ARC LAMPS.

of conditons and is well insulated and thoroughly waterproof, besides having a neat appearance. The wire furnishing the resistance is wound on asbestos-covered bars, which are insulated from the frame by porcelain blocks. This combination of asbestos and porcelain affords protection against fire. A terminal block at the bottom furnishes means for adjustment, so that five different resistances may be obtained by merely changing these connections.

The case and cap are finished in black. The binding terminals are insulated from the metal top by heavy petticoated porcelain insulators, both the terminals and insulators having square stems, which prevent them from turning and becoming loose, or twisting off the connections. By means of substantial brackets, just under the cap, the assembled outfit may be fastened with screws to the wall or other suitable support. The weight of the resistance complete is 30 pounds.

## Magnetic Club Dinner.

The Magnetic Club gave a dinner for Thomas A. Edison in New York city, on April 13th, at the Hotel Astor, which a number of well-known men attended. Among them were Clarence H. Mackay, President R. C. Clowry of the Western Union, President F. P. Fish of the American Telephone and Telegraph Company, General Manager U. N. Bethell of the New York Telephone Company and H. D. Estabrook of the Western Union Telegraph Company. All kinds of electrical signaling devices were utilized during the dinner for the amusement and convenience of the party. Just before the dinner was served the table was lit with candles, and at a given signal a brilliant flood of electric light illuminated the room, as the diners cheered the entrance of Mr. Edison.

## Sarnia Tunnel may Be Electrically Equipped.

Bion J. Arnold of Chicago has been engaged as consulting engineer in the preparation of plans and specifications for the equipment with electricity of the steam-railroad tunnel connecting Port Huron, Mich., and Sarnia, Ont. The tunnel is owned by the Grand Trunk railroad and is known as the Sarnia Tunnel. The work to be done includes the power house, distribution system and deciding upon the method of hauling the trains through the tunnel.

## Telephonic Aid in Hearing Sermons.

In the First Baptist Church in Chicago an unusual use is made of the telephone, by which members of the congregation who are partially deaf are enabled to hear the preacher. On a recent Sunday Mrs. Mary F. de Blois listened to a sermon for the first time in 25 years, and it was one delivered by her son, Rev. Austen K. de Blois, the pastor of the church, none of whose sermons she had ever before heard.

A special apparatus was installed in the church. It consisted of a telephone system such as is ordinarily used for branch-exchange work. The transmitters, of which there were four in multiple, into which the pastor's voice was directly spoken, were placed on the pulpit in an oblong box about 18 inches long. From the transmitters, wires were carried down to the floor, and under the carpets, the lines, of which there were eight in all, leading to eight receivers, which those who were "hard of hearing" could hold conveniently while sitting in their pews. It is said that the Rev. Mr. de Blois spoke in his usual tones and that the sermon was as distinctly heard by the persons using the telephones as by the rest of the congregation.

The battery for the system was placed beneath the floor, while the box holding the transmitters was out of sight of the congregation. Thus there was nothing unsightly about the installation.

## Telephone Rates in St. Paul.

The corporation attorney of St. Paul, Minn., says that the City Council has authority over telephone rates and can order a reduction in the rates of the Northwestern Telephone Exchange Company (Bell). The franchise of the Twin City Telephone Company (Independent) fixes the rates which it can charge, but in the case of the Northwestern the city has the power to regulate its charges. The attorney bases his view upon the general principle that such power was delegated by the state to the city in the act enabling cities to frame their own charters. He concludes that there is no reason why the Northwestern's rates should not be ordered reduced to those of the Twin City. He further says that subscribers in the Midway district, connected with the Minneapolis exchange, cannot demand connection with the St. Paul exchange without paying the toll.

## Telephone News from the Northwest.

The telephone fight at Springfield, Minn., has been brought into the Legislature by a resolution being passed directing the attorney-general to investigate the complaint of business men of that town that unfair means were being used to defeat an Independent telephone company there. It is charged that the offending telephone company has engaged in the general merchandise business, selling goods at cost for the purpose of destroying competition of Independent rural lines, and of coercing the business men who are interested in the local company into patronizing the exchange and connections of the offending company.

The council of Grand Forks, N. D., has refused a franchise for a competing local exchange for the Tri-state Telephone Company.

The Twin City Telephone Company will build a toll station, to handle long-distance calls into the Twin Cities, at Merriam Park, between Minneapolis and St. Paul. A building to cost $30,000 is to be erected.

At Big Lake, Minn., a local and rural telephone company has been formed with $50,000 capital stock. John M. Haven is president.

The Gregory County Farmers' Telephone Company will construct a line from Fairfax, S. D., to Echo and Baker.

H. G. Slater, the original builder of the Waupaca (Wis.) Citizens' Telephone Company, has bought in the plant at a chattel-mortgage sale, and the exchange is to be put in first-class shape at once.

The Northwestern Telephone Exchange Company will soon occupy the toll-exchange building in East Minneapolis, which is to receive toll calls for both St. Paul and Minneapolis. The toll boards at both cities will be concentrated at the new station.

The contract for constructing a telephone system at Sacred Heart, Minn., has been let to the Kellogg Switchboard and Supply Company.

Attorney-general Young of Minnesota has decided that the Frazer bill, placing telephone and telegraph companies under the jurisdiction of the Railroad and Warehouse Commission, is constitutional.

There is talk of holding a convention at New Ulm, Minn., for rural telephone representatives for that section in June.

The Clark County Mutual Telephone Company of Clark, S. D., has been incorporated with $15,000 capital stock.

The Nicollet County Telephone and Telegraph Company will build a local exchange at Nicollet, Minn., having been granted a franchise. The company has also secured a franchise in Cleveland, Minn.

The Vilas Telephone Company of Vilas, S. D., has been granted a franchise for a local exchange.

The Pringle Telephone Company of Pringle, S. D., has been incorporated with $10,000 capital.

The Watkins (Minn.) Telephone Company has been incorporated with a capitalization of $10,000. H. J. Wartman is one of the directors. R.

## Indiana Telephone Items.

The following telephone companies were incorporated during the last week and will build exchanges and install telephone systems: Vevay, Mt. Sterling and Sugar Branch Telephone Company of Mt. Sterling—capital stock $2,500, B. N. Davis, J. B. Ranseyer and W. O. Marble, directors; Bringhurst Co-operative Telephone Company of Bringhurst—capital stock $4,970, Albert B. Cohen, R. Q. Tidrick and C. M. Smock, directors; People's Mutual Telephone Association of Topeka, Lagrange County—capital stock $2,000, C. F. Massenan, Charley Mann, G. E. Miller and J. H. Barr, directors; Farmers' Co-operative Telephone Company of Milton—Wilbur Dodridge, president, and L. W. Besson, secretary.

It has always been the policy of the Bell Telephone Company to refuse to connect its lines or exchanges with others using any except Bell instruments, on which a high royalty was charged. It is said the Bell has defeated legislation in several states to compel connections. This policy has resulted in the country being covered with a network of rival lines and rival exchanges. Now it is announced that the Bell company has contracted with a number of Independent companies in Indiana for connections and will make the change in policy general. The Indiana Independents consider it a victory won, and yet they are suspicious of the change and the ultimate purpose.

The Mutual Telephone Company of Shelbyville is preparing for the work of installing 66,000 feet of conduits. The exchange apparatus will be a combination of the automatic and manual. The cost of the improvements will approximate $72,000.

The City Council of Tell City has granted a franchise to the Eckerty-Branchville and Cannelton Telephone Company to enter the city. Heretofore the Cumberland (Bell) company enjoyed a monopoly of the business.

Severe hailstorms put a large number of Indiana telephones out of service last Monday. At Seymour 200 were thrown out of service; at Jolleittville both the local and long-distance service was crippled, and at Nashville, Brown County, chunks of ice knocked the telephone wires down and crippled the service. S.

## Michigan Telephone Matters.

The Independent telephone companies of the eastern portion of the state held a meeting in Northville recently for the purpose of organizing an eastern district association, similar to those already formed in the northern, central and western portions of the state.

The Michigan State Telephone Company, at its annual meeting of stockholders, held in Detroit last week, re-elected the old directors and officers. The report of the transactions of the company for the 11 months ended December 31, 1904, shows $1,017,724 expended for improvements and extension of exchanges and toll lines and other betterments. It was announced that between February 1 and December 31, 1904, the company secured 10,736 new subscribers, making 66,342 subscribers receiving direct service. Recently the company reconstructed the exchange at Mount Clemens and moved into new quarters with entirely new apparatus.

The Farmers' Mutual Telephone Company of Hart has been organized to furnish service in Oceana County. C. W. Taylor is president. This telephone company will compete with the Lake Shore Telephone Company and the local Independent telephone company.

The Grand River Telephone Company of Grand Rapids has been incorporated with a capital stock of $3,000. W.

## Ohio Telephone Notes.

A report sent out from Toledo that the Bell people are buying up the stock of the Home Telephone Company has been vigorously denied by the management of the latter. J. S. Brailey said that two men interested in the Independent plants at Louisville and Kansas City had purchased about 12 per cent. of the stock of the Toledo company, all of which was held outside of Toledo. They secured this for capitalists interested in the Independent movement. About 85 per cent. of the stock, he said, is held by Toledo people and will continue to be held by them.

The Northwestern Toll Line Company has declared a semi-annual dividend of 2½ per cent., payable April 12th.

The Bell people have begun a lively campaign for the control of the telephone business in Northern Ohio. The Independents secured control of the plants at Chagrin Falls and Berea, where the Bell people expected to gain a foothold, and now the latter is putting in an automatic exchange at Chagrin

Falls and will follow with one at Berea. There they expect to operate so cheaply that they will have the advantage in rates. It is said that they are after plants in a number of the other small towns in that section, where the Independents have a good hold.

The novelty of a trial by telephone was witnessed in Columbus and Fostoria a few days ago. Chief of Police O'Connor called up the mayor of Fostoria and reported the facts in an arrest at Columbus. Mayor Cunningham said that he would convene court, hear the plea over the wire and render a verdict. When the plea had been made the defendant was found guilty and the mayor assessed the defendant the costs of the case, including the telephone tolls.

An increase of capital stock from $15,000 to $25,000 has been made by the Beaver Dam Telephone Company of Beaver Dam. C.

## TELEPHONE MEN.

Charles A. Casperke has succeeded George E. Bernecker as local manager of the Cumberland Telephone and Telegraph Company at Jeffersonville, Ind.

H. A. Johnson has resigned as manager of the American Telephone and Telegraph Company in St. Paul and will remove to California. P. K. Hardan of Chicago succeeds him.

Charles Wilson, H. C. Cooke and A. R. Lawrence have purchased the local telephone exchange at Granger, Texas, from R. H. Bradley, and will put in a new switchboard, etc.

Fred S. Myers, manager of the St. Cloud (Minn.) office of the Northwestern Telephone Exchange Company, has been promoted to have charge of the company's office at Sioux Falls, S. D.

J. L. Tucker of Minneapolis has succeeded John J. Maloney as wire chief of the Northwestern Telephone Exchange Company at Mankato, Minn. Mr. Maloney has been made manager of the company's office at St. Cloud, Minn.

F. A. Pickernell of Boston, chief engineer of the American Telephone and Telegraph Company, is, or was recently, in Salt Lake City, Utah, on business connected with the offices of the local company.

## MANUFACTURERS AND DEALERS.

The Farr Telephone and Construction Supply Company of Chicago gives a "heart-to-heart talk" to its customers and those interested, in a little pamphlet it has issued concerning Farr telephones, and illustrating some neat and substantial telephone sets.

The S. H. Couch Company of Boston, Mass., manufactures an extensive line of telephone apparatus, judging from its new bulletin, No. 10. The bulletin does more than simply enumerate the various types of telephones, giving three circuit diagrams, which are of considerable interest, accompanied by explanations of the systems.

Quite unusual in appearance, and valuable to the user and buyer of telephones alike, is the new wall hanger which is being sent out by the Swedish-American Telephone Company of Chicago. It describes the Hercules No. 99 telephone and shows a diagram of the connections of the subscriber's set and also a diagram of the ringing circuit from the station to the subscriber's apparatus.

The Central Electric Company, Chicago, is sending out to its telephone customers a new catalogue and price list, in which it lists telephones, appliance and construction material. On the first page of the book is a partial view of the company's quarters at 207-209-211 East Jackson Boulevard. A complete line of telephones, parts and material is listed. The catalogue is an attractive one, and the company requests all users of this material who do not receive a copy to write for one.

The Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., reports having closed contracts for switchboards for St. Marys, Ohio, Pageton, W. Va., Alma, Neb., Rayston, Ga., Perry, Ga., Elko, Ga., Aurora, Ill., Chicago, Ill., Waterford, Ohio, Lawrence, Kan., Greensburg, Ind., Dunbar, Ohio, Watertown, Ohio, Bladensburg, Ohio, Louisville, Ky., Davis, Ill., Minonk, Ill., Amboy, Ind., Fairport, Kan., Boise, Idaho, Marion, Mich., Rippey, Iowa, Meadville, Mo., Fenton, Iowa, and Center, Ind.

A complete system of 1,500 lines is to be installed for the Southern Independent Telephone Company of El Paso, Texas, by the Automatic Electric Company of Chicago, which is to install a complete central-office equipment having an immediate capacity of 1,500 lines and an ultimate capacity of 10,000 lines. The switchboard will be the regular standard type consisting of 15 units, each unit carrying the necessary switches for handling 100 lines. Five additional units will be installed, partially in blank, so that the plant may be increased to 2,000 subscribers by simply adding the additional shelves.

## CORRESPONDENCE.

### Great Britain.

London, April 5.—It is announced that the arrangement which was [illegible] between the postmaster-general and the Marconi Wireless Telegraph Company, by which messages were to be exchanged at inland telegraph offices for transmission by means of pure telegraphy, to places overseas via Atlantic, has been discontinued. The arrangement was in use for a short time and the publication of its discontinuance has caused no little surprise. The reason for it we are only left to conjecture, but the explanation given by the Marconi company is that the arrangement has been suspended pending a rearrangement of the plant at Poldhu. From the Postoffice side no reason for the abandonment of the service has been forthcoming.

Electric-lighting authorities in Great Britain have experienced a difficulty for many years in the matter of supplying electrical energy over the borders of their areas. The act of Parliament which regulates this has laid it down that under no circumstances, without the consent of Parliament, may a company or local authority supply beyond the limits of the area defined in its provisional orders. Several difficulties have arisen in consequence of this, such, for instance, as in the case of a neighboring authority requiring a supply in an emergency, owing to a breakdown. A curious case occurred quite recently, and although affecting only two very small districts the instance serves to illustrate the point. An electric-supply company obtained powers a few years ago to supply in Weybridge, a district a few miles to the southwest of London. A generating station was erected and supply started. Last year the same company obtained powers to supply in Walton, the next parish, but under the act referred to above it was prevented from supplying that district from the Weybridge generating station, although it was in its own territory that it wanted to supply. After an application to the law courts the company was compelled to go to the expense of promoting a bill in Parliament to secure the necessary consent. The two electricity supply bills which were introduced by the government last year and the year before, but abandoned, sought to remedy this state of affairs. No one has yet suggested that every supply authority should have a roving power to go anywhere outside its own district, but everyone is agreed that many points in the present law of electric lighting could be cleared up if the government showed the necessary disposition.

The proposal to inaugurate a system of pneumatic parcel dispatch, such as already exists in some American cities, is not likely to get very far forward in Parliament this session. A bill which has been deposited is being opposed on the ground that the enormous breaking up of the streets involved should not be allowed until the report of the Royal Commission on London Traffic has issued its report. The commission is paying particular attention to this matter, and as the view of the government itself is to the above effect, it is quite possible that the bill will be suspended for this session.

The unsatisfactory condition of the electrical-manufacturing industry in Great Britain, to which attention has more than once been drawn, does not seem to be quite so much in evidence this year. Willans & Robinson, although one of our oldest established firms of engine builders, were hit as badly as any firm, but in order to regain their former prosperity the manufacture of steam turbines has been commenced. A friendly arrangement has been entered into with the Parsons interests and a license has been taken enabling the Parsons patents to be worked. Willans & Robinson also own some valuable turbine patents of their own. The loss on the half year's trading ended December 31, 1904, amounted to over $200,000.

The postmaster-general, it is stated, intends to connect up Tasmania with the mainland of Australia by means of space telegraphy.

The parliamentary committee of the House of Lords, which is considering the large number of electric-power bills concerning London, is still very far off the conclusion of its labors, for although 16 sittings have been held, not one of the bills has yet been disposed of. Since my notes of March 22d the opposition to the $25,000,000 scheme of C. H. Merz of Newcastle-upon-Tyne has been carefully laying its case before the committee, and the number of tables and statistical information that has been prepared is prodigious. The main point of the opposition is that the new company proposes competition on unfair terms, and that on similar terms the existing authorities fear nothing. G.

### New York.

New York, April 15.—The New York state Legislature has passed a measure designed to take away from the New York Board of Aldermen the power of granting franchises. Since 1902 there have been several notable instances of the aldermen holding up important franchises for months, or even years, and then suddenly passing them for the apparent benefit of contracting interests associated with Tammany Hall. Mayor McClellan will [illegible] Manhattan, and the Metropolitan and New Haven companies would probably bid for the upper lines and the Bronx. Meanwhile the Interborough company [illegible] Avenue elevated line, which, however, in the present state of public opinion, is an impossibility.

An application [illegible] Board of Aldermen for a [illegible] Amsterdam Telephone Company, which asks for a 25-year privilege, at a rental of three per cent. on the gross receipts and 500 free telephones for departmental use. [illegible] knowledge of the men behind the application.

The revised and, generally speaking, reduced schedule of the New York Telephone Company comes into operation on May 1st. There are substantial reductions to large users, and for tariff messages between out-of-the-way suburbs. Brooklyn druggists who operate call instruments are demanding the installation of slot machines, alleging that they have been for some time past overcharged on their commissions.

J. D. Bears, W. J. Boroughs and George Stewart have incorporated as the Municipal Subway Company, for the purpose of dealing in conduits for electrical conductors. The new concern is capitalized at $100,000.

A. S. Kuhn and others of this city have incorporated as the Universal Electric Clock Company, capitalized at $25,000.

The annual report of the Brooklyn Rapid Transit Company shows that the gross earnings increased about $700,000 and surplus increased about $1,000,000. This surplus of $2,127,236 is about 4.7 per cent. on the stock of the road. The gross earnings for the company's last fiscal year were $15,459,660 and the operating expenses $9,261,916.

The first of a consignment of steel cars for the New York City Railway Company arrived at the Pennsylvania railroad yards at Thirty-seventh Street recently. This car has inside trimmings of wood, which is electrically treated and is said to be fireproof. The car was made at McKees Rock, Pa., by the Pressed Steel Car Company of Pittsburg.

The lighting committee's investigation has continued during the week and now promises to end on the 28th. Its proceedings are reported elsewhere in this issue. D. W. W.

### New England.

Boston, April 15.—The Greenfield, Deerfield and Northampton, the Greenfield and Turner's Falls and the Northampton and Amherst street-railway companies are authorized to consolidate by the approval of the railroad commission and to issue new stock to the amount of $310,000. The name will be changed to the Connecticut Valley Street Railway Company. Col. F. E. Pierce, who was president of two of the companies, becomes the president of the consolidated company and D. P. Abercrombie is treasurer and clerk. The combined track mileage is 54 miles.

The Railroad Commission has authorized the Boston Elevated Street Railway Company to issue $7,500,000 30-year four-per cent. bonds, to be used for Forest Hills extension, engineering, construction, equipment, etc., new power station and East Boston Tunnel equipment. Damage suits are also anticipated and provided for to the extent of $3,700,000.

Edward Kendall & Sons of Cambridge, manufacturers of boilers, have disposed of their business to the Robb Engine Company of Amherst, N. S., and the plant will be transferred to South Framingham in this state under the name of the Robb-Mumford Boiler Company. D. W. Robb is the president and G. W. Cole secretary and treasurer. F. H. Keyes of Newtonville, graduate of Massachusetts Institute of Technology in 1893, subsequently instructor there in the mechanical engineering department and more recently engineer with Stone & Webster, is to be the general manager.

The three large chocolate mills of the Walter Baker Company in Milton, on the Neponset River, are to be run by electricity. A plant is under construction above the mills at the falls, and power is to be conveyed in conduits therefrom.

The trackless-trolley idea is getting a footing in this state, and a company is in process of formation at Athol which proposes to run vehicles from Athol to Barre, with a branch up the Swift River Valley, the entire distance being 26 miles. The line is to be for freight as well as passenger

service. The capital proposed is $80,000. John A. Carter of Petersham is the chief promoter.

About 50 members of the Massachusetts Press Association were the guests last Saturday of the Edison Electric Illuminating Company of Boston and inspected the plants of the company at L Street, South Boston, and in other parts of the city, lunch being served at the L Street station.

The New York, New Haven and Hartford Railroad Company's efforts to secure control of the Springfield Street Railway Company have resulted in the acquisition of a majority of the stock on the basis of $225 a share, and the new management will be in the form of a trust, similar to that known as the Massachusetts Electric Companies. The trustees are named as follows: Charles S. Mellen, president of the New Haven road; C. F. Brooker, D. Newton Barney and William Barney, all of the steam-road management; J. J. Storrow of Lee, Higginson & Co., the Boston bankers who acted for the railroad company; Fred Harris and William Damon of Springfield, stockholders of the street-railway company.

Plans have been developed for the establishment of a plant for the generation of electric power for manufacturing purposes in Holyoke, Mass. The capital will be held largely by Hartford financiers, and the plant is estimated to cost $150,000.

The directors of the gas and electric-light company of Easthampton, Mass., have decided to discard the present plant and install new machinery, putting in a 23,000-volt alternating-current generator, in place of the direct-current machine now in use.

E. H. Richards, assistant general superintendent of the Boston and Worcester Street Railway Company for the last two years, has resigned to become superintendent of the Taunton and Pawtucket Street Railway Company, with headquarters at Taunton, Mass. B.

## Dominion of Canada.

Winnipeg, Man., April 15.—The undertaking of the city of Nelson, B. C., to construct an electric power plant on the upper falls of the Kootenay River for the purpose of increasing the supply of electric light and power within the city limits has received the approval of the Legislature. The mayor of Nelson has sold $150,000 of electric-light debentures to Wood, Grundy & Co. of Toronto through the Canadian Bank of Commerce. The debentures bear five per cent. interest and run for 20 years from April 1st. The proceeds are to be devoted to establishing the first municipality owned and operated electric-light and power plant in British Columbia.

The international executive of the Street Railway Employes' Union is asking the provincial administration for the enactment of a statute compelling all street-railway companies to have aisles through the center of their cars, claiming that it is dangerous to the employes to have to go along the outside of the cars collecting fares.

The superintendent of the Winnipeg Street Railway Company states that work on the Kildonan extension of the company will be begun at once. The company is about to double-track its line from Main Street to the Canadian Pacific railway shops, about three miles, and it is also the intention to double-track Higgins Avenue at the same time the city widens the street and lays down either block or asphalt pavement. There is an immense traffic on this street and it will be very materially increased as soon as the Canadian Pacific completes its new station and new hotel. H.

Ottawa, Ont., April 15.—The Consumers' Electric Company of Ottawa has replied to the city solicitor in response to the notice of civic expropriation of the company's plant. The company asks the city to buy out the entire stock and plant, and says that if a favorable reply is received no time will be lost in quoting a price.

There is a movement on foot to have the Carillon and Grenville canals lighted by electricity. At a recent meeting of the Montreal Board of Trade a communication on the subject was read from the Ottawa River Navigation Company asking the aid of the board in the matter, which will be brought to the attention of the Dominion government.

The establishment of the new lighting plant for Westmount, the large suburb of Montreal, will be pushed as rapidly as possible. The town has expropriated 110,000 feet of land for the purpose and building operations will soon be begun. The machinery is to be of the most improved kind.

The Canadian General Electric Company will issue $900,000 of new stock, and it is announced that the issue will be allotted to shareholders at 125, in the proportion of one to three. The purpose of the new issue is the clearing off of the bank loans. The net floating debt is $1,142,396. The new stock will yield $1,125,000, so that liabilities to the banks will be practically extinguished and the company will own all its own raw material as well as plant and equipment, against which there is no debt. The new stock issue will increase the dividend requirements by $90,000 a year, but will cut down the item of interest rates which was paid last year by $56,250, so that the net increased dividend requirement will be about $33,750. W.

## Indiana.

Indianapolis, April 15.—Representatives of the Tucker-Anthony syndicate of Boston, which operates the Indianapolis and Northwestern traction line, were here this week and gave out the information that they will build a line from Indianapolis to Terre Haute. The Randall-Morgan syndicate of New York, which proposed to build a line between the same points, will withdraw and allow the Tucker-Anthony people to build the line. The work of constructing the grade between Indianapolis and Danville is well along, having been directed by the Indianapolis and Eastern Traction Company, representing the Randall-Morgan company. The Indianapolis and Northwestern will complete the line and operate it when finished. This line parallels the Big Four and will connect Indianapolis, Danville, Brazil and Terre Haute. The interurban line now operating between Brazil and Terre Haute will be leased by the Indianapolis and Northwestern, it is said.

The Evansville and Mt. Vernon Electric Company has been organized at Evansville with a capital of $300,000. A private right-of-way has been obtained between the two cities and franchises will be granted this week. The incorporators are Edwin Walker, F. W. Reitz, F. P. Leonard and Bradock McGregor.

The Terre Haute City Council has granted a franchise over certain streets to the Terre Haute and Indiana Southern Electric Railway Company, which proposes to build a line between Terre Haute and Sullivan. The company pays the city $10,000 by June 1st and $500 a year thereafter for 50 years. This action will likely put a stop to the three-cornered fight to build this line. It is generally believed the other contesting companies will now withdraw.

Officials of the Indiana Union Traction, Indiana Northern Traction and the Kokomo, Marion and Western Traction companies are planning to build a joint interurban terminal station in Marion. Two interurban lines now end in Marion and three others are being constructed. The contemplated terminal building will be erected on a central site and will be large enough to give office room to all the interurban companies.

A freight terminal station for all the electric lines entering Indianapolis is now being constructed by the Indianapolis Traction and Terminal Company. The building will be modern and commodious and thoroughly equipped with the most approved appliances for handling freight.

Word comes from Elkhart that H. E. Bucklen, president of the St. Joseph traction line, is greatly pleased with the operation of his new line by means of electric motor cars which were made by F. M. Hicks & Co., in Chicago Heights. The motive power is derived from a generator which is operated by a gasoline engine. The generator is made by the Sprague Electric Company and is a 50-kilowatt, 250-volt, direct-current machine, which drives four 35-horsepower motors mounted upon the trucks.

The receiver for the Home Heating and Lighting Company's plant in Indianapolis has petitioned the court for authority to increase the price for heating from 17 to 25 cents a square foot of radiation. According to the receiver's report the plant run behind about $20,000 during the last nine months.

C. D. Emmons has been made general manager of the Fort Wayne and Wabash Valley traction interests in Indiana. Mr. Emmons is 34 years old and has had remarkable success in the management of traction companies. His headquarters will be in Ft. Wayne.

The American Engineering Company has been incorporated in Indianapolis with $300,000 capital and will at once enter the field for contracts to build electric and steam railroads, heating, lighting, telephone, hydraulic and other plants. J. C. Ostrop will be chief engineer and A. C. Neeley financial agent. August M. Kuhn and F. S. Hines are among the directors. The company's offices will be in the Traction Terminal Building. S. S.

## Michigan.

Detroit, April 15.—The Detroit city assessors have raised the Detroit United Railway Company's assessment $350,000, which will bring the assessed value of this property to over $11,500,000. The principal increase is on the Detroit Suburban line.

The Detroit Edison Illuminating Company is occupying the attention of the Detroit aldermen to a considerable extent and an effort will be made by them to reduce the price charged for illumination, as it is said that they can do so under the Edison company's charter.

The Muskegon City Council has granted a franchise to the J. B. Wheeler Company for the furnishing of electric light and power in the city for a term of 25 years. The company is to pay a franchise fee of $100 a year and forfeits its rights if it attempts to sell or transfer its privileges to a competing corporation. White River is to be dammed several miles above Whitehall and the power will be utilized for the furnishing of light and power to factories, business houses and residences in adjoining cities and villages as well as in Muskegon. The plant must be completed and furnish this power within four years.

The American DeForest Wireless Telegraph Company will locate a station at Alpena to be used in connection with similar stations at Buffalo, Detroit and other points on the Great Lakes. A 200-foot tower will be located near the Weather Bureau Building.

The city of Battle Creek has decided in favor of municipal ownership of gas and electric-lighting plants. The votes showed a majority of 2,566 in favor of this plan.

Mayor Codd of Detroit has taken a determined stand and will veto every franchise passed by the Common Council granting extensions to the Detroit United railway. He insists upon the city bonding itself to construct any new tracks that may be required, the street-railway company to be charged a fair rental for their use.

The Commonwealth Power Company of Jackson has let contracts aggregating over $100,000 for a modern steam plant to supplement the power furnished by water. It is stated that this will give the company 14,000 horsepower and will be sufficient to supply the Jackson-Lansing and other interurban railways outside of its present contracts. The building will cost $16,000 and will be a brick, steel and cement structure 80 by 160 feet. A 3,000-horsepower turbine engine will furnish the power. This company has also let a contract for a three-story office building in Jackson.

William Townsend has undertaken the construction of the 25-mile extension to the South Bend and Southern Michigan electric railway from Niles to St. Joseph. This line passes through Berrien Springs. There will be 18 bridges, one of which is over 1,600 feet long. The railway, with power house and car sheds, will cost upward of $600,000.

The Detroit, Ypsilanti, Ann Arbor and Jackson electric railway will raise its freight rates, making the minimum charge for handling single parcels 25 cents instead of 15 cents. It will also abolish the free-parcel carrying. C. G. W.

## Ohio.

Cleveland, April 15.—An additional surprise was given the city authorities in Cleveland a few days ago, when attorneys for the Cleveland Electric Railway Company claimed a perpetual franchise on the greater number of streets now occupied by the company's lines. At first only those which the proposed three-cent-fare lines are after were claimed in this way. It is entirely probable that the fight will be made against allowing the Forest City railroad to use the streets at present occupied by the old company's lines on this basis.

The Fort Wayne, Van Wert and Lima Traction Company has filed a mortgage in favor of the Fidelity Trust Company of Philadelphia for $2,000,000. This is the first lien on the property. The funds will be used, it is said, to extend the line east from Lima, with the intention of ultimately reaching Pittsburg, with a system paralleling the Pennsylvania lines.

William Miller has secured the contract for building the power house of the Toledo, Port Clinton and Lakeside Railway Company. The contract for grading the remainder of the line was awarded to Charles Warner of Toledo.

The town of Bellefontaine will spend $50,000 this summer in enlarging the municipal light plant, it is reported.

The Ross Electric Specialty Company of Cleveland has been incorporated with a capital stock of $10,000 by W. R. Wildow, M. Aldredge and others.

A new franchise has been awarded the Cleveland and Southwestern Traction Company for lighting the town of Norwalk. The company now holds the franchise, which expires in September.

An addition will be built to the plant of the National Carbon Company at Fremont.

Improvements amounting to over $2,500,000 will be made by the electric roads running out of Cincinnati within the next year, it is said.

It is reported that the lighting department of the Toledo Railways and Light Company earned a net surplus of $268,000 last year.

Owing to the efforts of Toledo business men the Lake Shore Electric has been allowed to resume traffic over the Cherry Street Bridge in Toledo. Some action has been taken toward the repair of the bridge by the city authorities.

General Asa W. Jones has resigned as president of the Youngstown and Southern and C. P. Phelps of Boston has been chosen in his place. General Jones will now give more attention to the practice of law.

C. D. Emmons is the new general manager of the lines running out of Fort Wayne, including the Fort Wayne, Lima and Van Wert Traction Company.

C. N. Wilcoxen, who had for some time been with the Western Ohio, is now general superintendent of the Cleveland and Southwestern. His son, Carl Wilcoxen, has been promoted from train dispatcher to his father's place on the former, it is reported.

Dr. J. E. Lowes, an electric-railway man of Dayton, has gone to California for a rest.

The People's Heat, Light and Power Company of Springfield has been incorporated with a capital stock of $2,000,000, to take over the light plant owned by the American Railways Company and the Citizens' Heat, Light and Power Company, which was organized some time ago. W. H.

Sharpe, R. H. Sharpe and some other men connected with the Columbia Public Service Company are said to be largely interested in the new company. The plan is to establish a hot-water heating plant, in connection with the light plant, on the same plan as the one is operated in Columbia. While nothing definite is known, it is said the price paid for the Springfield plant is $230,000, with the assumption of a bonded debt amounting to $100,000. O. M. C.

## Pacific Slope.

San Francisco, April 14.—It is reported that the Stanislaus Electric Power Company's entire bond issue of $5,000,000 has been placed. It is reported that no time will be lost in the construction of the electric power-transmission plant. The company has a site for a storage reservoir in the mountains, with a capacity of 500,000,000 cubic feet of water. About 24,000 horsepower can be generated if necessary.

W. J. Ferry of San Francisco, chief electrician of the Tuolumne Electric Power Company, has arrived at Groveland, Cal., and will establish a camp for the working crew, which is soon to put up the electric plant.

T. A. Nixon of Spokane, Wash., has been in Kennewick recently. He proposes to install at the latter place an electric-lighting and power plant.

Col. E. A. Forbes has been awarded a franchise to construct and operate an electric railroad in Sutter County, from Yuba City to the Colusa County line near Colusa, Cal.

Isidor Fuchs, W. S. Bowers and A. S. Shockley have incorporated the Baker City and Suburban Electric Railway Company, with a capital stock of $25,000. The company is empowered to build and operate street-car lines within the limits of Baker City, Ore.; also suburban lines in every direction.

The United Improvement Company intends to erect and operate a gas and electric-lighting plant at Long Beach, Cal.

The consolidation of the electric power plants of the Pacific Coast Company, which now furnishes light and power to the mines at Lawson and Black Diamond, Wash., will be completed in a short time, and the work of installing electricity as motive power at the Black Diamond mine will commence.

Five California men have organized what they call the California Foothill Company, for the purpose of dealing in water rights, electric-light and power plants, etc. The capital stock is $1,000,000. The stockholders are all residents of San Francisco.

The people along Verdugo Road and Sycamore Canyon are offering inducements to have the Pacific Electric Railway Company of Los Angeles, Cal., extend its road. The citizens of North Glendale and Burbank have succeeded in securing a bonus of $13,000 and the right-of-way for the proposed extension to the latter places.

The Electrical Appliance Development Company has been incorporated at Sacramento, Cal., by J. C. Ellis, Charles W. Hutton, Frederick T. Kitt and others. The capital stock is $64,000. The purpose of the company is to deal in mechanical devices and to operate and control electric energy. The principal place of business is Sacramento. A.

## Mexico.

City of Mexico, April 13.—An electric power concession has been granted by the Mexican government to Samson Lang for the utilization of the water of the Atacuzac River, in the district of Jojutla, state of Morelos, for operating an electric power plant. It is stated that the proposed plant will be located near the town of Xicotlacotla. The concession also gives authority to build and operate telephone and telegraph lines.

It is announced that a syndicate of Chicago, Detroit and St. Louis capitalists is about to close negotiations for the purchase of the street-railway and electric-light properties of Torreon.

M. C. Miller, formerly of Minneapolis, Minn., but now a resident of Guadalajara, Mexico, is making good progress in his project for building an electric railway from Guadalajara to the port of Chamela, on the Pacific Coast of Mexico. Mr. Miller has made formal application to the government of the state of Jalisco for a concession to build the proposed road. Mr. Miller is organizing a company with a capital stock of $10,000,000 for the purpose of building and equipping the road. A survey for a proposed government railroad between Guadalajara and Chamela was made about 12 years ago and this survey may be utilized for the proposed electric railway.

The concession obtained from the federal government and the franchise from the city of Guadalajara, granted the Bermejillo syndicate for its street-railway system in the city of Guadalajara, provided that the complete plans for the extensions and improvements must be submitted to Governor Ahumada within six months, and that the work of converting the system into electric-traction lines must be in progress before the end of the present year. The $400,000 which the syndicate is required to pay for the franchise must be paid in eight annual installments of $50,000. It is further provided that in the event Kunhardt Bros., who own the [illegible] Guadalajara, [illegible] a part of their payment [illegible] amount of [illegible].

The project of installing an independent electric-light plant for the city of Juarez [illegible] on account of the [illegible] the place having [illegible] the International Light and Power Company [illegible] lighting that city for a period of 10 years. This company has its plant and headquarters in El Paso, Texas, situated on the opposite side of the Rio Grande from Juarez.

The work of constructing the large aqueduct that will convey water from [illegible] River to [illegible] Palacio, where it will be used for motive power in the electric-light and power plant, is now in progress.

President Porfirio Diaz in his recent message to Congress said that the employment of water supplies in the public domain for industrial and agricultural purposes is constantly on the increase. Four motive-power concessions have been granted in the last six months for the utilization of 52,150 liters of water a second from the rivers Angulo, Lerma, San Geronimo, Atoque, Nexapa, Conchos and Balsas.

It is announced that improvements to cost about $50,000 are to be made to the new power plant of the Mexican Light and Power Company at Necaxa.

W. A. Marsden, an electrical engineer of St. Louis, Mo., has been making an investigation of the velocity of the current of the Panuco and Tamesi rivers, near Tampico, on behalf of a syndicate of American capitalists, who propose to construct a large electric power plant on one of these streams.

Plans have been prepared and approved by the municipal authorities for the installation of an electric-light and power plant at Matamoros. The proposed plant will cost about $50,000.

Steps have been taken toward the installation of a new independent electric-light and power plant in Nuevo Laredo. H.

## Rocky Mountain States.

Salt Lake City, April 14.—The Shoshone Power Company, with a capitalization of $5,000,000, has filed articles of incorporation with the secretary of state at Boise, Idaho. The company, which is incorporated by leading officials of the Mormon church, proposes the generation of power at the falls for distribution in Utah and Idaho. The headquarters of the new company will be in Salt Lake City. Apostle Francis M. Lyman of the Mormon church is the organizer and president of the company.

The breaking of a five-inch steel countershaft in the plant of the Reno Power, Light and Water Company at Reno, Nev., left the city temporarily in darkness. The remainder of the machinery escaped injury, but a rearrangement of the equipment at the plant was made necessary by the accident. The General Electric Company of Floriston furnished electrical energy during the progress of repairs.

Ordinances passed by the City Council of Ogden, Utah, granting franchises to B. Mahler of Cleveland, Ohio, and to Simon Bamberger of Salt Lake City for their proposed interurban railroads have been vetoed by the mayor, and the vetoes sustained by the council. The long life of the franchises, each of which was for 100 years, was the chief objection of the city's executive. It is expected that modified franchises will be granted to the petitioners within the next few weeks. G.

## PERSONAL.

At last advices, Lord Kelvin, who underwent a serious operation recently, is reported as gaining strength and is in every way making satisfactory progress.

Dudley W. Walton, the New York correspondent of the Western Electrician, has been elected president of the National Association of Isaac Pitman Shorthand Writers for 1905-06.

Prof. Emil Warburg of Berlin has been appointed president of the National Physical Laboratory at Charlottenburg, and his place in the university is to be taken by Prof. Paul Drude of Giessen.

Frank S. Beardslee, president of the Beardslee Chandelier Manufacturing Company of Chicago, who is making a tour of the Pacific Coast with his wife and son, expects to return to Chicago about May 1st.

Prof. M. I. Pupin of Columbia University, New York city, has been nominated for the award of the Cresson medal by the Franklin Institute for his "Art of Reducing the Attenuation of Electrical Waves and Apparatus."

W. B. Turner of South Bend, Ind., died at Hot Springs, Ark., on March 26th. He was superintendent of the Edison Machine Company when its works were moved to Schenectady, N. Y., and held that position until 1892. In 1894 he became connected with the Chicago Edison Company and [illegible]

[illegible] general manager of the Wisconsin [illegible]

[illegible]

Frank W. Frueauff, general manager, and John [illegible] cago last week. Like everybody else in Denver [illegible] ing Denver-Colorado Springs convention, which is to be "the greatest thing ever."

George W. Morse of Newton, Mass., died of pneumonia in Marseilles, France, on April 10th, while on his way home from a trip around the world. He was senior partner of the law firm of Morse, Hickey & Kenny of Boston, former counsel for the General Electric Company. Mr. Morse organized many street-railway companies. He was related to Prof. Samuel F. B. Morse, and was born in Lodi, Ohio, in 1845.

Charles Alexander Gerhardi, whose work in the field of telegraphy and submarine cabling is well known in England, died at his home in London on April 2d at the age of 68 years. He was identified with telegraph work since 1853, when he entered the Belgian telegraph service. In 1856 he entered the employment of the Electric and International Telegraph Company and left in 1857 to join the Atlantic Telegraph Company. In 1860 Mr. Gerhardi was appointed by the Submarine Telegraph Company as superintendent of its Channel Islands cable, and later on was put in charge, at London, of the Belgian, Dutch and German cables. He left the Submarine Telegraph Company in 1872, being appointed in the same year manager of the Direct Spanish Telegraph Company, which had just been formed, and he continued to manage this company until his retirement from active service in 1902.

## ELECTRIC LIGHTING.

Sealed proposals will be received by the board of public works, Des Moines, Iowa, until April 26th for lighting the public parks of the city for the term of five months from May 1, 1905.

Sealed bids will be received in duplicate until May 3d at the office of public buildings and grounds, Washington, D. C., for lighting portions of the public grounds during the year ending June 30, 1906.

The board of control has let the contract to W. W. Welch of Clarinda, Iowa, at his bid of $23,428.75 for the erection of the power house to be erected at the Home for the Feeble Minded in Des Moines, Iowa.

The Jefferson City (Mo.) Light, Heat and Power Company has been purchased by a syndicate of which H. H. Humphrey, the St. Louis electrical engineer, is a member. Mr. Humphrey is not only financially interested in this company but has been retained as its electrical engineer as well, and has become active manager of the property. Carrying out Mr. Humphrey's plans the company is now putting in a new 150-kilowatt alternating-current unit to supply the rapidly increasing power circuit. There has also been installed a new alternating-current street-lighting system, and Mr. Humphrey is also receiving bids on a new gas plant for the company of 125,000 cubic feet capacity per day.

## ELECTRIC RAILWAYS.

John Porter and W. S. Porter of Eldora, Iowa, have disposed of their holdings in the Des Moines and Eldora Interurban Railway Company to the Polk interests, which latter contemplate the construction of the line from Des Moines to Eldora and its operation in conjunction with their other interurban properties.

Reports say that an electric railway, having one terminus in Cripple Creek and the other in Colorado Springs, Colo., will be started in the next few weeks, connecting also Pueblo and Florence. It is understood that Thomas Robinson, president of the Florence Street Railway Company, is the authority for this statement. Passenger, express and freight will be handled on the new road.

Franchises have been granted by the City Council of Alton, Ill., to the Alton, Jacksonville and Peoria, and the Alton, Granite and St. Louis traction companies. The former is a 50-year franchise for an interurban railroad to be built from Jacksonville to Alton, and the latter for a street railway in the city. By a queer mistake both com-

panies are required to pave Belle Street from curb to curb, making two courses of paving unless the conditions are changed.

Representative Trautmann has introduced a bill in the Illinois House granting to street-car companies operating between one city and another the right to secure by condemnation, under the right of eminent domain, the joint use of all tracks and stationary property belonging to another company. The bill specially states that it shall not apply to the use of steam as a motive power or to the carrying of freight upon such tracks, and it "applies only when the city from which the railroad company goes is several miles from the limits of one through which it desires to pass."

Gross earnings of the United Railway Company of St. Louis for the month of March are considered remarkably good when compared with the corresponding month last year, at which time the system was known as the St. Louis Transit Company. Notwithstanding, in March, 1904, the World's Fair was only about a month off, and thousands of people from all parts of the world were in St. Louis preparing for the opening, the receipts for the month recently ended show an increase of $32,980.36 over the corresponding period of last year. The gross earnings for March, 1903, 1904 and 1905 were, respectively, $570,831.36, $649,142.78 and $682,123.14.

The annual report of the United Railways and Electric Company of Baltimore has been issued covering operations of the company for the year ended December 31, 1904. The income account shows gross earnings of $5,440,942 as compared with $5,480,630 for the preceding year. The operating expenses for the last year were $2,876,538. President Hood says in his report that the company passed through an ordeal without a parallel in rapid-transit experience. The fire disaster resulted in complete paralysis of the company's operations. The proceeds of $4,634,000 bonds set aside for extensions, improvements, etc., have been expended in providing necessary shop and power-house buildings and their equipment.

## POWER TRANSMISSION.

Electric power-generating plants are receiving considerable attention just now in Baltimore, Md. The Baltimore County Water and Electric Company will erect an addition to its power house at Herring Run; the Consolidated Gas, Electric Light and Power Company will erect a power house at Westport, and the Mount Washington Electric Light and Power Company has been receiving bids for its power house to be located at Mount Washington, six miles from Baltimore.

The committee of first-mortgage bondholders of the Michigan Lake Superior Power Company in its report recommends an expenditure of $800,000 for strengthening and preserving the power house, and favors a reorganization plan by which all classes of creditors would contribute on an equitable scale toward the improvements. C. D. Warren, president of the Lake Superior Corporation, who is receiver for the Michigan Lake Superior Power Company, wants to have the improvements paid for by receiver's certificates, which he proposes to pay for by the creation of a new first mortgage for $5,000,000, the holders of the present issue of $3,500,000 to exchange their bonds for a like amount of new ones, the balance of the new issue being available to pay the receiver's certificates. The committee, however, opposes this plan.

## PUBLICATIONS.

The Commercial Electrical Supply Company of St. Louis, Mo., has just issued a general loose-leaf catalogue and net price list that is probably one of the most complete articles of its kind ever distributed. It embraces in detail the full line of motors, generators, up-to-date lighting appliances and also the high-class specialties handled. The company will be pleased to send a copy on application.

The Switchboard Equipment Company of Pittsburg, Pa., is sending out its first bulletin, which is devoted to direct-current circuit breakers. Considerable pains have been taken and much skill manifested in the preparation of this bulletin, which is designed to show the prospective buyer just what the company can furnish in this line and how the apparatus is constructed. The company claims for its apparatus great reliability, durability, simplicity and economy of space.

"A Camera Journey to the Lewis and Clark Exposition" is the title of a very tasteful and interesting booklet issued by the Great Northern Railway Company's passenger traffic department, of which F. I. Whitney is manager. The principal exhibit buildings which will compose the Exposition are illustrated, with brief descriptions; also some general facts about the Exposition itself. Following this comes "Across America via the Great Northern Railway," which takes the reader pictorially on a journey through the varied and beautiful scenery which lies along this famous route. "A Thousand Miles on Inland Seas," describing the Northern Steamship Company's service on the Great Lakes, and a short directory to the Exposition grounds complete the booklet, which is a credit to the company's publicity department.

Reinforced concrete, as is well known, is now one of the most important materials of construction which the engineer must consider in construction work. The St. Louis Expanded Metal Fireproofing Company, St. Louis, Mo., has issued a finely illustrated and instructive catalogue devoted to this subject which calls for more than a casual reading. A large number of excellent half-tone pictures and dimension diagrams of some of the most important concrete constructions adorn its pages. Besides there are numerous tables and formulas for concrete construction which will be found useful for reference purposes.

Timed to the minute, the Standard Electrical Manufacturing Company's "baseball bulletin" appeared on the day the great championship series was on. It bears on the back an American League schedule for 1905 and it is further adorned with baseball pictures. Within the covers the opportunity is taken to "boost" the company's Central Station and Mill type lamps just a little. For instance, it is modestly stated that these lamps are probably as far ahead of other lamps as the "spit ball" is ahead of the old-time pitch. It is also maintained that there is hardly an "error" in a whole barrel, and as to striking ability they are guaranteed to "socket" at every opportunity.

## AUTOMOBILES.

The German Automobile Club and the automobile manufacturers of Germany are planning to hold an automobile and bicycle exposition in Frankfort, October 6 to 15, 1905.

The George N. Pierce Company of Buffalo, N. Y., is offering three sets of first and second prizes in automobile design, as follows: First, for the best design of a body for an enclosed car; second, for the best design of a body for a touring car, and third, for the best color scheme for any motor car. The first prize for each of the first two competitions is $250, and the second prize $100. For the last competition the first prize is $200 and the second $100.

The Electric Storage Battery Company of Philadelphia has issued an instructive pamphlet giving directions for the care of Exide batteries in electric vehicles, which is quite a departure from the ordinary catalogue or bulletin. The pamphlet describes first, the battery parts to the minutest details and gives also directions for unpacking the parts when they come from the factory. Then are taken up, charging connections, charging batteries in vehicles, charging batteries when removed from vehicles, taking batteries out of commission, general rules for proper care of a battery, testing specific gravity of electrolyte, and a great many other things which it is necessary that the operator of these batteries should know. Several pictures illustrate the battery and its several parts.

## SOCIETIES AND SCHOOLS.

A course in telephone engineering is to be given during the summer session at Armour Institute of Technology, Chicago. It is designed to meet the wants of those who desire to devote their whole time to the acquirement of a knowledge of telephony as it is practiced today.

A department of electrical and mining engineering has been established by the trustees in the North Georgia Agricultural College at Dahlonega, Ga. Professor O'Byrne of the Colorado School of Mines has been selected to fill the new chair. Professor O'Byrne has been an instructor for several years and has also had considerable experience in installing electrical plants.

Mr. Arthur Williams has received for his report on municipal ownership, to be presented at the Denver-Colorado Springs convention of the National Electric Light Association, some 50 or more reports from foreign cities and towns as well as a large quantity of information regarding municipal plants in this country. His report will be very voluminous and will be eagerly welcomed by members threatened with municipal competition.

## TRADE NEWS.

The Marks Electric Construction Company, New Orleans, La., has been incorporated with a capital stock of $25,000.

The American Stone Conduit Company of Chicago has removed its office to Room 423 Chamber of Commerce Building, where it will be glad to see its friends and customers.

The Simplex Company has been organized to manufacture electrical measuring instruments at 60 Nassau Street, Newark, N. J. The president of the company is M. C. Rypinski, who until recently had charge of the business of the Empire Electrical Instrument Company of New York. Mr. Rypinski's experience covered 12 years, all in the electrical instrument line.

The Universal Spring Motor Company, recently organized at Montreal, Canada, with a capital of $500,000, undertakes to manufacture the Universal spring motor as well as electric, water and steam motors.

Anderson & Nachman, manufacturers of the metaphone, which was described in the Western Electrician of April 8th, who formerly occupied offices in the Schiller Building, Chicago, moved recently to new quarters at 356 Dearborn Street, Chicago.

The National Battery Company of Buffalo has opened a Chicago office at 1525 Old Colony Building, in charge of Edwin L. Draffen. Mr. Draffen is one of the most capable storage-battery salesmen in the West, with several years' valuable experience, and he should be able to show good results in his new connection. The company is prepared to furnish batteries for lighting and railway power stations as well as for isolated plants, telephone exchanges and automobile work.

The Crescent Machine and Tool Company of Indianapolis, Ind., has been incorporated, capitalized at $250,000. The company proposes to manufacture power machines of various kinds and traction engines for operation by steam, gas, gasoline, electricity or other agency. The company will build motors and motor cars for all purposes and will also manufacture automobiles and automobile engines and appliances. The officers and incorporators are J. C. Piper, George L. McKay, W. S. VanBuskirk, M. H. Whitney and Joseph Kress.

"Commercial Mexico in 1905" is the title of a monograph just issued by the Department of Commerce and Labor through its Bureau of Statistics. Its object, as indicated by the title, is to present commercial conditions in Mexico at the present time. The investment of American capital in Mexico was estimated by United States Consul-general Barlow in 1902 at $500,000,000. Exports of electrical machinery from the United States to Mexico have increased from year to year until they reached a total value of $646,398 for the year 1904.

The American Circular Loom Company of Chelsea, Mass., announces that the National Board of Fire Underwriters, after careful consideration of the subject, at an open meeting held by its special committee, has canceled all the specifications of rule 50-C of the Electrical Code referring to the construction of flexible tubing and has directed that circular loom of the type made by the company mentioned during the last 12 years be put back upon the list of approved fittings and that this change be noted in the April supplement to the Electrical Code, to be issued soon.

## BUSINESS.

John W. Brooks, sales manager for Pass & Seymour, Solvay, N. Y., visited Chicago last week. Mr. Brooks spent only a few days in Chicago and then left for the East.

W. C. Colburn and associates of Troy, N. Y., have incorporated as the Eastern Electric Company with a capital of $100,000. The company will engage in general electrical contracting.

H. H. Humphrey of St. Louis has been retained as electrical engineer for the new Grand Leader department store in St. Louis. There have recently been placed likewise under his care a number of St. Louis office-building installations that will be in operation when the structures are finished.

The Tray Plate Battery Company of Binghamton, N. Y., has in its possession a letter from Uriah Biery of Merztown, Pa., which states that a battery installation made for him at his residence and hotel has "decreased the consumption of gasoline practically 60 per cent., and in addition has enabled us to have light 'on tap' at all hours of the day and night. The only attention the battery has received in three months is the addition of a little water."

The Chicago House Wrecking Company, Chicago, which purchased all the electrical material and everything else used in the construction and equipment of the Louisiana Purchase Exposition, states that it is placing on the market for quick sale at low prices $750,000 worth of copper wire, $250,000 worth of lead-covered cables and $500,000 worth of miscellaneous electrical material. The company says that it is in a position to make prompt shipments from its Chicago warehouse.

The United Electric Light and Power Company of New York city has contracted for a Westinghouse motor-generator set consisting of a 1,400-horsepower induction motor and a 1,000-kilowatt revolving-field alternating-current generator, with automatic-regulating-control outfit. On the same day orders were received for 104 induction motors varying in size from one-half to 350-horsepower and aggregating 2,200-horsepower capacity. An order for 204 Westinghouse railway motors was also placed by the Transit Development Company of Brooklyn.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued (United States Patent Office) [illegible]*

786,795. Trolley Wheel. Edwin W. Clark, Columbus, Ga. Application filed July 28, 1904.

Supporting arms carry the trolley wheel, which consists of a freely revoluble central hub provided with a drum. Spring-pressed flanges overlap the drum and are revoluble and slidably mounted independently thereof on the axle.

786,797. Electrical Stop Motion. George B. Cocker, Frankford, Pa. Application filed November 20, 1903.

An electric stop motion is provided with a rotatable circuit closer, a rotatable thread holder, and means whereby the thread holder is supported into driving engagement with the circuit closer.

786,800. Automatic Safety Switch for Hoisting Machines. Oscar S. Hertzog, Birdsboro, Pa. Application filed April 25, 1904.

Associated with the hoist are a safety switch arranged in the working circuit, an electromagnet controlling the movement of the switch, and successively engageable contacts under the control of the hoist and serving to close the circuit in different positions of the hoist.

786,823. Electricity Meter. Friedrich Lux, Heidelberg, Germany. Application filed November 29, 1902.

In an electrolytic electric meter are an anode consisting of liquid mercury with a cathode located in a plane above the surface of the anode. A tube has a rim or flange to produce a movement of rotation in the upper portion of the electrolyte.

786,832. Trolley-wire Guide. Stewart P. McMullen, Sioux City, Iowa. Application filed June 4, 1904.

Curved parallel arms are pivotally secured to the outer end of the trolley pole, the curve of the arms opening downward. A flexible connection is provided for the lower ends of the arms and a trolley wheel is pivotally secured between the outer ends of the arms. A spring forces the lower ends of the arms downward and away from the pole and presses the upper ends of the arms upward in the direction of the wire.

786,843. Electric Signaling System. William F. Robinson and Columbus F. Broadhurst, Kansas City, Mo. Application filed October 3, 1903.

An electric circuit having branches is provided with means for generating a current therein. A signaling device is controlled by the current in the circuit, and door locks located one in each of the branches are provided each with a casing forming a part of the branch circuit and having each a contact connected electrically with the branch circuit and normally electrically insulated from the casing.

786,859. Method of Heating Carbon Articles. Frank J. Tone, Niagara Falls, N. Y. Application filed April 2, 1904.

Heating carbon articles by this process is done by placing the articles in proximity to, but out of contact with, an electric resistance conductor. The intermediate space serves as an insulator of electricity, but a conductor of heat. An electric current is then passed through the conductor.

786,887. Trolley Device. Anton F. Flierboom, Elizabeth, N. J., assignor of one-half to John F. Conrad and William R. Bonnell, Elizabeth, N. J. Application filed January 28, 1905.

Independent and rotatable disks are mounted on opposite sides of the trolley wheel. They are provided with radially projecting fingers carrying inwardly directed dogs and serve to direct the trolley wheel onto the wire.

786,894. Railway Signal. Orlando W. Hart, Fall River, Mass. Application filed August 14, 1901.

A number of post or signal stations are placed in series with a sliding semaphore for each station. Three circuits run between the central station and the signal stations, one a selecting circuit provided with means at the central station for sending impulses to any signal station. These operate means at the latter station to close the second circuit through an electromagnetic device and trip the semaphore signal. The latter falls and a device projects from the semaphore signal, whereby the latter in falling automatically closes the third circuit through a return signal device at the central station. A switch at the latter station completely closes the third circuit and supplies current thereto. (See cut.)

786,899. Coin-controlled Actuating Mechanism for Auto-pneumatic Pianos. Adam J. Hobart, St. Johnsville, N. Y., assignor to Roth & Engelhardt, New York, N. Y. Application filed July 11, 1904.

A motor, the circuit of which is closed by the insertion of a proper coin, drives the perforated strip of the piano player.

786,901. Telephone-exchange System. John C. Hubinger, Keokuk, Iowa. Application filed April 18, 1904.

The details of a polarized relay for telephone-exchange work are described.

786,907. Electric Time Relay Switch. William W. Lackie, William T. Calderwood and William H. D. MacEwen, Glasgow, Scotland. Application filed April 26, 1904.

Several electrically operated switches successively actuate a number of time switches. Circuits branched from the main circuit connect the time switches with the electrically operated switches and are controlled by the time switches to cause the latter to successively operate the electrically operated switches.

786,911. Electric Conduit Terminal. William J. Miles and Jesse Patterson, Buffalo, N. Y. Application filed June 21, 1904.

An electric conduit terminal comprises two similar members, each having a trunk section and two branch sections. Pins are arranged at the lower end of one trunk section on opposite sides and hooks are arranged at the lower end of the other trunk section on opposite sides and engaging with the pins. A screw connects the members at the crotch between the branches.

786,912. Burglar Alarm. Charles O. Miller, Estherville, Iowa, assignor to the Millers Electro-Pneumatic Burglar Alarm Company, Estherville, Iowa. Application filed [illegible]

A [illegible] [illegible] contact [illegible] [illegible] [illegible] connected [illegible] [illegible] [illegible] formed [illegible] ring.

786,918. Continuous-current Electric Motor. Henri Pieper, Paris, France, assignor to Société Anonyme pour le Travail Electrique des Métaux, Paris, France. Application filed January 6, 1905.

Two cores are located in the armature [illegible] around each end of the armature. A number of separated polar extensions [illegible] each of the cores [illegible] so that consecutive extensions [illegible] opposite polarity. Pole pieces extend from each polar extension [illegible] core to the corresponding polar extension [illegible] the core, the polar extensions being so arranged relatively to the shaft that parallel to the latter there are always in view two pole pieces of the same polarity extending over the armature in the direction of its length.

786,925. Means for Signaling and Telephoning on Electric Trolley or Other Systems. Charles R. Van Trump, Wilmington, Del. Application filed August 4, 1904.

A signaling apparatus for electric power or trolley lines comprises a conductor for the transmission of direct current, signal stations, an electrical connection between the station and the conductor, a condenser in the [illegible] of each electrical connection and interposed between the station and conductor and means at each station for transmitting and receiving an independent signal current through the conductor, electrical connections and condensers.

NO. 786,894.—RAILWAY-SIGNAL SYSTEM.

786,946. Means for Recovering Magnetic Iron from Ore-separating Tanks. Erastus S. Bennett, New York, N. Y. Application filed October 17, 1903.

Combined with a separating tank are means for producing a jet or jets for scouring the material in the tank and a magnetic device for removing from the tank the iron sand from which the gold has been scoured. The device is located intermediate the inlet and tailings end of the tank, the tank having means for recovering the gold freed from the iron sand.

787,005. Electric Recording Instrument. David J. Steele and Charles Kratt, Glasgow, Scotland. Application filed May 7, 1904.

In a galvanometer are combined a tube comprising a main arm containing a liquid, a secondary arm adapted to receive the overflow therefrom and a restricted tubular communication between the main and secondary arms. An electromagnetic device is associated with a float in the main arm adapted to be attracted by the electromagnetic device for displacing the liquid.

787,012. System of Electrical Distribution. William A. Turbayne, Lancaster, N. Y., assignor to the Gould Coupler Company, New York, N. Y. Application filed June 24, 1904.

A main generator and exciter have means for varying the speed of the exciter in an inverse sense to the speed of the main generator. Other means vary the excitation of the exciter in an inverse sense to the speed of the main generator.

787,024. Means for Controlling the Charging of Storage Batteries. Rufus N. Chamberlain, Depew, N. Y., assignor to the Gould Storage Battery Company, New York, N. Y. Application filed February 8, 1904.

A charging circuit for a storage battery has a hand-closed switch. A device opens the switch automatically when the switch is released. Means hold the switch closed, and an electromagnetic releasing device for the holding means contains differential windings which cause the magnetic effect to vary inversely in accordance with variations in the charging rate of the charging circuit.

787,027. Monophase and Polyphase Alternating-current Machine. Michael von Dolivo-Dobrowolsky, Berlin, Germany. Application filed May 18, 1903.

An arrangement for diminishing the fall in potential in monophase or polyphase alternating-current machines consists of a source of continuous current, a circuit in connection therewith, which circuit is also in connection with the magnet windings of the alternating-current machine, a transformer in the main circuit of the latter and a unipolar cell in the circuit of the secondary current of the transformer, which is also connected with the magnet windings of the alternating-current machine.

787,029. Apparatus for Preventing Collisions on Railways. Heinrich Gerstmann, Charlottenburg, near Berlin, Germany. Application filed July 21, 1902.

Electrical conductors of opposite polarity extend along the sides of a railway section. Circuit closers are placed [illegible]

[illegible] center and [illegible]

787,0[illegible]. Trolley Stand. [illegible] Richmond, Va. Application filed [illegible] 1904.

[illegible]

787,034. Trolley Stand. Benjamin A. Grasberger, Richmond, Va. Application filed [illegible] 1905.

[illegible] trolley leaves the line wire.

787,035. Trolley Stand. Julius A. Grasberger, Richmond, Va. Application filed September 10, 1904.

An arm for carrying the trolley [illegible] its pivot. A [illegible]

787,036. Trolley Stand. Julius A. Grasberger, Richmond, Va. Application filed January 20, 1905.

Combined [illegible] ing a trolley pole pivoted to the bar, a catch pivoted to the arm, a [illegible] nected with the bar and [illegible] with the catch and a setting rod pivoted at one end to the arm and having its other end portion slidable with reference to the longitudinal bar.

787,043. Electric Arc Lamp. Bruno Jackisch, Charlottenburg, Germany, assignor to the firm of Allgemeine Beleuchtungs und Heiz Industrie Actien Gesellschaft, Berlin, Germany. Application filed September 23, 1904.

A slidable upper carbon holder [illegible] A guide [illegible] a slidable bar and [illegible] stop which limits its downward movement. A contact piece carried by the bar normally rests on the contact piece and a shunt coil is connected in circuit with the contact pieces so that the shunt circuit is broken when the carbon holder descends to a prearranged point.

787,047. Electric Resistance. Harry W. Leonard, Bronxville, N. Y. Application filed December 8, 1904.

A conductor in the form of a [illegible] between the strands with means for supporting the conductor. A heat-resisting insulating material filled within the interstices surrounds the conductor, the material serving to conduct and dissipate heat.

787,057. Wireless-telegraph Transmitter. Harry Shoemaker, Jersey City, N. J., assignor to the International Telegraph Construction Company, New York, N. Y. Application filed July 29, 1904.

In a space telegraph transmitter [illegible] Leyden jars in series-parallel grouping. Spark-gap terminals supported upon a container, an inductance winding surrounding the spark-gap terminals, and connections for a radiating conductor and earth at the terminals of a group of the Leyden jars are supplied.

787,089. Variable Resistance or Conductor for Electric Currents. William H. Fahrney, Chicago, Ill. Application filed January 10, 1903.

In a variable resistance or conductor for electric currents are a compressible elastic tube, a mass of particles of conducting material filling the tube, an electric circuit having its terminals electrically connected with the mass, means for compressing the tube and a spring for retracting the tube.

787,091. Electric Clock. Martin Fischer, Zurich, Switzerland, assignor to Actiengesellschaft "Magneta," Zurich, Switzerland. Application filed September 3, 1901.

Details are described.

787,107. Telegraph or Telephone Wire Insulator. Robert J. McDaniel and Salathiel V. Graves, McFall, Mo., assignors to Samuel I. Hudson, Watkins, Mo. Application filed December 10, 1903.

An insulating device comprises a bracket having a hollow head, the arms of which are flexible and spaced apart. One edge of one arm of the head has a recess for mounting an insulating block having diametrically opposite grooves to receive wires to be insulated.

787,113. Apparatus for Telephone-exchange Systems. John G. Roberts, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed January 18, 1904.

A sub-station switch controls the line circuit and a line relay in the circuit is controlled by the switch. Multiple spring jacks for the line each have a test piece normally disconnected from the line, and a normally open conductor is adapted to form an extension of the talking-line circuit leading from one of the line conductors to the several test contacts of the spring jacks. Contacts of the line relay close the conductor whereby

the line circuit is extended to the spring jack, while a test potential is applied to the test pieces upon the closure of the sub-station switch.

787,119. Desk Telephone Bracket. Thomas Q. Scott, Baltimore, Md. Application filed May 14, 1904.

The bracket comprises a number of pivoted sections with means for clamping it in position.

787,120. Trunk Line for Telephone Exchanges. Charles E. Scribner, Chicago, and Frank R. McBerty, Downers Grove, Ill., assignors to the Western Electric Company, Chicago, Ill. Application filed April 23, 1897.

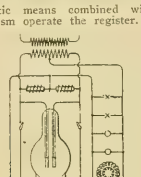
Each line has a telephone switch at the sub-station, operated automatically in the use of the telephone apparatus and controlling the flow of current. A trunk line unites the telephone lines, while two supervisory signal devices at one terminal of the trunk line are responsive to the telephone switches at the respective sub-stations. A supervisory signal at the other terminal of the trunk line is responsive to the telephone switch at the sub-station of the corresponding line.

787,147. Lock for Electric Switches. Charles L. Buschmann, Indianapolis, Ind. Application filed February 20, 1903.

A plug connects the terminals of the switch to close the circuit and a toothed wheel is movable in the path of the plug with an opening through it for the passage of the plug. A gear wheel meshes with the toothed wheel and means outside of the gear casing rotate the gear wheel for moving the toothed wheel into and out of the path of the plug.

787,163. Register System. Antonio Fevola, Yonkers, N. Y., assignor of one-half to Thomas Lisa, Yonkers, N. Y. Application filed September 9, 1904.

Electromagnetic means combined with a pawl and ratchet mechanism operate the register.



NO. 787,193.—FREQUENCY CHANGER.

787,169. Trolley Catcher and Retriever. Charles E. Gierding, Newark, N. J. Application filed July 7, 1904.

Spring-operated mechanism acts to wind or unwind the trolley cord automatically.

787,184. Dynamo. Edward B. Jacobson, Pittsfield, Mass., assignor to the Pittsfield Spark Coil Company, Pittsfield, Mass. Application filed January 27, 1904.

Combined with the rotating armature are poles grooved transversely at their outer ends and field coils surrounding the poles. Opposite segmental yokes consist of strips located side by side and having the ends seated in the grooves of the respective poles and between the raised partitions produced by the grooving.

787,187. Electric Time Switch. Robert D. Jones, San Antonio, Texas. Application filed October 1, 1903.

A contact arm driven by clockwork mechanism at a predetermined time closes a circuit controlling the switching apparatus.

787,192. Means for Transforming Direct Current. Osias O. Kruh, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 9, 1903. Renewed September 1, 1904.

A source of alternating current is provided with energy-storing and restoring devices in series across the mains. A vapor conductor has a number of electrodes, two of which are connected respectively to the mains and a third to the junction between the devices. A consumption circuit is connected between the junction and a point of intermediate potential on the source.

787,193. Frequency Changer. Osias O. Kruh, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 12, 1903. Renewed September 1, 1904.

Associated with a vapor conductor are a source of alternating current, an energy-storing device and connections for combining waves from the source with waves due to discharges from the device such as to produce a current the frequency of which differs from that of the source. (See cut.)

787,212. Sparking Igniting Device for Hydrocarbon Engines. James W. Packard, Warren, Ohio, assignor to the Packard Motor Car Company, Warren, Ohio. Application filed June 27, 1903.

An igniting device for hydrocarbon engines comprises a sparking circuit, a rotating shaft and a contact cam adapted to rotate with and slide on the shaft. The cam is adjustable about the shaft and is secured to the shaft in any desired position to advance or delay the spark.

787,221. Electrolytic Method. Alexander S. Ramage, Detroit, Mich. Application filed January 31, 1905.

The method consists in electrolyzing an aqueous solution of a metallic salt with an insoluble anode, recovering a cathode product and oxidizing an aniline compound at the anode.

787,227. Electric-motor System. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 5, 1903.

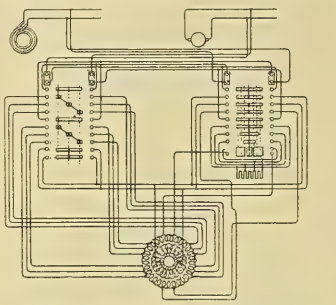
The motor embodies a member provided with a distributed winding and a member provided with a winding connected to the segments of a commutator. Means connect the motor windings to an alternating-current source of supply in such a manner that the motor will operate as a repulsion motor. Other devices provide for connecting the same motor windings to a continuous-current source of supply in such a manner that it will operate as a continuous-current motor. (See cut.)

787,228. Means for Transforming Direct Current. Charles P. Steinmetz, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 17, 1903. Renewed September 1, 1904.

The device embodies a cathode, anodes arranged around the cathode, means for producing between the cathode and anodes an arc shifting in regular succession from anode to anode and means for deriving from the pulsations of current passing to each anode a quarter-phase alternating current.

787,256. Direct-current Meter. James S. Anthony, New York, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 15, 1902.

Several field coils are provided with an armature operatively related thereto. Switches modify the circuit connections of the field coils in such a manner as to operate the movable element of the meter. Other means, fixed with reference to the armature, operate the switches without actual contact therewith.



NO. 787,227.—COMBINED CONTINUOUS AND ALTERNATING-CURRENT MOTOR.

787,292. Dynamo-electric Machine. Tracy B. Hatch, Los Angeles, Cal. Application filed March 7, 1904.

A field magnet pole having a movable part is provided with agencies for varying the position of the movable part to vary the effective magnetic area of the field magnet, at the same time moving the collecting brushes consistently.

787,293. Control of Bulkhead Doors. Laurence A. Hawkins, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 30, 1904.

A manually operated reversing switch for the motor has means for holding it normally in one operative position. A switch controllable locally or from a distance completes the motor circuit.

787,302. Single-phase Dynamo-electric Machine. Marius C. A. Latour, Paris, France, assignor to the General Electric Company, Schenectady, N. Y. Application filed August 30, 1904.

The machine is equipped with a field winding having a conductor short-circuiting equipotential points.

787,303. Alternating-current Series Motor. Marius C. A. Latour, Paris, France, assignor to the General Electric Company, Schenectady, N. Y. Application filed August 30, 1904.

A distributed field winding is connected in series with the armature and provided with two sets of terminals so disposed that the current through a portion only of the field winding is reversed upon alternately connecting the two sets of terminals in circuit.

787,305. Alternating-current Motor. Maurice Milch, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 12, 1903.

A single-phase primary member is associated with a secondary member having its winding connected to the segments of a commutator. Commutator brushes and short-circuiting connections are so arranged that the motor will have an initial starting torque and will operate at a substantially synchronous speed.

787,318. Electric Signal Device. Ludwig S. Walle, Brooklyn, N. Y., assignor to Fridtjof Jebsen, Bergen, Norway. Application filed December 29, 1903.

In an electric signal device is an indicator, a portion of which is a permanent magnet. An electromagnet operates the indicator. Means bring about the reversal of the current in the coil of the electromagnet and an electrically operated locking device holds the indicator in a predetermined position when the electromagnet is inoperative.

787,319. Protective Device for Electric Apparatus. Leonard Wilson, Pittsfield, Mass., assignor to the Stanley Electric Manufacturing Company, Pittsfield, Mass. Application filed May 12, 1904.

Combined with current-transmitting apparatus are switches adapted to open the circuits, tripping coils for the switches and means for energizing the tripping coils only upon a change of the normal ratio of current input to output of the apparatus.

787,336. Method of Operating Alternating-current Motors. Waldo A. Layman, St. Louis, Mo. Original application filed December 28, 1903. Divided and this application filed September 3, 1904.

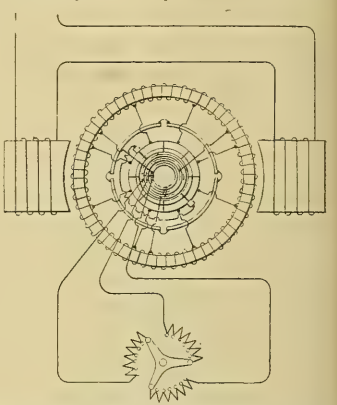
A method of operating alternating-current motors consists in directing a portion of the current in one of the members to produce definite magnetic poles at starting; short-circuiting a portion of the current in the member before normal running speed is attained; varying the amount of the short-circuited current, and increasing the number of short-circuits in the member when normal speed is attained. (See cut.)

787,338. Rosette or Receptacle for Conduits for Electric Wires. George A. Lutz, New York, N. Y., assignor of one-half to Frank K. Boland, New York, N. Y. Application filed May 23, 1901. Renewed June 5, 1903.

A rosette for drop-light wires embodies means for making electrical connections and is provided with a gain to receive a molding strip.

787,343. Wire Replacer for Trolleys. William Peck, Steubenville, Ohio, assignor of one-half to W. W. Harper, Toronto, Ohio. Application filed December 13, 1904.

A revoluble platform carries a harp and a wheel is journaled in the harp. A fork is pivotally mounted upon the platform carrying grooved wheels. Means adjust the fork in respect to the harp.



NO. 787,336.—ALTERNATING-CURRENT MOTOR SYSTEM.

787,344. Electrical Fire-alarm Apparatus. James P. Robertson, Sydney, New South Wales, Australia. Application filed August 13, 1902.

Local signal transmitting mechanism comprises telephonographic signal-transmitting devices and an electric motor for operating them. A line circuit connects the signal-transmitting mechanism with a distant station and a local circuit supplies current to drive the motor.

787,345. Phase-rotation Indicator. Rudolph F. Schuchardt, Chicago, Ill. Application filed May 13, 1904.

A rotary member is supplied with means whereby the member can be given a rotative movement in one direction or another according to the direction of phase rotation. Such rotative movements can be interpreted by suitable devices to indicate the direction of phase rotation with reference to the leads of the system.

## EXPIRING PATENTS.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on April 17, 1905:

381,220. Static Compensator for Telegraphs. M. M. Davis, Brooklyn, N. Y.
381,222. Electric Motor. P. Diehl, Elizabeth, N. J.
381,228. Means for Regulating and Controlling Electric Motors. B. A. Fiske, U. S. Navy.
381,234. Telephone Transmitter. J. M. Graham, Pittsburg, Pa.
381,246. Telegraphy. Z. P. Hotchkiss, Oak Park, Ill.
381,251. Dynamo Telegraphy. F. W. Jones, New York, N. Y.
381,254. Regulator for Electric Currents. E. R. Knowles, Brooklyn, N. Y.
381,260. Electromagnetic Spectacles. J. T. Leighton, Edinburgh, County of Edinburgh, Scotland.
381,269. Electric Contact Changer. P. C. Morse, Natick, Mass.
381,279. Electrical Registering Device. S. M. Pruden, Newark, N. J.
381,303. Electric Switchboard. R. H. Welden, Chicago, Ill.
381,304. Electrical Coil and Conductor. E. Weston, Newark, N. J.
381,305. Electrical Coil and Conductor. E. Weston, Newark, N. J.
381,336. Galvanic Battery. C. R. B. Claflin, Jr., and J. W. Flagg, Worcester, Mass.
381,343. Electric Train-signaling Apparatus. J. R. De Mier, Las Cruces, N. Mex.
381,344. Electric Train-signaling Apparatus. J. R. De Mier, Las Cruces, N. Mex.
381,372. Apparatus for Electrolysis. E. Hermite and C. F. Cooper, Pownall Road, Dalston, County of Middlesex, England.
381,382. Telephone Transmitter. E. H. Johnson, New York, N. Y.
381,394. Commutator Brush for Electric Generators. O. P. Loomis, Somerville, Mass.
381,398. Electrical Railway. J. C. Love, Philadelphia, Pa.
381,398. Dynamo-electric Machine. R. H. Mather, Windsor, Conn.
381,421. Dynamo-electric Generator. E. E. Ries, Baltimore, Md.
381,422. Electrical Indicator. A. L. Riker, New York, N. Y.
381,430. Circuit for Double-stranded Telephone-switchboard cords. C. E. Scribner, Chicago, Ill.
381,431. Long-distance Connection for Multiple Switchboards. C. H. Scribner, Chicago, Ill.
381,441. Electric Meter. E. Thomson, Lynn, Mass.
381,442. Electromechanical device. E. Thomson, Lynn, Mass.
381,443. Electric Meter. E. Thomson, Lynn, Mass.
381,446. Switch Circuit Breaker, etc. J. von der Kammer, Newark, N. J.
381,451. Dynamo-electric Machine. J. Wenstrom, Orebro, Sweden.
381,459. Electric Valve Controller for Automatic Fire Extinguishers. T. Atkinson, Richmond, Va.
381,480. Electric Meter. S. D. Mott, New York, N. Y.
381,482. Electric Elevator. G. C. Blickenderfer and J. K. Hallock, Erie, Pa.

# WESTERN ELECTRICIAN

**EVERY SATURDAY**

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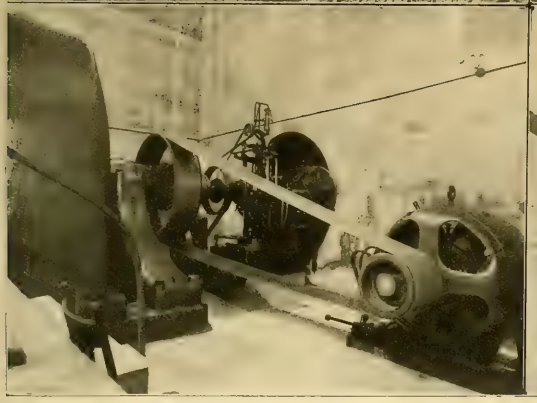
## Electricity as Used in the Operation of Lead and Zinc Mines Near Joplin, Mo.

The Joplin mining district, the lead and zinc fields of the state of Missouri, extends from Galena, Cherokee County, Kan., east through Jasper County, Mo., to Carthage, and from South Joplin, Mo., north as far as Alba and Neck City, comprising in area about 150 square miles. The mining industry in this section dates back to about 1878, during which time it has been continually increasing in volume, until the present output of zinc and lead ores amounts to slightly over $7,000,000 a year, this consisting of nearly 200,000 tons of zinc ore and perhaps 25,000 tons of lead ore.

At first the lead only was mined, the ore being

operation. Steam plant is comparatively [illegible] units, and very cheaply installed do not give [illegible] high mechanical efficiency, and result in a high cost of power to the mine operator. The question was recognized by the capitalists interested in certain Joplin mines, and as the result of their investigations it was decided that the waterpower along Spring River should be investigated with a view to utilizing this power throughout the mining district. For this purpose the Spring River Power Company of Joplin, Mo., was organized. The company is composed of Chicago men. Mr. Francis W. Farwell is president, Mr. Jamot Brown, vice-president, and Mr. Samuel Brown, Jr., secretary and treasurer. The Arnold Company of Chicago was commissioned to prepare complete plans and specifications for the proposed development, and

[illegible] downstream side of the dam, are the aprons, affording [illegible] the gate [illegible] wall and [illegible] point the embankment runs into the road leading from Lowell to Va[illegible] has been [illegible]



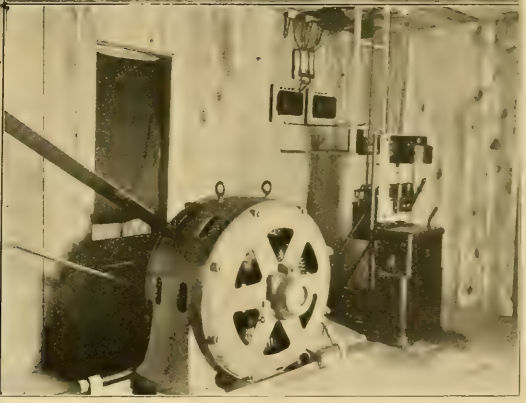


Fig. 1. Type of Better Class of Ore Mills.
Fig. 2. Dam, Power House and Long Span Arch over Shoal Creek.
Fig. 3. One of the Generators Showing Connection to Turbine Shaft.
Fig. 4. Typical Mill Installation.

ELECTRICITY AS USED IN THE OPERATION OF LEAD AND ZINC MINES NEAR JOPLIN, MO.

found very close to the surface of the ground. Later, when the surface ore was exhausted and it was necessary to go deeper for the lead, quantities of zinc ore were found. Since that time the importance of the zinc industry has rapidly increased until now it is far in excess of the lead industry. Fig. 1 is a view of one of the better class of ore mills, and an idea of the number of these mills that have sprung up in parts of the district may also be gained from the picture.

Zinc ore is found in pockets, and the amount of ore upon any mining claim cannot accurately be determined by prospecting. This makes the life of any particular shaft very uncertain, but the average may be placed at three years. Some pockets are worked out within a few months, while others are worked for a period of five or six years before being exhausted.

This characteristic of the zinc fields makes it necessary to change the location of the mills at frequent intervals, and as a result of this the machinery is installed at the least possible expense and all installations are of a very temporary nature. One direct result is a very low efficiency in later was awarded the contract for the entire construction.

Following these plans a hydro-electric plant has been located at Lowell, Kan., at the confluence of Spring River and Shoal Creek. At this point a dam was constructed and the necessary turbines and generators installed, as well as the step-up transformers and the necessary switching apparatus. From this point a transmission line leads through the zinc district, by the cities of Galena, Joplin and Webb City—in all about 30 miles. Four sub-stations were constructed, and from these secondary lines lead out to the mills to be supplied with electric power. For the transmission line a voltage of 33,000 was chosen, while for the secondary distribution 2,300 volts is used. In taking up the description of the property somewhat in detail, it may be well to begin with the work at Lowell and take up the various parts of the property in sequence.

### The Dam and Power Plant.

The dam (Fig. 2) is constructed entirely of concrete resting upon solid rock in and below the quarters of a mile beyond the end of the core wall. At a point along this road, about half a mile from the dam, sluice gates are installed, which makes it possible to divert a part of the river's flow during flood time. The water so diverted flows into Spring River about three-quarters of a mile below.

The layout of the dam and power house is somewhat unique, the generator and turbine rooms being a part of the dam. The normal elevation of the water in the tailrace will be about 113 feet. The floor of the turbine room is at an elevation of 121 feet, and from this floor the draft tubes under the turbines project downward into discharge tunnels built in solid masonry in the lower part of the dam. The normal elevation of the headwater is 141 feet, thus giving an available head of 28 feet. The turbines are installed on the floor of the turbine room and are practically situated on the river bed just above the dam. This method of entirely doing away with the headrace is very advantageous, as there is no question of difficulty arising from any currents which often are found in the headrace of ordinary construction. Fig. 3

is a view showing a plan and sectional elevations of the plant.

In each turbine room are installed four pairs of horizontal turbines, all mounted on one shaft. The shaft extends through bulkheads into the generator room, where it is directly connected to the generator, as seen in Fig. 3. This exceedingly simple construction is the most desirable, as in the operation of the plant there is absolutely nothing necessary but to attend to the bearings.

In front of the turbine room is installed a grid-bar rack, supported by steel columns placed five feet apart. Provision is made for mounting sliding gates between these columns in case it is desirable to shut the headwater off from the turbine room in order to make repairs on wheels.

The roof of the turbine room consists of heavy planking laid over the steel beams connecting the top of the columns with the dam proper, which forms the back of the turbine room. This construction is seen in section CC, Fig. 5. Section BB is taken through the generator room and shows the relative location of the generators, exciters and switchboard. Section AA shows the construction of the Taintor gates. The axes of these gates

working head of 24 feet, will develop 2,800 horsepower at about seven-eighths of full gateage. This gives a total capacity of 2,800 horsepower in each unit, or 5,600 horsepower in all.

The electrical equipment in the generator room is very simple. To the end of each turbine shaft is directly coupled the shaft of a 1,500-kilowatt three-phase 25-cycle 2,300-volt alternating-current generator, designed to operate at 187½ revolutions a minute. One only of these machines is shown in Fig. 3. A 55-kilowatt 125-volt direct-current exciter is directly belted to each turbine shaft. Each exciter is of sufficient capacity to provide current for both generators, and at the same time supply the necessary current for lighting and small motors about the plant. These two generators and two exciters, together with the switchboard, constitute all the electrical apparatus installed in the generator room. The step-up transformers and high-tension switches are installed in the transformer house, located on the bank of the river about 50 feet south of the south end of the dam, and indicated in Fig. 2. As seen from the plan, the switchboard is located on the upstream side of the generator room about 4½ feet from the wall.

on which are mounted ammeter, voltmeter and indicating and recording wattmeters for the 1,500-kilowatt alternators; also the remote-control switch for operating the oil switch installed in the transformer house.

Electrical connections between the generator room and transformer house are all paper-covered, lead-encased cable laid in tile ducts of ample size. For each generator there is a three-wire 600,000-circular-mil cable, each laid in its own tile duct. Other ducts of ample size are provided. In these are laid the two-wire cables used for switch control and for instrument leads. There is as well a 125-volt line leading from the main switchboard bus bars to distributing panels in the transformer house for furnishing light and power to small motors. In the transformer house are installed the six 500-kilowatt, 2,300-33,000-volt water-cooled transformers, the necessary oil switches, the high-tension bus bars, the lightning arresters and the necessary current and potential transformers. The building is constructed of hollow tile and is approximately 41 feet long by 31 feet wide. It is shown at the left in Fig. 2. The 2,300-volt cables end in the ordinary discharge

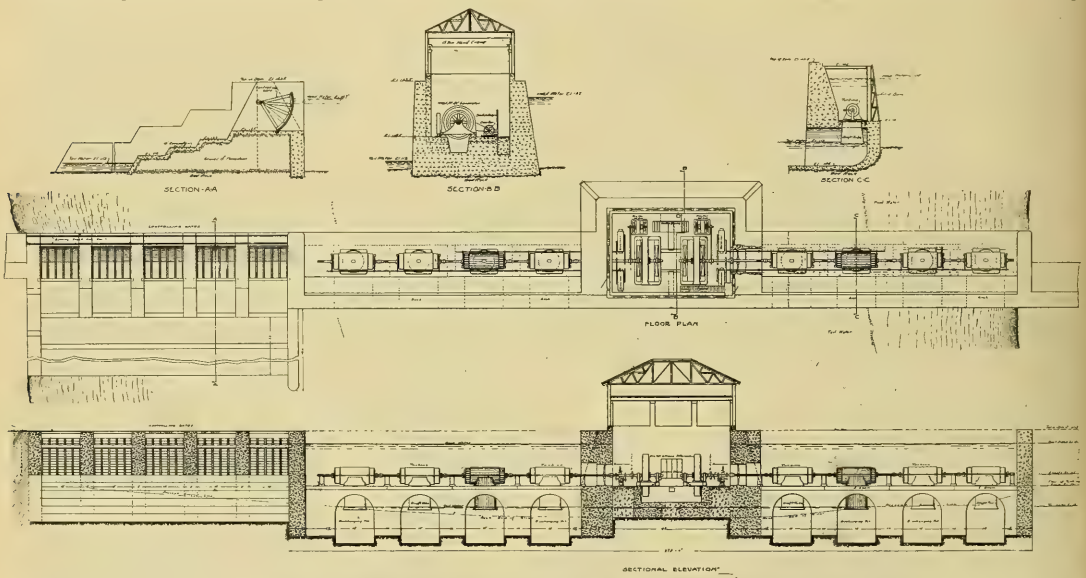



FIG. 5 PLAN AND SECTIONAL ELEVATIONS OF ELECTRIC POWER PLANT FOR THE OPERATION OF LEAD AND ZINC MINES.

consist of two 15-inch 42-pound I-beams, securely riveted together with steel plates and the necessary angle plates for attaching the wooden framing. The radius of these gates is about 13½ feet. As plainly indicated in the cut, they are designed to allow the water to pass through underneath the gate. By means of the controlling gates, the headwater can be kept at any desired height. The gates are designed to take care of the excess water at all ordinary times. In case of extreme high water, the overflow is to be taken care of by the special cut-off referred to in a preceding paragraph.

The turbines were furnished by James Leffel & Co. of Springfield, Ohio. There are two units, each consisting of four pairs of the latest improved 42½-inch center-discharge horizontal turbines connected in tandem on horizontal shafts. The turbines are designed to run at from 180 to 200 revolutions a minute and will develop 80 per cent. of the theoretical efficiency under a 24-foot working head. Each pair of turbines is mounted on heavy base plates, which in turn are mounted on heavy steel beams, forming the turbine-room floor. Each two pairs of turbines are provided with one gate shaft, and the end of each gate shaft is provided with couplings for direct connection to a Lombard governor. The installation, as noted above, contemplates receiving the water in an open flume, thoroughly protected by racks, and discharging the water through central-draft tubes set vertically below each pair of wheels. The lower end of these tubes is to be at all times submerged at a depth of from six to 12 inches. The tailwater will at all times show a depth of from 10 to 12 feet in the channel below the bottom of the draft tubes. The turbines, under a

The generator-field rheostats are installed in pits underneath and behind the switchboard. The current and potential transformers used in connection with the 2,300-volt generators are installed in a pit of ample size underneath the generators. This pit also makes it possible to make any necessary repairs underneath the large generators. In the generator room is installed a 15-ton hand-power traveling crane, which greatly facilitates any small repairs that may be necessary. The crane was furnished by the Whiting Foundry Equipment Company of Harvey, Ill. All the electrical apparatus in the generator room and transformer house was furnished by the General Electric Company.

Current generated in the generator room at 2,300 volts is taken directly through a three-wire paper-insulated lead-encased cable to the transformer house and led directly to the low-tension side of the transformers. From the high-tension side of the transformers the current is led through oil switches and single-pole disconnecting switches to the high-tension bus bars, and from the bus bars through single-pole disconnecting switches and oil switches to the line. The line is protected by lightning arresters. The high-tension switches installed in the transformer house are operated from the switchboard in the generator room by means of the General Electric standard system of remote control. Leads are also brought back from the current transformers installed in the line circuits to the switchboard, where they are connected with ammeters on the line panel.

The switchboard consists at present of five panels. There are two exciter panels, on which are mounted ammeter, voltmeter, exciter, rheostat and main switch. There are also two generator panels

bells, located on the side of the transformer room. The cables lead directly to the low-tension delta connection for the low-tension side of the transformer. The high-tension delta is installed directly above the transformers. All the wire connections are made of No. 2 bare copper wire, supported on a Locke insulator. The high-tension lines pass through Locke wall insulators into another part of the transformer house and pass directly to the oil switches. The oil switches are supported on the floor of the second story, the floor being constructed of concrete and steel. The bus-bar compartment is located directly beneath the switches and is built up of the hollow tile used in the building construction. Between the high-tension bus bars and the switches are installed single-blade disconnecting switches.

For the outgoing line, the leads pass from the high-tension bus through the disconnecting switch to the oil switch, thence along the ceiling to the opposite side of the room, then directly up along the wall back of the lightning arresters to the double-pole disconnecting switch near the high-tension entrance.

The entrance to the building is built up of slate panels mounted on strap-iron supports. The high-tension wire passes directly through an opening in the wall of the transformer house into this wiring compartment and downward through a porcelain insulator to a standard line insulator mounted on a bracket on the outside of the building wall. This insulator serves to take up all strain at the end of the line. The impedance coils used in connection with the lightning arresters are formed by winding the conductor in the form of a spiral about six inches in diameter with one-half-inch

pitch, and placing these coils along the wall directly back of the arrester. This gives a very compact and simple layout. At present only three oil switches are installed, one for each generator transformer unit and one for the line. Space has been provided in the design of the building for the installation of two more such switches when additional transmission lines are built. Space is also provided for the necessary future lightning arresters.

Circulating water for the transformers is drawn in from the river above the dam by means of a small centrifugal pump direct connected to a 125-volt two-horsepower motor, and after passing through the transformers is discharged through a pipe, the end of which is submerged below the tail-water. The difference in head under normal conditions is sufficient to maintain the necessary circulation, the system acting as a simple syphon; but, in order to start the syphon in operation and assure positive operation, the circulating pump has been installed.

### Transmission Line and Sub-stations.

The transmission line consists of three No. 4 bare copper wires supported on Locke No. 311 [illegible] line to cross other transmission lines. In the latter case, however, wherever it is possible, as in the case of the transmission line crossing the telephone line at right angles, two poles have been set close together on each side of the telephone line, making it impossible for any broken transmission wire to fall on the telephone line.

At present four sub-stations are being installed—one near Galena, one near Joplin, one southwest of Webb City in the Prosperity mining district, and one north of Webb City in the Oronogo mining district. At each sub-station there is installed in the main transmission line a horn switch of special design, the arrangement being such that the transmission line on the side furthest from the generating plant may be cut off. This provision is made so that, in case of difficulty on the line, no [illegible] line switches the cables are carried in conduits [illegible]

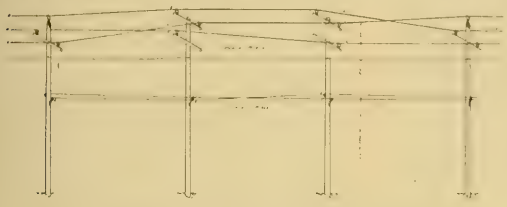


Fig. 6. Method of Transposing Transmission Lines with Double Cross-arms.

Fig. 7. Transmission Wires Crossing Railroad Tracks.

ELECTRICITY AS USED IN THE OPERATION OF LEAD AND ZINC MINES NEAR JOPLIN, MO.

insulators. The wires are arranged in the form of a delta, the top insulator being attached by means of a ridge iron to the top of the pole. The two lower insulators are supported on a 3¼ by 4¼-inch five-foot cross-arm. All insulator pins are provided with porcelain bases. The distance between wires is 44 inches. A ground wire, consisting of No. 6 soft-drawn steel, is installed on the side of the pole about two feet below the bottom of the cross-arm. This wire is attached to the pole by means of a three-eighths by three-inch lag screw and washers and is carried from pole to pole parallel to the transmission-line wires. At every fourth pole a ground connection leads from the ground wire to the ground and is buried below the bottom of the pole. These precautions have been taken on account of the fact that the district through which the transmission line runs is subject to very severe electrical storms during a good portion of the year. It is hoped that the carrying of the ground wire so near to the transmission line, together with its frequent grounding, may materially lessen the difficulties in the operation of the system. The standard poles are 35 feet long with seven-inch top, set six feet in the ground, and this brings the lower wire of the transmission line to about 26 feet above the ground, while the ground wire is about 23 feet above the ground. Upon leaving the transformer house the line crosses the river by a single long span, as shown in Fig. 3.

In transposing the transmission line, a partial revolution is made about once every mile, the number of transpositions being so chosen as to make a complete turn in the delta in each section of the line, that part of the line between the power house and sub-station, or between any two sub-stations being considered as a section, the sections being from two to three miles long. Fig. 6 shows the method of transposing with double cross-arms, one-third of a revolution being shown. The telephone line is installed about six feet below the ground wire, this line being transposed every second pole. This is accomplished by using a transposition insulator on every other pole and two telephone insulators on the intermediate poles. It is found that this frequent transposition very materially decreases all difficulties, due to induction, arising from the high-tension line.

Wherever the line crosses the main tracks of steam roads, special cradles are installed, as shown in Fig. 7, composed of No. 4 steel wire, so designed as to prevent any broken transmission wire from reaching the ground. These cradles are very thoroughly grounded, which will result in tripping the automatic oil switch, thus throwing the broken wire out of commission in case any break should occur in the line. Similar protection has been provided in each sub-station between the fault and the generating plant need be permanently put out of service. By opening this switch repairs can be made on the line, while all sub-stations nearer the generating plant can be kept in operation. Between Joplin and Webb City there is a branch in the main transmission line—one branch leading to the Prosperity sub-station and the other branch leading to the Oronogo sub-station. At this junction point two air-brake switches are installed, thus making it possible to cut either end of the line off from the main line leading to the dam.

Sub-station No. 1, Fig. 8, is located near Galena, while that known as sub-station No. 2 is located near Joplin. These two sub-stations are each built of brick and are about 18 feet square (outside measurement) by about 30 feet high. The line entrance is in every respect similar to that used in the construction of the transformer house at Lowell, and likewise similar lightning arresters, designed for 30,000 volts, are connected to the line just inside of the entrance. Three single-pole oil switches, provided with suitable mechanism for hand operation, are installed on the second floor of the sub-stations.

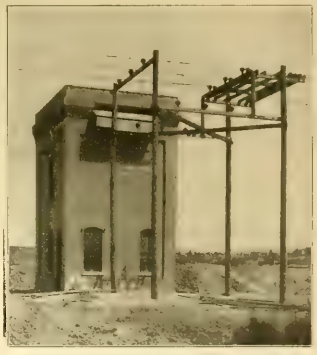


FIG. 8. SUB-STATION NO. 1 OF JOPLIN POWER-TRANSMISSION PLANT.

The operating mechanism is connected to the switchboard, which is installed on the lower floor in front of the transformers. The high-tension wires coming from the oil switches pass directly to the delta, and thence to the transformers located on the lower floor. Three 250-kilowatt 25-cycle 30,000-2,300-volt water-cooled transformers are in-

porcelain insulating tubes to the secondary distributing line. Fig. 9 is a wiring diagram typical of the four sub-stations and explaining the general arrangement of the apparatus.

The design of the sub-stations is made as simple as possible, there being provided only one high-tension switch for disconnecting the sub-station from the line. In case it is desirable to disconnect the line leading from the sub-station or the line going to the sub-station from the power house, it can be done by means of the air-brake switch referred to. An ammeter, voltmeter and recording wattmeter, to give the total station output, are mounted on the switchboard.

While the layout for sub-stations Nos. 3 and 4, which are located at Prosperity and Oronogo, is exactly similar to that of the two just described, the equipment is somewhat different. In the two preceding sub-stations General Electric apparatus is used throughout. In sub-stations 3 and 4, high-tension switches of this make are installed, but the balance of the apparatus, including the transformers, switchboard, lightning arresters, etc., are of Westinghouse manufacture. The buildings, too, are of different design. In this case it has seemed desirable to build a structure which could be easily moved from one place to another, and to accomplish this a light steel framework has been designed and built in such form as will permit its readily being taken down. Fig. 10 is a view of sub-station No. 4, of the portable type.

The siding is of corrugated iron supported on angle iron, and the roof of wood sheathing lined with fireproof material and covered with corrugated iron. The whole structure is mounted on concrete piers, which also carry the weight of the transformers, the only weight necessarily carried in the building being the oil switches mounted on the second floor and the lightning arresters. With this form of construction, it becomes a very simple matter to take down the sub-station and move it to another point in the mining district in case the mines in the immediate vicinity become exhausted, resulting in a change in the center of distribution of the area supplied with power. In some cases this may be very desirable, on account of the mining conditions peculiar to the Joplin district.

Secondary lines are run from these sub-stations to the various mills served by the company. These lines are mounted on standard 35-foot poles. A four-foot six-inch cross-arm is placed at the top of the pole and beneath it a four-foot two-inch cross-arm. This makes it possible to carry two three-phase lines on each pole. For secondary transmission bare copper wire or cable of requisite size is used, the sizes ranging from No. 0000 down to No. 1, depending upon the load and the distance

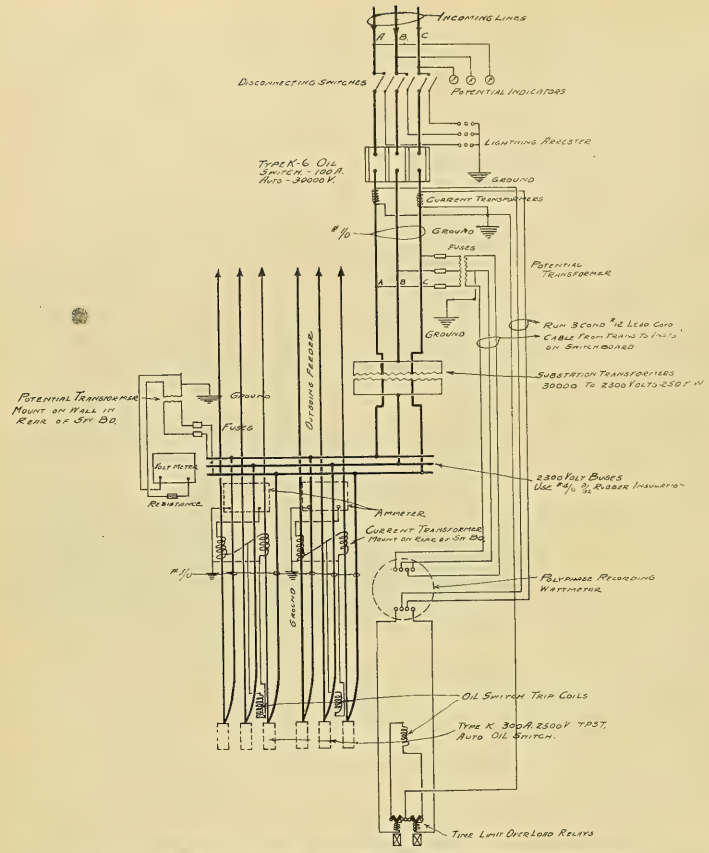



FIG. 9. WIRING DIAGRAM OF TYPICAL SUB-STATION OF JOPLIN POWER-TRANSMISSION PLANT.

of the load from the sub-station. In case two lines are not to be installed at once, only the upper cross-arm is put in place, and the three wires of the transmission line first installed are arranged in a horizontal plane on this cross-arm. In case the second line is added, it simply becomes necessary to install the lower shorter cross-arm and the additional insulators. It is probable that when two lines are installed, the ordinary delta arrangement will be adhered to, although for practical purposes the inductive drop, due to placing the three wires of the transmission line on one horizontal plane, is not at all serious.

### Telephone System.

A private telephone system has been installed, with telephones located in each of the four sub-stations and in the generator room and transformer house at the dam. The telephones are very carefully insulated from the walls, and insulated stools are provided, to be used when talking over the telephone. For lightning protection an ordinary 2,000-volt lightning arrester has been installed on the telephone line just as it enters the building. The telephone line next passes through the ordinary telephone fuses and then through sneak-current coils, which are also grounded, and finally through the small lightning arrester on the telephone. A double-pole single-throw knife switch is installed between the telephone and the sneak-current coil, thus making it possible to disconnect the telephone from the line. An extension bell is permanently connected to the line. This arrangement is made with the idea that the telephone can ordinarily be disconnected from the line, and the attention of the operator can be attracted by means of the extension bell. The operator can then close the knife switch, thus putting the telephone in service, after which a conversation can be carried on. This precaution is taken with the idea that the telephone itself may be protected from any accident that may happen to the line.

### Mill Equipment.

The standard mill equipment might be said to consist of a 15-horsepower hoist motor, a 10 or 15-horsepower pumping motor and a 50 or 75-horsepower mill motor with, in some cases, a 75 or 100-horsepower compressor motor. In cases requiring motors of 50 horsepower or over, 2,300-volt motors have been chosen. In such cases the motors are protected by automatic oil switches. Motors of smaller horsepower are 440-volt motors, and suitable transformers are installed for supplying current at lower voltage to all such motors. These motors are generally of the squirrel-cage type and are operated by the starting compensator. A typical installation for one of the mills is shown in Fig. 4. A 2,300-volt polyphase recording wattmeter is connected to the line at its entrance to the building. The large power motors operating at 2,300 volts are each controlled by its own automatic switch as well as the tap from the main service box which leads to the transformers reducing the voltage to 440 volts. Leads are taken from the secondary transformers to the starting compensators of the various 440-volt motors. In case a small amount of lighting is to be done, a single-phase transformer can be connected across one phase, and sufficient current for this purpose can be transformed to 110 volts.

FIG. 10. PORTABLE SUB-STATION OF JOPLIN PLANT.

### Operation.

Sub-stations No. 1 and No. 2 have recently been put in operation and are furnishing power regularly to the mines now equipped with motors. The motors are rapidly being installed for the balance of the Spring River Power Company's customers, and all four sub-stations will soon be in service. The plant will be operated for the Spring River Power Company for the coming year by The Arnold Company.

The work of construction has been done under the immediate supervision of Mr. William H. Rosecrans, civil engineer for The Arnold Company, who has been in charge of all hydraulic features of the work. Mr. P. L. Battey, electrical engineer for The Arnold Company, is now in charge of the installation work and has superintended all the electrical construction work.

## Public Lighting Inquiry in New York City.

The investigation into the cost of public lighting in New York city was concluded on Friday, April 21st, after a hearing lasting four weeks. On the previous Sunday the committee visited various gas and power plants, including that of the New York Edison Company at East Thirty-ninth Street, where the visitors were received by General Manager J. W. Lieb, Jr., Vice-president Thos. E. Murray, and Station-manager Walter F. Wells. On Monday W. W. Freeman, secretary of the Kings County Gas and Electric Company (a concern controlled by the Brooklyn Edison Company), testified that his company was operated by the Edison company, and last year paid an eight per cent. dividend on a capital of $3,700,000, besides laying up a surplus of $385,000. The Edison company had paid $400,000 in bonds for the Amsterdam Electric Light, Heat and Power Company, but in 1901 the stock of this company was worthless, and since its incorporation had lost about $11,000 every year. The Brooklyn rates for current were reduced last January, and under the new schedule Mr. Freeman averred that receipts had fallen off 20 per cent. There had, however, been an increased consumption of current to the amount of six per cent., and the cost of generating was lessened. The average cost of the 4,260 arc lamps in Brooklyn was $115.32 each, and 3,109 of these were wired overhead.

The evidence on the following days was mainly given by "political" witnesses. Col. Robert Grier Monroe, former lighting commissioner under the Low administration, said on Tuesday that when he took office in July, 1902, he started an investigation into the cost of public lighting. He alleged that the prevailing method was "extravagant, wasteful and inefficient," and that the city was in the hands of a monopoly. It was Colonel Monroe's attitude that eventually led to the present investigation.

Prof. William Hallock of Columbia University gave voluminous evidence as to the quality of the gas supply. The quality was poor, he said, and when it was poorer than usual the company increased the pressure. By this means the consumer at times paid $3 for one dollar's worth of standard illumination.

On Wednesday Controller Edward M. Grout told how the lighting bids were rejected in 1903. Since then the city had paid only a percentage on the bills. He dissociated himself with a contract made by Lighting Commissioner J. T. Oakley, and refused to pay the money therefor.

Mayor G. B. McClellan was asked, among other things, as to the proposed municipal plant. He said, in part:

"In regard to that I will state that the city is committed to it. We have obtained a commission to estimate the cost and prepare plans. Meanwhile I am making an experiment under the Williamsburg Bridge to have a small plant to light the bridge and certain schools, using city refuse for fuel. If successful, I am in hopes of using city refuse for the entire city plant. I have also hoped that we could use the power generated in the Esopus watershed for the purpose of city lighting, but I have just learned that my part of the bill which would permit that has been stricken out by the governor. We expect to acquire the ducts, and, even without that, we claim, under the agreement with the subway companies, the right to use all the space we need for municipal electrical conductors."

On Thursday Charles F. Murphy, the leader of

Tammany Hall, was questioned as to his relations with the Consolidated company. He admitted speculating in Consolidated stock. He had never interfered in public lighting matters, so he considered that Lighting Commissioner Oakley was able to do his work properly.

On Friday E. H. Rochester, president of the Bronx Gas and Electric Light Company, gave evidence. This company is independent, and under its charter can charge whatever prices it likes for gas and current.

The official report of the committee is expected to be published in a few days' time, and may lead to a legislative enactment affecting the cost of public and private lighting. W

## Modern Electrically Operated Pumping Plants.

By Frank C. Perkins.

Part II.

Electric motor driven fire engines are now in operation in England and other foreign countries, the electric current not only being utilized for pumping but also for operating electric searchlights at the scene of the fires, thus greatly aiding the firemen in their work. The electric-pump fire engine is much lighter than the steam fire engine and the current can be supplied from electric supply boxes near the hydrants. With the great development of electric power in Buffalo there is every reason to believe that electric fire engines will be utilized to advantage in the near future, the present steam fire engines being utilized in the outlying districts while the automobile fire-fighting machines will be employed in the crowded districts.

For the high-pressure electrically driven fire pumps those types in use in mines are particularly applicable. One of these electric twin mining pumps was installed in the Ferdinand mine in Germany by Siemens & Halske of Berlin, the motor operating at a speed of 184 revolutions a minute and geared to pumps installed in an underground chamber lined with white enamel brick, the water being raised to a height of 200 meters.

A Helios 450-horsepower, three-phase Express mining pump is shown in Fig. 6, and a 570-horsepower Hoppe Express pump, operated by a slow-speed motor, has been in successful operation for a considerable time at the Dortmund mine at the Keiserstuhl shaft, raising the water to a height of 400 meters. A Riedler Express pump for high pressures may also be mentioned. Such a pump was in one instance coupled directly to a 2,000-volt three-phase motor operating at a speed of 200 revolutions a minute and raising water to a height of 600 meters.

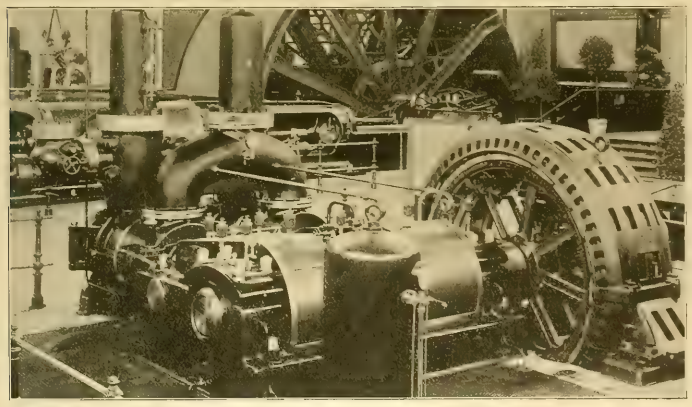


FIG. 6. HELIOS 450-HORSEPOWER ELECTRICALLY DRIVEN PUMP.

There is a large hydro-electric station at Chevres, near Geneva, Switzerland, having a capacity of 7,200 horsepower, with six two-phase electrical generators of 1,200 horsepower each, driven by vertical turbines in a similar manner to those at Niagara Falls. In the Coulouvreniere pumping plant there is an electrically operated pump of 1,000 horsepower, directly coupled to a 5,000-volt two-phase induction motor, and this has been in operation at the waterworks of the city of Geneva for several years, giving excellent satisfaction. There are also in this waterworks 18 pairs of double-acting plunger pumps, the [illegible] being at right angles [illegible] by a common crank [illegible] vertical shaft of a [illegible] seen that at the waterworks [illegible] a part of the pumps are driven [illegible] while one of the largest, of 1,000 horsepower, is operated electrically by an alternating-current induction motor. There are three different services supplied by these pumps. The heads of these services are 164 feet, 328 feet and 492 feet [illegible]

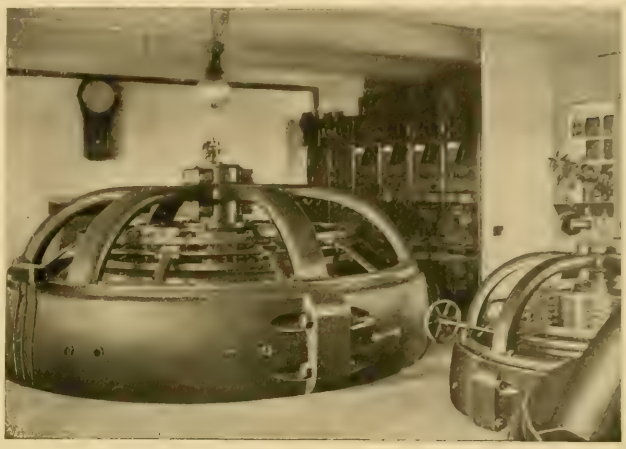


FIG. 7. ELECTRIC VERTICAL-SHAFT PUMP AT NEWPORT NEWS.

being respectively 206,000 gallons, 114,900 gallons and 71,300 gallons an hour, illustrating the point that electric pumping plants of high power are in successful operation, and where electric power is available can be installed in this country to meet the conditions of city service.

The 1,000-horsepower electric pump in the Geneva waterworks in Switzerland just mentioned is of the centrifugal type, operated at a speed of 455 revolutions a minute by a two-phase motor directly from the 5,000-volt mains of the electric power circuit and has given excellent service for several years.

Besides the illustrations showing electric pumping units at the city waterworks at Austin, Texas, and at New Orleans, La., another at Newport News is illustrated by Fig. 7, indicating that electric pumping plants have been thoroughly tried and have demonstrated their success in the United States.

An electrically operated pumping outfit, now under construction for the city of Buffalo, will undoubtedly soon be placed in service and give a good account of itself. The valuable experimental data supplied by this equipment will in all probability demonstrate that by its economical and satisfactory operation Niagara power can be utilized for a large proportion of the new pumping service without an extensive installation of new steam pumps

[*To be continued.*]

## Industrial Education and Organization.

[illegible]

There it was customary to teach four "R's" instead of three as in England, the fourth signifying "Reason." Every child was taught to reason and to think for itself instead of learning by rote. Education had done more for America than all the natural resources had done for England. The industrial development of America was alarming, and it behooved Englishmen to face the question in a serious fashion. The British Empire stood at the parting of the ways—either it would cling to tradition and sink into obscurity, or it would accept modern advances and ideas so that the present would be nothing more than its birth. The entire system of English education was wrong, because it did not make every child self-supporting and capable of rising to almost any position in the world. He had met would-be office boys in England who had passed through board schools and were not able to do arithmetic—they could barely write their own names. In justice, he confessed that American boys stayed longer at school, but then in that country all education was free, even including the universities. Dealing next with the relations existing between employers and employed in America, Mr. Mosely said these were most cordial. In almost every American factory there was an "idea box," into which workmen were encouraged to insert letters setting forth new ideas which might occur to them; if these ideas were valuable their originators were well rewarded. In America the men worked longer and harder than in England, and they were usually 50 per cent. better off. Machines were run at a higher speed and the factory organization was immeasurably superior. Piecework was almost universal and prices were not cut.

## American Electrochemical Society.

[Special dispatch to the Western Electrician.

Boston, Mass., April 25.—The American Electrochemical Society's convention opened auspiciously this morning in Lowell Hall, Massachusetts Institute of Technology. Dr. Henry S. Carhart, president of the organization, was in the chair, and the session was devoted entirely to papers on technical topics. Prior to the meeting in the lecture hall the registration in progress showed upward of 130 members and guests among the arrivals. Tellers were appointed to count the votes for officers for the ensuing year, announcement of the result to be made tomorrow. A large number of the members listened to the papers at this morning's session, manifesting a lively interest in the topics. The luncheon at noon at the Technology Club, given by the Institute, was thoroughly enjoyed, and the afternoon trip to Lynn to visit the General Electric works was participated in quite generally. A smoker at the Lenox this evening will wind up the first day. Tomorrow the session will be held at Pierce Hall, Harvard University, in Cambridge. Thursday's session will be at Lowell Hall. B.

[The full report of the Boston convention will be given in the Western Electrician next week.]

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## DATES AHEAD.

Association of Railway Telegraph Superintendents (annual meeting), Read Hotel, Chattanooga, Tenn., May 17th and 18th.

National Electric Light Association (annual convention), Denver, June 6th, 7th and 8th, and Colorado Springs, June 9th, 10th and 11th.

International Association of Municipal Electricians (annual convention), Erie, Pa., August 29th, 30th and 31st.

National-Interstate Telephone Association (first convention of consolidated telephone associations), Chicago, June 21st, 22d and 23d.

Ohio Electric Light Association (annual convention), Hotel Victory, Put-in-Bay, August 16th to 18th.

American Electrotherapeutic Association (annual meeting), Academy of Medicine, New York city, September 19th, 20th and 21st.

Old-Time Telegraphers' and Historical Association (annual meeting), New York city, August 29th to September 1st.

ALTHOUGH some telephone companies do not like it, the useful word "hello" promises to stick in the telephone vocabulary; in fact, it seems practically indispensable, as the Western Electrician endeavored to show in a previous issue. An interesting anecdote in relation to the telephonic debut of "hello" was told by Mr. F. P. Fish at the recent dinner in New York given by the Magnetic Club in honor of Thomas A. Edison. Mr. Edison himself was the hero of the story. Mr. Fish said that in the early days of the telephone those who used it greeted each other with the awkward phrase: "Are you there?" Nobody ever thought of any other words for the purpose until one day Edison had occasion to step to a telephone instrument for his first actual use of it outside the laboratory. As in reply to his own ring the signal came back from the other line, he called out, "Hello!" The idea took root at once in the minds of those who happened to be present, and in a marvelously brief time the new word had been accepted all over the country as the best method of beginning a telephonic conversation. Thus was a new laurel added to the brow of the great inventor.

DUBUQUE was the scene of two electrical conventions last week, the larger and perhaps the more interesting one being that of the Iowa Electrical Association, while the other, smaller in size but select in quality, was that of the younger Iowa Street and Interurban Railway Association. The two organizations held overlapping conventions, as several active members are prominent in both, operating combined street-railway and lighting properties. They are thus on friendly terms, but preserve, nevertheless, distinct organizations.

In the electric-lighting field Iowa is distinguished by its number of small central stations, having no less than 165 plants in towns of less than 5,000 inhabitants. As everybody knows, the state is prominent in agriculture and one of the most prosperous in the Union, but with no large cities and few of medium size. Its inhabitants are largely of good American stock and possess a high order of intelligence. Those of them who are engaged in electrical pursuits rank well with their fellow citizens in every respect. They have one of the very best of the smaller electric-light associations of the country, and their papers and discussions are of value to wideawake managers of the smaller stations all over the United States. Their plants are not large, but many of them are managed with an enterprise and acumen, a realization and adaptability to conditions and environment, that would do credit to any electrical proposition anywhere. It is significant that the new president of the association, Mr. Burt of Waterloo, who comes from a city of 15,000 people, is a graduate of Cornell in mechanical engineering, a man who took the Sibley prize in mechanic arts in college and who had for the subject of his thesis the testing of the electric street railways of Buffalo, in which he was assisted by a body of 80 fellow students. Again, the fact was brought out at last week's convention that the central-station management at Cedar Rapids (with its 30,000 inhabitants) had quietly procured one of the new tantalum lamps and had been testing it on a commercial circuit for efficiency and life, being one of the first electric-light companies in the country to make such a determination for itself. These circumstances show that the electric-light men of Iowa are bright fellows who think out their own problems. Further, the showing is distinctly American, distinctly electrical and distinctly gratifying.

Like other societies of similar character, the Iowa Electrical Association has found that it lacks funds to carry out its allotted work, owing to the small sum charged for annual dues. Accordingly, a graded scale was adopted, by which the companies in the larger places will pay more in future—a plan which ought to work out well. The convention was also marked by the retirement of Mr. W. S. Porter from the position of secretary. Mr. Porter has been a tower of strength to the association, not only in performing the duties of his office, but by his counsel, his experience with men and affairs and his constant and hearty interest in the welfare of the society. A prospective absence from the state made it imperative, however, to accept his resignation. Mr. Bellamy, his successor, is a younger man, but he is well trained, both theoretically and practically, for practical electrical work, and he is sure to make up by well-directed effort what he lacks in experience.

The reports in this issue will give an idea of the character of the proceedings at the Iowa conventions of last week. Among the electric-light men perhaps the most attention was attracted by the papers on "Steam Turbines" and "Gold-brick Finance," both dealing with popular subjects. But Professor Spinney's paper on testing the spherical candlepower of incandescent lamps and Mr. Burt's committee report on "Facts and Factors" were also particularly valuable. In the street-railway convention Mr. Polk's paper on "Electric-railway Freight Service" is particularly entitled to commendation, treating a live subject in a fresh, serviceable way.

Visitors to Dubuque were treated with cordial hospitality by the mayor of the city, the Union Electric Company, the Dubuque Club and the citizens of the place generally. The conventions were entirely successful, both technically and socially, and will long be remembered with pleasure and profit.

IN THE REPORT of the Department of Electricity of the city of Chicago for the year 1904, just out, Mr. Edward B. Ellicott, the city electrician, says: "An average of 5,034 arc lamps was maintained throughout the year at a total cost of $273,639.24, or an average cash cost of $54.36 per lamp for the year." This "cash cost" (the qualification of "cost" may possibly imply that the figure is not the total cost) does not include office expense, which would add 80 cents, Mr. Ellicott says. It includes simply these items: Coal, carbons, globes, repairs to steam and electric plants, to lamps and to circuits and lamp posts, "expenses not classified," superintendence, lamp trimming and station labor. In other words, it is merely the "L & M" of the manufacturer—labor and material. And for any manufacturer to regard "L & M" cost as his real cost would be to invite bankruptcy.

By a coincidence, a paper on "Gold-brick Finance" was read by Mr. J. G. Boyd before the Iowa Electrical Association at Dubuque during the very week in which Mr. Ellicott's report made its appearance. The character of this breezy paper may be guessed by the title. In it the writer said: "A certain western metropolis has stated repeatedly that it is, under municipal ownership, producing its arc service for about $55 per lamp-year, when an analysis of its own published figures indicates that the fixed charges alone exceed that amount." Probably nobody knows exactly what the street arc lamps of Chicago are really costing the taxpayers. But it is a notable fact that the fixed charges to which Mr. Boyd refers are entirely absent from Mr. Ellicott's itemized "cash cost." A few years ago we made a rather elaborate analysis of one of the Chicago municipal electric-lighting reports, and the lamp-year cost figured out, we remember, including depreciation, taxes, interest and water, something between $90 and $100. So it is probable that Mr. Boyd, with his implied $110, is nearer right than Mr. Ellicott, with his published "cash cost" of $54.36, or, rather, $55.16.

It is a weariness to the spirit to reiterate that the fixed charges enter just as much into the price of producing the lights as the cost of the coal or the fireman's wages. To quote Mr. Boyd again, and to quote him because what he says is manifestly true, "Probably every wideawake merchant in this land knows that if he does not open up his store for one day, 30 days or six months, his taxes, insurance and interest charges will go on just the same. Thus it also is in the electric-light business. Close down your plant for any period of time and those self-same fixed charges will continue right on doing business at the old stand, 24 hours each day and 365 days in each year."

Mr. Ellicott is an intelligent, able and honest official. He is an electrical man, not a politician, and we can readily understand that, in accepting office, with the legacy of municipal plants, he had a difficult task to perform. But we believe, nevertheless, that he is mistaken in saying that the cost of municipal street lighting in Chicago is $54.36 a year; and, furthermore, the statement should not be allowed to pass uncontradicted.

# IOWA ELECTRICAL ASSOCIATION.

Iowa, with no large cities, has nevertheless [illegible] electric light plants, [illegible] of which are in towns of less than 5,000 inhabitants. Something less than half of the whole number of electric light companies in the state are banded together in the Iowa Electrical Association, which held its fifth annual convention in the Hotel Julien, Dubuque, on April 19th and 20th. This convention was the best attended and most enthusiastic of any the association has ever held. Perhaps 160 persons were present, of whom a large proportion were central-station men. The supply men were out in good force, many of them with exhibits. A list, not quite complete, of the names of those present is given on pages 328 and 329. Aside from the reading of papers (one of which, on "Gold-brick Finance," attracted much more popular attention than is usually given to a convention paper) and the discussions, the principal features of the meeting were the retirement of Secretary W. S. Porter of Eldora, who had served the association unselfishly and with conspicuous ability for four years, and the raising of the annual dues to the companies in the larger towns and cities. President W. L. Bowers of Davenport filled the chair at all sessions, and often, by a shrewd, kindly, humorous remark, cleared the atmosphere if the proceedings threatened to become monotonous. He wielded a formidable gavel made of a glass insulator, an insulator pin and a handle, which was adorned with white and purple ribbons. As these are the colors of the Elks, and as Mr. Bowers is a popular member of that order, it is surmised that the memento was due to admirers in the organization mentioned.

The opening session was held in the assembly room of the hotel on Wednesday morning, April 19th. President Bowers introduced Mayor C. H. Berg of Dubuque, who delivered a brief address of welcome. His Honor's speech was couched in graceful terms. He announced on behalf of the Union Electric Company of Dubuque an entertainment in honor of the visitors in the clubroom of the hotel in the evening. Mr. Porter, the secretary, responded in fitting language. The members of the association, he said, represented more capital than any other industry in the state of Iowa save the banking industry.

In his annual address Mr. Bowers recommended that some action be taken to increase the revenues of the association and that an associate membership be established. He referred to the municipal-ownership question briefly in alluding to Mr. Boyd's paper and then called for the report of the secretary. Mr. Porter, in his report as secretary, made various recommendations, and said that the association needed more money. The present revenue is inadequate. It was necessary to take in the supply men or to raise the dues. This report was referred to the executive committee.

The election of the nominating committee came next. Tellers were appointed to receive the votes, which, when counted, showed the election of A. W. Zahm of Mason City, W. J. Greene of Cedar Rapids, Austin Burt of Waterloo and D. F. McGee of Red Oak.

Mr. Greene offered an amendment to the by-laws in the matter of dues. This amendment was referred to the executive session and will be referred to later.

L. D. Mathes, general manager of the Union Electric Company of Dubuque, read the first paper of the convention. It was entitled "Methods of Obtaining Business," and an abstract will be given in a future issue. Messrs. Zahm, Burt, P. E. Bellamy of Knoxville and McGee took part in the discussion, which concluded the morning's session.

### Commercial Lighting, Tantalum and Nernst Lamps.

At the afternoon session of Wednesday the report of J. A. Innes of Eagle Grove on "Commercial Lighting" was read by the secretary in the absence of the author. The writer referred with praise to the recent paper of George N. Eastman of the Chicago Edison on the use of small carbons for small enclosed arc lamps. (See Western Electrician of April 15th.) There is a liability of the small carbon points wedging in the lamp when the current is turned off. This is one point to be considered, but on the whole the change proposed is one of much promise. Mr. Innes spoke hopefully, also, of the tantalum lamp.

J. R. Cravath of Chicago exhibited samples of the tantalum lamp and rehearsed some of the data available on the subject. Mr. Burt and Mr. Carson also discussed the tantalum lamp. The latter said there was hope that the new lamp would be to the ordinary incandescent lamp what the Welsbach mantle is to the ordinary gas burner.

Cedar Rapids has the distinction of being one of the first cities to test the tantalum lamp in actual operation under commercial conditions. At the instance of Mr. Greene, general manager of the Cedar Rapids and Iowa City Railway and Light Company, Thomas Sloss of the same company gave the results of some tests made by J. C. Martin for the company. These tests are summarized as follows:

Test No. 1—Initial candlepower and wattage—Voltage, 110. Candlepower, 20.22. Wattage, 35.1[illegible]. Efficiency, 1.[illegible] watts per candle.

[illegible]

In a memorandum giving the results of these tests Mr. Martin continues: [illegible] the lamp. This lamp has been burned on our No. [illegible] incandescent line and has therefore been subjected to actual service.

"The filament which in the new lamp has the smooth surface and the same appearance as the ordinary carbon filament has roughened materially and appears under the light as though it had crystallized. In the new lamp the filament is strung loosely over the supports. It has shortened so that it has drawn much tighter, although it is still somewhat slack and could contract yet more." This report is dated April 18th.

Mr. Sloss exhibited the lamp that had been tested at Cedar Rapids.

AUSTIN BURT, PRESIDENT IOWA ELECTRICAL ASSOCIATION.

Mr. Greene reported excellent success with Nernst lamps in Cedar Rapids. They were a fine weapon to compete with four-burner gas lamps.

C. F. Freehauf of Cresco also reported good results with the Nernst lamp in his town. He said that the glowers last as long as the filaments of an ordinary incandescent lamp.

### Other Papers and Reports of Wednesday.

Paul E. Bellamy of Knoxville read a report on "Commercial Power." This was discussed by Messrs. Burt, Carson, Greene, Rufus Lee of Clarinda, D. F. McGee of Red Oak, Mathes and others. This report will be published in a future issue of the Western Electrician.

S. Sparrow of the Wagner Electric Manufacturing Company of St. Louis was introduced by the president and described the new single-phase elevator motor of that company. (See Western Electrician of March 25, 1905.) The Wagner company, he said, has built over 10,000 automatic single-phase constant-speed motors. It has been practically alone in advocating single-phase distribution rather than polyphase. The elevator motor for variable speed is new. The appearance of the new motor was considered by the speaker an important step in the advancement of the electrical art. The motor is capable of speed control through 40 per cent. of the speed range. The normal speed is 1,200 revolutions per minute.

F. H. Lancashire, superintendent of the electrical department of the Davenport Gas and Electric Company, read next his paper on "Boiler-room Economics." In the discussion Mr. Lancashire said that automatic grates were not to be recommended for a small battery of boilers. Mr. Freehauf differed from him and said that he used under-feed stokers in a small town and found them satisfactory. There was advantage in saving of attendance and in evaporation, even in small plants. He obtained an evaporation of 7½ pounds.

A. W. Zahm of Mason City read his paper on "Methods of Accounting." He exhibited many sample forms. Mr. Burt, Mr. Lee, Mr. Bellamy, H. V. Fuesell of Charles City, Mr. Carson, E. Reavy of Davenport, Mr. McGee and others discussed the various systems of keeping accounts in small plants. This was the last paper of the day.

[illegible]

[illegible] tion and visitors by the Union Electric Company of Dubuque on Wednesday evening. A number of [illegible]

[illegible]

[illegible] ing completion. This company does the street-railway, [illegible] station, located on a slough of the Mississippi River at the foot of Eighth Street, was visited by the delegates [illegible] pite a discouraging rainfall. It was inspected with much interest. The plant has three 500-kilowatt, 2,300-volt, three-phase turbo-generators. Another similar unit has been shipped from the factory, and there is room for two others, the ultimate capacity being 3,000 kilowatts. One unit is in operation, but non-condensing. The steam pressure is 200 pounds. There are four boilers rated at 400 horsepower each and fitted with automatic stokers. The coal crusher and coal conveyor are motor driven. The steel stack is 200 feet high, self-supporting, brick lined and 11 feet in diameter. Both feed and condensing water are taken from the river. The current is distributed as high-potential alternating for the lighting, with transformers at points of consumption. But for the railway and power it is first reduced to 430 volts by four air-cooled transformers (with two motor-driven fans), and then, by four rotary converters, to 600 volts direct. These rotaries are of 300 kilowatts each and are described as six-phase. There are two exciters—one steam-driven and one motor-driven. A hand-operated crane spans the engine room, which contains a fine marble switchboard elaborately equipped. Such is an outline description of this fine station, which is distinctly up-to-date and a great credit to Dubuque. Curtis turbines and General Electric apparatus are used.

### Lamp Testing, Central-station Heating and Other Matters.

After returning to the hotel the first feature of Thursday morning's session was the reading of a paper on "The Rating of Incandescent Lamps," by Prof. L. B. Spinney, professor of physics and electrical engineering at Iowa State College at Ames. The engineering branch of the experiment station at that college has received a small appropriation from the Legislature and has been thus aided in its work of testing incandescent lamps. It will issue bulletins giving the results of this work. The laboratory is open at all times to incandescent lamps sent in for testing. The charges are just sufficient to cover actual outlay. Thus far the charges for tests for wattage and horizontal candlepower have been $1 a dozen. Professor Spinney's paper is given elsewhere in this issue.

Frank L. Perry, the assistant business manager of the Western Electrician, addressed the convention briefly in reference to the Denver-Colorado Springs convention of the National Electric Light Association, for which he is western manager of transportation. Mr. Perry spoke of the prospective magnitude of the convention, its many attractions and the arrangements for the convention special trains. He warmly urged all his hearers to attend the convention.

E. B. Hillman of Quincy, president of the Illinois State Electric Association, was introduced by President Bowers and extended greeting to the sister association of Iowa. He spoke of the recent fight at Springfield against oppressive measures introduced in the Legislature designed to enable the state to fix the lighting rates with practically no limit to its power. He said that the sentiment that public-utility corporations should be regulated and controlled pervades every community. That sentiment is all right, provided the companies are treated fairly and protected from competition if their prices are regulated by the state. The Massachusetts plan seems a good one and should work well in Illinois if a fair board or commission is secured. The companies will be satisfied if their investments are made reasonably secure, even if, in return, their earnings are somewhat reduced.

D. F. McGee of Red Oak made a verbal report from the committee on "Hot-water Heating." He alluded to the difficulty of getting information from owners of central-station heating plants. In his own experience the speaker considered heating as an exhaust-steam proposition entirely. Some customers will not place their electrical business unless they can get heating too. The lowest price per square foot of radiation should be, for hot water, not less

than 25 cents a year; that is, considering the heating pure and simple. Besides, the customer should be compelled to put in sufficient radiation to keep the temperature to 70 degrees in the coldest days of winter. The speaker guarantees to furnish water in a man's cellar at 180 degrees when the temperature is 10 degrees below zero.

J. W. Walsh of Davenport said that the price for exhaust-steam heating should be 40 cents a square foot of radiation.

Mr. McGee said that in his town they had not solicited a heating customer in four years, but the people wanted the service, even with increased prices.

Mr. Zahm said that his experience in Mason City was that people were anxious to get heating from the stations. He told of a 35-cent rate in St. Paul with seven months' service—five cents a month.

Mr. McGee said they could not have built up the load they had in Red Oak without heating. The people demand station heating and if the electrical man doesn't furnish it somebody else will.

W. S. Porter of Eldora said that in heating it made a great difference whether the business or residence district is served. The former, with a short main, might be profitable.

Mr. Walsh said that the paying radius was from half to three-quarters of a mile from the station.

Mr. Greene of Cedar Rapids advocated a meter system—condensation meters—as the only safe way of doing heating business.

Mr. McGee did not believe that steam heat could be sold by the square foot of radiation at any price with a fair degree of satisfaction to both buyer and seller.

### Thursday Afternoon.

President G. B. Hippee of the Iowa Street and Interurban Railway Association as well as President Hillman of the Illinois Association occupied seats at President Bower's table at the last session of the convention on Thursday afternoon. The first event was the paper on "Steam Turbines," by W. E. Boileau, constructing engineer for the Union Electric Company of Dubuque. This paper was illustrated by lantern-slide pictures. In the discussion Mr. Boileau said that the step bearing caused as little trouble as any part of the turbine. An abstract of this paper will be given in a later issue of the Western Electrician.

"Gold-brick Finance" was the suggestive title of the next paper, by J. G. Boyd of Sioux City, devoted, of course, to municipal ownership. Mr. Boyd read his paper with effect and had the hearty sympathy of his auditors. This was the longest paper of the convention, but it was listened to with flattering attention and greeted with a hearty burst of applause at its close. Mr. Boyd was given an unanimous vote of thanks. An abstract of the paper is given elsewhere in this issue.

"Meter Data" was the next subject, the paper being read by Edward Reavy, superintendent of the People's Light Company of Davenport. The paper was carefully prepared, with practical details of value.

### Scientific Central-station Management.

Austin Burt's report on "Facts and Factors" showed that the central-station manager should make a careful analysis of his business and compare these results with those of other stations. The manager should investigate his business and report to the association, which can make up averages of great value. Determine the population of the district to be served. In Iowa there are 189 central-station cities. Of these 165 have less than 5,000 inhabitants; 20 have from 5,000 to 25,000 people, and four have over 25,000. Determine also the permanent investment at actual cost value. Then can be found the cash investment per capita. An approximate figure for this is $10. Another thing to be determined is the cost per kilowatt of station capacity. An approximate figure for this is $250. Find, further, the equivalent number of 50-watt lamps per capita. An approximation for this is 0.8 of a lamp.

In operation determine the gross income. What is it per capita? An approximate answer is $2.25. What is it for $100 invested? Approximately, $20. What for each kilowatt capacity? Approximately, $50. What for each 50-watt-lamp equivalent? Approximately, $3.

The gross expenses are to be determined. These are made up of fixed expenses and variable expenses. What is the ratio of gross expenses to gross income? Approximately, 65 per cent. What is the ratio of fixed expenses to gross expenses? Approximately, 60 per cent. The net earnings are determined from the foregoing. If data or facts such as suggested were contributed by the members, valuable averages or factors could be compiled by the association. Only those contributing should get the tabulated data in return.

The paper on "Association Matters" was next read by the author, George S. Carson of Iowa City. This paper was given in the Western Electrician last week.

### Concluding Business.

In the executive session Mr. Greene's amendment to the by-laws, to increase the annual dues to provide greater revenue, was taken up. Formerly the dues to all members were $5 a year. By the Greene amendment, which, with some changes, was adopted, the schedule of dues is now as follows:

| | |
|---|---|
| In cities of less than 5,000 population | $ 5 a year. |
| In cities of 5,000 to 10,000 population | 15 a year. |
| In cities of over 10,000 population | 25 a year. |

The matter of coal freights and demurrage charges was referred to the executive committee with power to act.

Invitations were received from Ottumwa, Burlington and Davenport to hold the next convention in the cities named, but Des Moines was chosen, owing to its central location.

Thanks were voted to the cities extending invitations for the next meeting, to the Union Electric Company and city of Dubuque and particularly to Mr. L. D. Mathes, general manager of the Union Electric Company, for his unwearied attentions to the members of the association. Mr. Mathes made a pleasant little speech of acknowledgment.

Accepting the report of the nominating committee, these officers were elected:

President—Austin Burt, Waterloo.
Vice-president—A. W. Zahm, Mason City.
Secretary—P. E. Bellamy, Knoxville.
Treasurer—W. A. Mall, Belle Plaine.

Executive committee—George S. Carson, Iowa City; L. D. Mathes, Dubuque; J. A. Innes, Eagle Grove.

Mr. W. S. Porter of Eldora was renominated by the committee as secretary of the association, but, owing to impending long-continued absence from the state, he declined the honor. A strong effort was made to induce Mr. Porter to reconsider his determination, as he has been of great help to the association, having been secretary nearly from the first, but when he announced that he was fixed in his determination, his decision was accepted with regret.

Mr. Burt was escorted to the chair and in a few remarks thanked the association for the honor conferred upon him. He said that the association should constantly endeavor to increase its membership among the smaller stations.

After thanking the retiring officers, the association adjourned without day.

### The New President.

Austin Burt, the new president of the Iowa Electrical Association, constitutes a good example of a number of well-trained engineers who are engaged in building up electrical properties in the smaller cities of the West. He is general manager of the Waterloo (Iowa) and Cedar Falls Gas and Electric Light Company. Born in 1870 in Detroit, he was educated in the schools of that city and later at Cornell University, from which he graduated, in the mechanical engineering course, in 1898. He is a member of the Phi Gamma Delta fraternity and also of Sigma Xi, the latter a scientific honor society similar to the Phi Beta Kappa. He took the Sibley prize in mechanic arts while in college. His graduating thesis was based on an elaborate test of the Buffalo electric-railway system, and he took a party of 80 Cornell students with him to Buffalo to make these tests.

Before completing his college course Mr. Burt was for five years with the E. P. Allis Company of Milwaukee. After graduating he accepted a position with the Cedar Falls (Iowa) Electric Light, Heat and Power Company as manager. In 1902 the Waterloo and Cedar Falls plants were combined, and Mr. Burt removed to the former city, becoming general manager of the consolidated company in November, 1902. Mr. Burt is married and has one daughter. He is a member of the Knights of Pythias. It is an interesting coincidence that his grandfather, William Austin Burt of Detroit, who secured the first United States patent for a typewriter and who invented the solar compass used in surveying, laid out the government lines on the site of the city of Dubuque 60 years ago, when the native Indians were still roaming through Eastern Iowa.

Mr. Burt is a student and a man of energy and capacity. He should prove a good president for the association.

## Iowa Street and Interurban Railway Association.

The second annual convention of the Iowa Street and Interurban Railway Association was held at the Hotel Julien, Dubuque, on April 20th and 21st, partly coincident with the convention of the Iowa Electrical Association. President George B. Hippee of Des Moines presided, and Secretary and Treasurer L. D. Mathes of Dubuque performed the duties of his office. Mr. J. R. Lindsay, secretary and treasurer of the Union Electric Company of Dubuque, welcomed the delegates at the opening session on behalf of the local company and the citizens of Dubuque. After the address of the president and the report of the secretary, Harry H. Polk, president of the Interurban Railway Company of Des Moines, read a paper on "The Electric-railway Freight Service." An abstract of this interesting paper and of the discussion following will be given in a later issue of the Western Electrician.

The afternoon session of Thursday, April 20th, was held jointly with the Iowa Electrical Association, the papers presented being those on "Steam Turbines" and "Gold-brick Finance." Afterward the street-railway men visited the new power house of the Union Electric Company.

On Friday morning R. A. Leussler of Council Bluffs read a paper on "Accounting as an Aid to the Operating Department." As a rule, said the author, operating departments do not avail themselves as fully as they might of intelligent and efficient systems of accounting. In the discussion it was stated that half-fare tickets, good during workingmen's rush hours, were sold in Dubuque, owing to a provision in the company's charter. Mr. Lindsay said that the system increased business sufficiently so that it was not so great a hardship as might be imagined.

The paper of John D. Fish of Davenport on "Car-shop Methods" was read by J. B. Mendenhall of St. Louis, in the absence of the author. The writer described cars designed and built by the Tri-city Railway Company of Davenport, of which Mr. Fish is master mechanic.

The next paper was on "Rural Railways" and was read by the author, F. McDonald of Waterloo. Mr. McDonald described a combined steam and electric railway 45 miles long running out of Waterloo. The author said that the steam locomotive served the purpose of his company well for a portion of the line, and must not be regarded as obsolete, even for light railways. In the discussion considerable attention was paid to the width of right-of-way. The author was strongly of opinion that the strip should be not less than 100 feet wide. Grades, too, especially where there is freight business, should be not greater than one per cent.

H. H. Clarke of Chicago, representing Fairbanks, Morse & Co., gave a little talk on "The Adoption of Gasoline Motors for Street and Interurban Service." Various types of cars were briefly described.

The concluding session of the convention was held at the Dubuque Club, after the members had been entertained at luncheon at the club by the Union Electric Company. The question of admitting supply men to associate membership came up and was referred to the executive committee. These officers were elected:

President—George B. Hippee, Des Moines.
Vice-president—James F. Lardner, Davenport.
Secretary and treasurer—L. D. Mathes, Dubuque.

After appropriate votes of thanks had been passed, the association adjourned to meet in Des Moines next year.

## Members and Visitors.

Following is a list, not quite complete, of the names of members and visitors at the Dubuque convention. Where no state is given Iowa is to be understood:

Alderson, F. J., Stanley Instrument Company...Chicago, Ill.
Alline, J. K., Electric Appliance Company.....Chicago, Ill.
Ames, Charles S., Adkins, Young and Allen Company ..... Chicago, Ill.
Bellamy, P. E., Knoxville Electric Company.....Knoxville
Bennett, A., Illustrated Electricity.....Chicago, Ill.
Blunt, F. M., Orange City Electric Light Company..Hamburg
Boileau, W. E., Union Electric Company.....Dubuque
Boole, E. R., Electric Appliance Company.....Chicago, Ill.
Bowen, F. P., Pulford Electric Light Company..Savannah, Ill.
Bowers, W. L., Davenport Gas and Electric Company. ..... Davenport
Boyd, J. G., Columbia Incandescent Lamp Company. ..... Sioux City
Branson, D. C., Clear Lake Electric Light and Power Company ..... Clear Lake
Brownell, O. E., Lake City Electric Company.....Lake City
Burt, Austin, Waterloo and Cedar Falls Gas and Electric Light Company.....Waterloo
Carson, George S., Iowa City Electric Light Company. ..... Iowa City
Chase, H. E., Leon Electric Light, Heat and Power Company ..... Leon
Clark, J. H., People's Light Company.....Davenport
Clarke, H. H., Fairbanks, Morse & Co.....Chicago, Ill.
Cole, O. K. ..... Grinnell
Colman, W. H., General Electric Company.....Chicago, Ill.
Coughlin, H. H., Westinghouse Electric and Manufacturing Company .....Waterloo
Coulter, S. M., Central Electric Company.....Chicago, Ill.
Crane, T. M., Nernst Lamp Company.....Chicago, Ill.
Cravath, J. R., Electrical World and Engineer..Chicago, Ill.
Cummings, C. R., Webster City Electric and Water Works ..... Webster City
Delafield, C. E., Wagner Electric Manufacturing Company .....St. Louis, Mo.
Diederich, G. ..... Avery
Diserens, F. ..... Cedar Rapids
Dodge, C. H., Taylor Electric Truck Company..Chicago, Ill.
Downer, J. D., Western Electrician.....Chicago, Ill.
Doxey, F. E., Waterloo and Cedar Falls Gas and Electric Light Company .....Waterloo
Draffen, E. L., National Battery Company.....Chicago, Ill.
Eddy, H. C., American District Steam Company..Chicago, Ill.
Emerson, S. T. ..... West Branch
Emery, E. A., Sorge, Jr., & Co.....Chicago, Ill.
Evers, Edw. A., Warren Webster.....Chicago, Ill.
Ewing, C. C., State Electric Company.....Clinton
Ferris, W. J., Eldora Electric Light Company....Eldora
Ferris, Thomas, Osage Electric Light, Heat and Power Company ..... Osage
Foster, F. E., Peterson Heat, Light and Power Company ..... Iowa Falls
Frechauf, C. F. ..... Cedar Rapids
Fuesell, H. V., Charles City Lighting and Heating Company ..... Charles City
Gannon, M. A. ..... Chicago, Ill.
Gardner, D., Clinton Gas Light and Coke Company..Clinton
Garner, H. W. W., Ottumwa Traction and Light Company ..... Ottumwa
Garton, W. R., W. R. Garton Company.....Chicago, Ill.
Goll, Walter, Fort Wayne Electric Works.....Chicago, Ill.
Gray, Percy, Jefferson Light, Heat, Power and Water Company ..... Jefferson
Greene, W. J., Cedar Rapids and Iowa City Railway and Light Company ..... Cedar Rapids
Grover, W. H. ..... Ames
Hamlin, E. M., W. R. Garton Company.....Boston, Mass.
Hanlon, W. J., Brice Gas and Electric Company..Mason City
Hill, E. B., W. R. Garton Company.....Chicago, Ill.
Hillman, E. B., Hamburg Electric Light Company..Quincy, Ill.
Hoag, E. W., E. W. Hoag Electric Light and Power Plant ..... Manchester
Hovey, S. B., Jones & Hovey Company.....Independence

H[illegible], G. C., Nashua Electric Light Company ... [illegible]
Hruby, W. F., Simplex Electrical Company ... Chicago, Ill.
Hunt, L. C. ... Belle Plaine
Johnson, Frank E., H. W. Johns-Manville Company ... Des Moines
Kelly, W. E., Western Electrician ... Chicago, Ill.
Kelley, F. W., People's Light Company ... Davenport
Kellogg, H. [illegible] ... [illegible]
Kimmel, O. T., Illinois Electric Company ... Chicago, Ill.
Kirk, F. L. ... [illegible] City
Klingenfeld, H. M., National Electric Company ... Milwaukee, Wis.
Kramer, Henry F., Dyersville Light and Water Company ... Dyersville
Kroymann, G. T., Keystone Electric Light Plant ... Keystone
Kuehmsted, A. O., Gregory Electric Company ... Chicago, Ill.
Lancashire, F. H., Davenport Gas and Electric Company ... Davenport
Lee, Rufus E., Lee Electric Light Company ... [illegible]
Lever, A. J., Tama and Toledo Electric Light and Railway Company ... Toledo
Lindsay, J. R., Union Electric Company ... Dubuque
Lias, F. W., Cedar Rapids and Marion City Railway ... Cedar Rapids
Loose, R. W., Standard Electric Manufacturing Company ... Niles, Ohio
Lundgren, Gus, Cherokee Electric Company ... Cherokee
Lyons, James W. ... Chicago, Ill.
Madson, L. L., Northwood Electric Plant ... Northwood
Mall, W. A., Belle Plaine Electric Light Company ... Belle Plaine
Mason, E. R., Porter & Berg ... Chicago, Ill.
Mathes, L. D., Union Electric Company ... Dubuque
McClun, Frank L., Cedar Rapids and Iowa City Railway and Light Company ... Cedar Rapids
McGee, D. F., Red Oak Electric Company ... Red Oak
Mendenhall, J. B., National Lead Company ... St. Louis, Mo.
Michel, F. W., Orange City Electric Light Company ... Orange City
Miller, A. M., Westinghouse Electric and Manufacturing Company ... Chicago, Ill.
Morton, A. A., Stanley G. I. Company ... Chicago, Ill.
Nissen, Harry, Reinbeck Electric Light Company ... Reinbeck
Oldenburg, A. W., Peterson Light and Heating Company ... Iowa Falls
Olmstead, C. J., Westinghouse Traction Brake Company ... Chicago, Ill.
Payne, L. F., Williams Electric Light Company ... Williams
Peck, A. P., National Electric Company ... Milwaukee, Wis.
Perry, J. Frank, National Electric Company ... Chicago, Ill.
Perry, Frank L., Western Electrician ... Chicago, Ill.
Pfiffner, F. J. ... Humboldt
Phillips, F. D., American Electrical Supply Company ... Chicago, Ill.
Pinckard, W. R., Westinghouse Electric and Manufacturing Company ... Chicago, Ill.
Pide, P. R., Tipton Light and Heating Company ... Tipton
Pomeroy, J. G., Adams-Bagnall Electric Company ... Chicago, Ill.
Porter, W. S., secretary Iowa Electrical Association ... Eldora
Raymond, Francis, General Incandescent Arc Light Company ... Chicago, Ill.
Reavy, Edward, People's Light Company ... Davenport
Rice, John, Standard Electric Manufacturing Company ... Niles, Ohio
Ross, Clarence A., Westinghouse Electric and Manufacturing Company ... Chicago, Ill.
Royse, Daniel, Street Railway Review ... Chicago, Ill.
Schmidt, R. F., Schneider Bros. Company ... Elkader
Schneider, C. J. ... Garner
Seabury, G. A., General Electric Company ... Omaha, Neb.
Seymour, E. K., Wagner Electric Manufacturing Company ... Chicago, Ill.
Sinks, William H., Duncan Electric Manufacturing Company ... Lafayette, Ind.
Skeel, F. F., Crouse-Hinds Company ... Chicago, Ill.
Snyder, C. W. E., Snyder-Hunt Company ... Belle Plaine
Sparrow, S., Wagner Electric Manufacturing Company ... St. Louis, Mo.
Spinney, L. B., Iowa State College ... Ames
Stanton, W. J., Conrad Electric Light Company ... Conrad
Stubble, E. R., Viscosity Oil Company ... Chicago, Ill.
Sullivan, J. C., Creston Mutual Electric Light, Heat and Power Company ... Creston
Switzer, F. B., The National Conduit and Cable Company ... Muscatine
Taylor, T. W., General Electric Company ... Schenectady, N. Y.
Walsh, C. H., Burlington Railway and Light Company ... Burlington
Walsh, J. W., Davenport Gas and Electric Company ... Davenport
Walters, J. P., Tama and Toledo Electric Light and Railway Company ... Toledo
Wheeler, N. J., Denison Electric Light and Power Company ... Denison
Whipple, F. G., Allis-Chalmers Company ... Chicago, Ill.
White, F. L., Traer Electric Company ... Traer
White, John A., Electric Storage Battery Company ... Chicago, Ill.
Wienmeyer, F. S., Ft. Wayne Electrical Works ... Chicago, Ill.
Wilkins, C. W., National Carbon Company ... Cleveland, Ohio
Yates, P. B., Gould Storage Battery Company ... Chicago, Ill.
Zahm, A. W., Brice Gas and Electric Company ... Mason City

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## Convention Notes.

Julius Andrae & Sons. Co. of Milwaukee, Wis., sent Otto Borchert.

C. A. Wanner appeared for the American Steel and Wire Company.

The Murray Corliss engine of Burlington, Iowa, was talked about by George Millard, Jr.

Purchasing Agent George Knoche of the Wesco Supply Company dropped in from St. Louis.

The interests of the State Electric Company, Clinton, Iowa, were attended to by C. C. Ewing.

The Manhattan Electrical Supply Company and W. Byars Allan were synonymous at the Dubuque convention.

H. H. Clarke of the railroad department of Fairbanks, Morse & Co., was in Dubuque and addressed the street-railway convention.

A little celluloid sticking plaster case was distributed with the compliments of the National Lead Company's St. Louis branch.

O. T. Kimmel of the Illinois Electric Company came over to Dubuque from Des Moines, where he has permanent headquarters as representative of his company.

The H. W. Johns-Manville Company was represented in Dubuque by Frank E. Johnson, who presented a complete display of Noark fuse devices and railway-line material.

A. O. Kuehmsted, vice-president of the Gregory Electric Company, Chicago, came early and stayed late. Mr. Kuehmsted went out on the train with the Chicago delegation and [illegible] than Kuehmsted.

E. J. [illegible], Chicago, [illegible] Stanley Instrument Company, [illegible] Mass., talked [illegible] Mr. Alderson [illegible]

Fred G. Whipple, representing the Allis-Chalmers Company and the Bullock Electric [illegible] Company, was one of those constituting and entertaining the Chicago delegation to the Dubuque convention.

The National Carbon Company appeared in the person of C. W. Wilkins. Mr. Wilkins was very welcome and his good spirits and witty stories won for him a place of honor at every social gathering at the convention.

The Simplex Electrical Company and the Simplex Electric Heating Company appeared in the person of W. F. Hruby. Mr. Hruby was in constant attendance and his efforts were unceasing in behalf of his company and of Chicago Manager Hixson.

John A. White was in constant attendance seeing that the Electric Storage Battery Company of Philadelphia and Chloride accumulators were kept before central-station managers interested in more advanced electrical practice. Mr. White is connected with the company's Chicago office.

Francis Raymond, as usual, was most energetic in his representation of the General Incandescent Arc Light Company's interests. Mr. Raymond made no exhibit, but his knowledge of convention "ropes" usually enables him to "get there," and this occasion was no exception to his general practice.

The only "Pomeroy" of the Adams-Bagnall Electric Company, Cleveland, was as usual "there" in full force, and his pink advertising cards were pinned to practically everyone in attendance at the Iowa convention. Even the vaudeville performers at the Dubuque Club had been buttonholed and appeared with these cards attached.

E. L. Draffen, the well-known western storage-battery man who has recently accepted the management of the western branch of the National Battery Company of Buffalo, was on hand at Dubuque. Owing to the heavy nature of the company's product, no exhibit was attempted at the Julien, but Mr. Draffen was in constant attendance day and night and indefatigable in behalf of his company.

Western Manager H. C. Eddy, surnamed "the Ubiquitous," of course did the honors for the American District Steam Company of Lockport, N. Y. Mr. Eddy is not only popular personally, but a student of electrical and mechanical problems, and his excellent educational work along the line of central-station steam economics has given him the well-earned reputation of being an expert in his field.

The poular Chicago representative of Flexduct, I. A. Bennett of 529 Monadnock Block, Chicago, appeared in the interests of that specialty, but made no attempt at a display. Mr. Bennett also as western manager of the Marion Insulated Wire and Rubber Company saw to it that that company was kept well to the front. Mr. Bennett is also exploiting an interesting electrical publication for local distribution by central stations.

Western Sales Agent F. F. Skeel of the Crouse-Hinds Company's Chicago branch was one of the most welcome at the convention. Mr. Skeel came West a couple of years ago and has won the hearts of the electrical fraternity in the West through his businesslike methods and courteous manners. The western office of the Crouse-Hinds Company has, under Mr. Skeel's management, prospered exceedingly.

Superintendent R. C. Lamphier of the Sangamo Electric Company exhibited in the gallery of the Julien a line of integrating wattmeters and direct-current meters for the Electric Appliance Company of Chicago, which is the exclusive agent for the Sangamo company. Manager of Sales Perry Bolles did the honors, generally speaking, for the Appliance company. The Electric Appliance Company's little souvenir, "Food for Thought," too, made quite a hit.

A. A. Morton, the popular and energetic representative of the Stanley Electric Manufacturing Company's supply department, ran in off the road and mingled with the boys at the Hotel Julien at Dubuque. Mr. Morton has for several weeks been on an extended business trip and reports the company's western business as rapidly growing. Mr. Morton was formerly connected with the eastern office of the Stanley company and has only lately decided to make the western territory his field of effort.

Western Manager Walter Goll of the Fort Wayne Electric Works' Chicago office, supported by Mr. Colman of the General Electric and Mr. Boole of the Electric Appliance, did the honors as master of transportation for the Chicago delegation to the Dubuque convention. Mr. Goll carried his party over the Great Western road Tuesday evening, and to his credit it should be said that not only was every courtesy shown the Chicago delegation but the train-equipment and dining service over this line were of the best, and met with unanimous approval on part of all on hand. Mr. Goll was assisted at [illegible] at the Julien. The display consisted of single and [illegible]

[illegible] front, in which endeavor they were aided by the fact that the new power house of the Union Electric [illegible] General Electric apparatus.

The Wagner Electric Manufacturing Company of St. Louis [illegible] C. E. Delafield and Superintendent Sparrow of the company in company with E. K. Seymour of the Chicago office. These gentlemen kept the delegates busy inspecting their exhibit of a single-phase, type B, one-horsepower Wagner motor. This little machine was kept in constant operation to illustrate its action during starting and stopping. Superintendent Sparrow also read an interesting paper on the new Wagner variable-speed elevator motor.

Of the well-known Ferris brothers, W. J. and "Tom," were at the Dubuque convention. "Tom" Ferris recently severed his long connection with the General Electric Company to become a central-station man. The Ferris brothers, so well known for years through their prominent General Electric connections, now constitute a firm that is operating in central-station properties; and rumor has it that they are succeeding remarkably with their enterprises. Thomas Ferris is now personally managing one of these properties and at the same time is supervising others possessed or controlled by his syndicate.

Chicago's new supply company was most energetically put to the front by that skilful electrical salesman, F. D. Phillips, who is now the new company's vice-president and general manager. Mr. Phillip's new house, under the title of the American Electrical Supply Company, has its Chicago store at 83 Fifth Avenue. At the Dubuque convention Mr. Phillips made no attempt at an extensive exhibit, but he was constantly on hand and everyone was made welcome in the company's parlor. Mr. Phillips presented the delegates each with a very handsome pocketbook or wallet that was much sought after as a souvenir.

The Westinghouse Electric and Manufacturing Company was represented by C. A. Ross, W. R. Pinckard, A. M. Miller and H. H. Coughlin. The company exhibited a line of portable testing instruments, including voltmeters, ammeters and wattmeters for both alternating and direct current. There also was shown a new portable instrument which combines a voltmeter and wattmeter designed particularly for testing incandescent lamps. This instrument is provided with a socket which permits the lamp to be tested; the pressure of one button gives the watts and of another the volts. The company also exhibited a novel circuit breaker, arc lamps, lightning arresters, fan motors and integrating wattmeters.

Porter & Berg of Chicago were represented by E. R. Mason, the vice-president of the company, which had the largest line of goods on exhibition in the balcony over the lobby. Among the companies represented in the exhibit and whose products are handled by Porter & Berg were the Ohio Brass Company, overhead material and rail bonds; Crouse-Hinds Company, headlights; the Falk Company, gears and pinions; "Miller" anchors; Speer Carbon Company, carbon brushes; Locke Insulator and Manufacturing Company, porcelain insulators; International Register Company, fare registers; Hunter Illuminated Car Sign Company; National Brake Company, Peacock brakes, besides a general line of supplies and tools.

One of the most welcome visitors at the Iowa electrical convention was C. W. E. Snyder of the Snyder-Hunt Company of Belle Plaine, Iowa. Mr. Snyder made a special trip to the convention to exploit his novel insulator knob, and met with remarkable and substantial success; he returned with a pocket full of orders. Electrical people at the convention found his argument concerning the advantage of the knob, from its great economy, a strong one. The Snyder-Hunt Company is a dealer in electrical supplies, and within the last six months has gone quite extensively into the manufacturing of electrical specialties, of which the knob exploited in the convention is one. Mr. Snyder is looking forward to joining the national convention train going to the Denver convention in June.

Clarence A. Ross, the energetic incandescent-lamp man, so well known throughout the United States for his most excellent work in the interests of the Westinghouse Electric and Manufacturing Company, was on hand during the entire convention period. Mr. Ross has only recently been promoted to the responsible position of general lamp agent for his company, with headquarters at Chicago. Few men in the incandescent lamp field are better acquainted

with the intricacies of the art of electrical illumination with the incandescent lamp than Mr. Ross. His continuous and energetic policy on behalf of the Westinghouse incandescent-lamp department has made him a factor to be reckoned with in the lamp trade and his recent promotion was certainly a most proper recognition of his value.

The National Electric Company of Milwaukee, manufacturer of the Christensen air brake and electrical machinery, was well represented. The New Universal Lundell motor was shown. The design is a departure from standard practice, as the entire magnetic circuit, including the yoke, is laminated. This type of motor also embodies other features of advantage and improvement. The walls of the exhibit were hung with bromide enlargements conveying a good idea of the line of apparatus manufactured by this company. The "National Electrical Catechism," a new publication dealing with the fundamental elements of electricity, was distributed, the company inviting persons on its mailing lists to receive free of charge all future issues. Catalogues, mailing cards and other literature was also distributed, including the National souvenir watch fob, bearing as a charm a bas-relief representation of the company's trademark. Representing the company's interests were Ashley P. Peck, electrical sales agent; J. Frank Perry, sales engineer, and H. M. Klingenfeld, advertising manager.

The Duncan Electric Manufacturing Company was kept well to the front by Traveling Representative W. H. Sinks, who had numerous up-to-date features in meter construction to show and explain in connection with the latest improvements in the Duncan meter. The Duncan meter of today embodies many up-to-date qualities, such as the "visual" bearing, threadless jewel post, hollow nickel-steel spindle, very light revoluble element, very high torque, dustproof cover, fireproof binding posts, non-tension changing brushes, exceptionally wide range of compensation for friction and vibration, requiring exceedingly small amount of power to operate it. Its insulation is guaranteed to be lightning proof and its magnets are absolutely constant by reason of their being put through an artificially aging process for six months before being used. This company reports that the demand for the Duncan direct-current wattmeters has increased at such a rate during the last few months that it has been compelled to treble its manufacturing facilities. Mr. Sinks reports also that his company has been awarded some large contracts lately for power meters or those specially adapted for 500-voltpower service.

## Lighting Rates and Municipal Ownership before the Illinois Legislature.

There is considerable activity in the Illinois Legislature at Springfield over bills before that body intended to empower villages and cities to regulate the price of gas and of electricity for lighting, power and heating purposes. As the Western Electrician goes to press the situation is somewhat complicated on account of varying demands from representatives of Chicago and from those urged by other cities of the state. Chicago, or that portion of it that is making itself heard in the matter, wants not only the power to control gas and electric rates but is asking for legislation to empower it to own plants and enter into the manufacture of gas and electricity. The other cities, so far as can be ascertained, are asking merely the power to regulate rates.

Representatives of the gas and electric companies in the smaller cities of the state were able last week to get the rate-regulating bills back from third reading to the committee. Now, however, since the municipal-ownership idea has come to the front, the owners of plants about the state seem to be willing to sacrifice the bill granting power to regulate prices if they can kill the municipal-ownership measure.

Chicago, Peoria, Galesburg and other cities have sent delegates to Springfield to urge the passage of the various bills. As the situation stands at the present writing, it seems likely that if any bills are passed they will be only to the extent of giving the cities power to regulate rates. The Chicago contingent points out that the city already owns a large electric street-lighting plant, and it contends that with the Drainage Canal power to be developed the city must secure legislation which will give it the right to sell electricity to private consumers. Plant owners in other cities of the state say that if municipal-ownership legislation is enacted whereby all cities in the state would be empowered to manufacture and sell gas and electricity, this would result in the confiscation of their property. This being the situation, it may be that by the time the Western Electrician comes off the press the subject will be taken up in two different forms by two different committees, one acting solely for Chicago and the other to deal with the other cities.

## Gold-brick Finance.[1]

By John G. Boyd.

A town in Middle Iowa something like 30 days ago published its annual statement (?) of public utilities. It embraced three departments, viz., water, light and heat. The water plant is entirely segregated, hence it is within the bounds of reason to readily ascertain its exact performance, yet the result is debatable to say the least. The electric-light and heat departments are jointly operated, and as suitable means appear to be entirely lacking to actually determine a division of operating expenses, it is assumed that the division is made according to the best guesses obtainable.

If my analysis of the figures submitted in the report is correct, then the disbursements exceed the gross earnings as follows: Water, $1,865.20; electric light, $1,922.29; steam heat, $403.90, thus making an apparent deficit in the three departments amounting to $4,191.39. To this amount should be added an overdraft in the water department of $6,693.73. One item which will appeal to you is free-lighting service furnished several manufacturing industries in the town. Such procedure might possibly have the sanction of the courts, but, be that as it may, it cuts a most pious figure in the fixed charges. Parenthetically, it might be stated there is nothing in the report which enables one to determine whether or not any regard is had for the items covered by fixed charges.

So far this year three previously operated municipal plants in this quite immediate vicinity have been sold to private parties. Two in our sister state of Illinois and one in Iowa. In the case of the two former plants considerable objection developed over the change, yet, judging from the papers, the rebellion was more on account of the particular methods adopted for transfer than against the accomplished fact.

As having a direct bearing on the subject of street lighting, it may be in order to state that a few years ago it was my privilege to be in a position to vise the figures of cost in a case where something like 2,200 full open-series arcs, together with 1,500 commercial arcs, were in service. The price for the street arcs was, substantially, $75 per lamp per year on an all-night every-night schedule, and that at that price the central-station company sustained a large loss each month. Understand, however, the bookkeeping included all fixed charges as well as operating expenses. Surely a plant pulling approximately 4,000 arcs should be able to deliver the service at minimum cost, yet, as before stated, it was a losing contract. Water-tube boilers were employed and high-grade fuel was low in price, about $1.50 per ton, as recalled. The general manager was thoroughly competent and understood his business both theoretically and practically and administered the duties pertaining to his office in a manner satisfactory to his board of directors, but was in no manner responsible for the low contract price obtaining. This formed an instance where there was no change of administration each year or two, and as a consequence the position of general manager was not menaced by "pull" or influence.

Notwithstanding all this, a certain western metropolis has stated repeatedly that it is, under municipal ownership, producing its arc service for about $55 per lamp-year, when an analysis of its own published figures indicates that the fixed charges alone exceed that amount.

Statistics similar in character could be cited you almost indefinitely; therefore it may be more prudent to pass on and bestow some attention to the causes which underlie the effect, and the first factor considered, it is believed, more than any other one, is the rock upon which profits are wrecked in both municipally and privately owned plants.

If the fundamental cause for failure could be summed up in a terse expression it doubtless would be that the primal cause of failure is found in a lack of comprehension of the character of electric-light investments. If the peculiar character of electric-light investments were more fully established in the minds of investors, fewer occasions would exist for the red flag of the county sheriff. Moreover, if the general public and our state legislators understood that phase of the industry it is unlikely we would hear so much about empowering towns to regulate rates for electric service. The basic conditions are most peculiar, and well has Professor Meyer put it when he states that "the general public is not fitted to pass judgment." Why! just stop and think a moment. Can one of you, no matter how long you have been in the business, recall a single schedule rate ever promulgated which was just and equitable to both producer and patron? Did you ever observe one which did not work a hardship to one or the other party? If you know of no such rate, does it not seem passing strange that a body of laymen who do not know a watt from a bull's foot should presume to name a set of rates which they tell their constituents will make the property self-supporting?

Is it not your duty, gentlemen, in case you have not done so, to study this matter, and after having mastered the facts to do all in your power to set your fellow citizens right? If your people fully understand the true situation you will have absolutely nothing to fear from the menacing perils of municipal ownership. No one but you yourselves, together with other operators, are to blame for the delusions under which the general public rests. You understand the true situation and you should marshal your facts and present them in a convincing manner to the end that justice may obtain.

It is but a few years ago that painstaking efforts were put forth to learn the exact result of average operation. Sets of questions were sent out to almost every plant in the United States and to Canada as well asking for confidential information; and an analysis of the figures obtained evidenced that of those reporting no less than 12 per cent. were actually losing money. With 11 per cent. the earnings barely covered fixed charges and operating expenses, and the balance were paying dividends with a minimum of two per-cent. The average amount carried to depreciation was nine per cent., exclusive of real estate.

In almost every mercantile venture the capital invested has an average earning range throughout the entire work-day period. In the electric-light field a vastly different situation confronts the investor.

In the average-sized plant the maximum investment is necessitated by, and is directly contingent upon, the magnitude and character of peak load. In this class of plants the peak load prevails not much in excess of three hours out of each 24, and, as you know, calls for an investment of 100 per cent. During the balance of the night's run an investment anywhere from 25 to 40 per cent. is amply sufficient to provide the generating equipment demanded during that long-burning period. Granted such statement is true, the query arises, "Well, what does that signify?" The answer is, "Nothing much, other than success or failure."

Include all fixed charges in your bookkeeping and you will soon note that a lamp burning but one-half hour daily costs you to produce that minimum service more than 900 per cent. above that of a lamp burning all night. In the first instance the fixed charges are all added to one-half hour's burning, and in the latter instance the fixed charges are divided into 10 or more hours.

Probably every wide-awake merchant in this land knows that if he does not open up his store for one day, 30 days or six months, that his taxes, insurance and interest charges will go on just the same. Thus it also is in the electric-light business. Close down your plant for any period of time and those self-same fixed charges will continue right on doing business at the old stand 24 hours each day and 365 days in each year.

If the reports of either municipally or privately owned plants were comprehensive there would be at least two columns of figures covering the disbursements or liabilities and another column showing the source of the total earnings. One of the two first-mentioned columns would comprehend all the fixed charges, which are, in part, interest on investment, depreciation, taxes, insurance (fire, casualty and boiler), and all such other items as properly come under that heading. The other column would cover the true operating expenses and include such items as are purchased from time to time and which do not add to the inventory cost of the plant. Improvement and betterment is not one of the items for this column, but the expenses thereof (if any) belong to the first-mentioned column and the additional investment should be included in inventory. The earnings should show their source, that is, whether derived from incandescent or arc-lighting service, wiring and supplies, meter rents, motor service, etc. A report of that character would possess real intrinsic value and would shut the door to abuses silently tolerated at present, owing to the fact that "what is everybody's business is nobody's business."

Having taxes form a fixed charge in the case of municipal plants is, perhaps, the one item receiving more adverse criticism than any or all other items. The belief quite generally obtains that inasmuch as the town owns the plant it is ridiculous to charge taxes up against it and to take the money out of one pocket and put it into the other. Another flagrant evidence of the ignorance of the character of investment. The town probably does not, but, nevertheless, should base its selling schedule upon what the service costs to produce. When the selling price is so determined, then the taxes become important and are a material factor in basing the cost. Besides, it makes absolutely no difference who owns the plant. The plant is in existence. It occupies a taxable location, and if it were owned by a private company it would be taxed and the taxes collected; therefore, inasmuch as the town is directly losing the taxes the taxes become just as much a liability as the interest.

When a privately owned plant faces a deficit the owners, not the taxpayers, walk the floor. Those same owners are frequently charged with obstructing a campaign for municipal ownership for no other reason than that the scheme menaces their holdings, and to a great extent that may be, probably is, and of rights should be, true. No sensible person yearns to have his vested rights improperly and unduly tampered with; yet, were municipal plants in general wisely and properly administered, but little, if any, fear would ruffle the minds of the

1. Extracts from a paper read before the Iowa Electrical Association at Dubuque on April 20, 1905.

private owners. The standing menace is based upon the almost total ignorance of underlying factors of operation. Parties who have followed the business for years are by no manner of means a unit upon certain details of operation; therefore it is pertinent to ask, "Whence comes the supreme (?) knowledge affected by such individuals as are, obviously, unfamiliar with the simplest details of operation and whose utter lack of detailed knowledge is exemplified in the total elimination of fixed charges?"

There is one more very important item which has been, purposely, left for final treatment in order the better to accentuate its importance. That is the item of sinking fund. Do not confound sinking fund with depreciation. The latter is simply to enable you to keep the property in correct operating condition; the former, the sinking fund, to enable the principal on the bonds to be met and the bonds duly paid. An Indiana (Mishawaka) town failed to provide a sinking fund. When the bonds matured there was no fund to be applied to their redemption and the county sheriff really did the rest. The property was sold to avoid foreclosure.

## The Rating of Incandescent Lamps.[1]

By L. B. Spinney.

The candlepower of an incandescent lamp, as commonly rated, is a specification of its average illuminating effect in a horizontal direction, the axis of the lamp being vertical, and its efficiency is given in terms of this horizontal illuminating effect and the total power consumed.

While it is true that most lamp makers and lamp users accept this method as a convenient means of rating an incandescent lamp, it must be admitted that the chief reason for adopting it has been the facility with which such rating is obtained, and that, aside from this reason, there is very little argument in favor of its use. It has been pointed out again and again that this method of rating an incandescent lamp or other source of light is illogical; but, because no convenient means has been suggested for obtaining the average illuminating effect in all directions—that is to say, the mean spherical candlepower—those who have to do with lamp testing and lamp rating have clung to the horizontal candlepower method as the only practical one for comparing the illuminating effects of various lamps.

It would seem that a very simple consideration of the question would convince one that the only logical rating of any source of illumination is in terms of the total illuminating effect and the total power consumed. It must be admitted that in some cases we are particularly concerned with the illumination produced in a given direction and that for these special purposes the consideration of the mean spherical candlepower of the source is not so important. Nevertheless, in determining what return is made for that which is put into a given lamp, it is necessary to take account of the total illuminating effect secured. This is true for lamps used for these special purposes, as well as for others. And in order that we may be able to make efficiency comparisons between lamps of this sort, we must know, in addition to the illumination secured in the desired direction, the mean spherical candlepower. It will be evident that of two lamps used thus for any special purpose and giving equal illuminating effects in the desired direction that one is the more efficient which for a given consumption of power gives the greater mean spherical illumination. It will seldom happen in practice that after the illumination in the desired direction is assured that any outside illuminating effect will be found objectionable. It is readily conceived that in case of two so-called "downward candlepower" lamps the downward effects may be equal, while the mean spherical effects may be more or less widely different.

It will thus be seen that even though we are discussing lamps which are designed to give a certain candlepower in some one direction that the question of mean spherical candlepower is still of importance. It would be absurd to attempt to compare heating appliances in terms of the total heat radiated in a horizontal direction. Is it not really quite as illogical to attempt to rate light sources in the same way?

It is true the analogy is an imperfect one, since the convection currents about any heating appliance make the vertical effect of relatively greater importance in such a device than it would be in case of an incandescent lamp of any of the ordinary forms. At the same time in the average problem in illumination the vertical effect of the radiant is important and the analogy is useful, in that it emphasizes the need of taking this effect into consideration.

The illumination at any point in a room, for example, is determined in part by the light which falls upon it directly from the source and in part by the diffusely reflected light which reaches it from other parts of the room. In the production of this secondary effect the ceiling and upper parts of the walls play an important part, especially so since these are ordinarily the lighter parts of the room. The diffusely reflected light is, thus, determined largely by the illumination which the ceiling and upper walls receive directly. It is [illegible], therefore, to ignore this effect in an attempt to predetermine the illuminating effect of an incandescent lamp for any point in the room, even for those points which lie beneath or in a horizontal direction from the source.

Again, the term efficiency, as applied to the ratio of the horizontal illumination and the total power supplied to the lamp, is meaningless. The efficiency of any device for the transformation of energy is defined as the ratio of the total energy transformed

FIG. 1. RATING OF INCANDESCENT LAMPS.—PHOTOMETER ZONE DIAGRAM.

to the total energy put into the transforming device. And for purposes of specification there neither is nor can be any other conception of its meaning.

The electrical world is ever on the alert for a new lamp which, in addition to all the desirable features of the carbon incandescent lamp, shall embody a higher efficiency. Not a higher "horizontal efficiency," mark you—no sane man would ever think of making such a provision in this connection—but a larger value of the ratio of output to input. If, as seems to be the case in the tantalum lamp, a higher efficiency is secured, no one will stop to inquire as to the direction in which the light is delivered by the source. Once the higher efficiency is obtained, it will be a relatively simple matter, by properly shaped filaments, or by reflectors, or other means, if need be, to adapt the source to any special purpose. This example will perhaps suffice to illustrate that, after all, in each and every mind the term efficiency has but the one meaning.

It has been urged, as one of the chief objections to the method of mean spherical candlepower rating, that the measurement of the mean spherical candlepower of any source of illumination, and particularly of a source for which the distribution is far from uniform, involves great difficulties and

FIG 2. RATING OF INCANDESCENT LAMPS.—PHOTOMETER ZONE DIAGRAM.

tedious labor. It has been a weighty argument and has perhaps done more than any other one thing to establish the rating of lamps in terms of their mean horizontal candlepowers, which are much more easily obtained.

It must be admitted that, in the case of commercial ratings, this argument has been a difficult one to meet. In recent times, however, methods have been suggested and apparatus has been devised by means of which the mean spherical candlepower of a lamp is quite conveniently determined. Therefore, the argument just referred to in favor of the mean horizontal candlepower method no longer carries the same weight as formerly, and it semes reasonable to expect that in the near future [illegible] time.

[illegible] operation.

[illegible] device depends are readily understood from the [illegible] disposed at equal angles in a vertical plane about the source of light under test. These 11 pairs of [illegible] be of either the Lummer Brodhun or the Bunsen type, [illegible] the intensity of illumination in the corresponding directions from the source. The lamp under test is placed in a vertical position at the center of the system of mirrors, and rotated. The screen being disposed in a vertical plane at the side of the source, each mirror will send back upon it an effect which is the average of the illumination effects in the corresponding zones, neglecting for the moment the absorption effect at the mirrors. The effect upon the screen is the same as would be secured if the lamp was stationary and the system of mirrors caused to rotate about the axis of the lamp. If we imagine the system of mirrors rotating in this manner, each mirror will describe a zone (A) (B) (C) (D), etc., Fig. 1, and the effect sent back to the photometer screen by the individual mirror is a mean zonular effect. One of the desirable features of this photometer is the simple manner in which each of these mean zonular effects is "weighted." It is evident that the zones described by the rotating mirrors in the discussion just given are of different areas, and the average effects in these different zones should therefore be given different weights in determining the mean spherical candlepower. For example, if one zone (F), Fig. 2, has an area of 10 square feet, and the average illumination in that zone is one candle-foot and another zone (B), Fig. 2, has an area of five square feet and the illumination is two candle-feet, it is evident that the average illumination of these two zones is not 1½ candle-feet, as would be the case if the difference in areas were neglected, but 1⅓ candle-feet. Now the area of a spherical zone of a given width is proportional to the cosine of its mean angular distance from the equator of the sphere. The light returning from each zone should therefore be diminished in the ratio of unity to the cosine of the mean angular distance of the zone from the equator.

In the arrangement of mirrors described the horizontal pair is the only one which directs the light to the photometer screen in a direction perpendicular to its surface. It is well known that a beam of light falling at right angles to the surface illuminated is more effective than would be the case if the angle of incidence had any other value, so that as the angle of incidence, that is, the angle between the beam and the normal to the surface, increases, the illuminating effect falls off and may be shown to be proportional to the cosine of the angle just mentioned. This is known as the cosine law.

It will therefore be seen that the cosine law, as applied to the illuminating effect of a beam reflected from any pair of mirrors, will correct for the difference between the area of this zone and the area of the horizontal zone. In other words, the decreasing zones corresponding to the mirrors above and below the horizontal are "weighted" by the cosine effect at the surface of the photometer screen. It is only necessary, therefore, to balance the total illumination on the photometer screen as produced by the 11 pairs of mirrors by some illumination as in ordinary photometric methods, in order to determine the average illumination in the directions of the various mirrors, that is, the mean spherical effect.

In such a device we have, therefore, a simple and convenient means of obtaining with one setting of the photometer the mean spherical candlepower of an incandescent lamp, and with this device the determination of the mean spherical effect is a matter of a few moments, whereas, under the old methods, whereby the candlepowers in various directions were determined and averaged, the operation involved the expenditure of very much more time.

A photometer of this type has recently been installed in the testing laboratories of the department of physics and electrical engineering of the Iowa State College, and it is proposed during the coming months to make an extended series of comparative tests of the mean horizontal effects and the mean spherical effects of a variety of lamps, and it is scarcely to be doubted that in such a comparison of lamps some, at least, of the decisions of the lower court of mean horizontal candlepower, will be reversed by the higher one of mean spherical effects.

1. A paper read before the Iowa Electrical Association at Dubuque on April 20, 1905. The author is professor of physics and electrical engineering in Iowa State College, Ames, Iowa.

## The Bijur High-duty Battery.

As the result of several years' work on the part of Mr. Joseph Bijur of New York, a new form of storage-battery plate has been produced which, while retaining the well-tried electrochemical combination of lead and sulphuric acid, differs radically in design, construction and results from forms hitherto known in the storage-battery art.

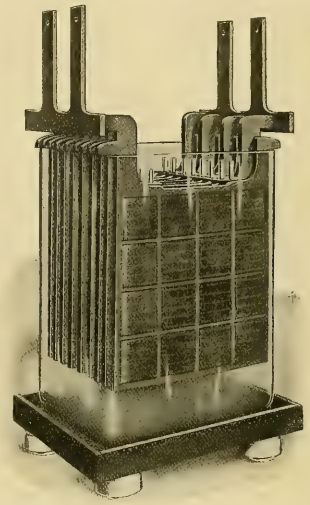
With the collaboration of Dr. J. S. C. Wells of Columbia University, in the earlier stages of the work, Mr. Bijur set out to produce a storage-battery plate according to an ideal design which should be both mechanically and chemically perfect. This design embodied a rigid structure, freedom from tendency to distortion, perfect acid diffusion, active material incapable of being displaced, high specific capacity, high rates of charge and discharge, high efficiency, good regulation and freedom from "sulphation," buckling, or any other destructive action, save ordinary and unavoidable wear and tear. These characteristics, it was believed, could only exist in a form of plate made up of small, finely subdivided structures, each free to expand unrestrainedly and firmly welded to a strong supporting and conducting grid.

The active portions decided on as most advantageous could not be produced at commercial cost by any known method, whereupon Mr. Bijur set to work to produce these crudely, following this up by devising automatic machinery by which these parts are now made with great uniformity and at low cost.

The Bijur plates are composed of multiples of pure lead structures in the shape of gratings or "grills." These are welded to and in one piece with a stiff frame made of lead and antimony only. The weld goes clear through the plates and is produced without the use of tin, solder flux, or any extraneous material whatsoever. The frame merges into the grill without joint. At each end of the grill a space is provided for its elongation by expansion, and provision is made for expansion sidewise. The result is a plate having the stiffness, strength and inoxidizable support of the alloy grid, rigidly held active parts, yet with complete provision for their expansion without the setting up of any strains that could produce buckling.

The grills are composed of a multitude of minute openings, or cells, open through from face to face. When in the untreated metallic state these grills are very open structures, having a large number of component ribbons running in the vertical direction, supported by heavier cross members running horizontally, which serve as conductors and give lateral stiffness. During the formation process part of the metallic lead is converted into oxide, which by reason of the large increase in volume nearly fills the openings. The ribbons on the positive elements have a large amount of metal left as a reserve for the oxidation which is attendant on the normal action of every storage battery.

When the oxide is formed in the rectangular cells it assumes a slightly eliptical shape, which, expanding into the rectangular containing space, produces a locking-in that is so positive that nothing short of destruction of the plate can dislodge it. At the same time, even when the oxidation is carried to the point of apparently completely filling the cells, the tendency of the ellipse to grow larger along both its axes insures the presence of a minute slot through the center of the oxide mass, which allows the flow of electrolyte to take place freely through it. The resultant oxidized plate, therefore, is rigid, the grills are firmly held, they expand without producing strains, each particle of oxide is firmly pressed against the lead from which it is grown and the entire plate is open through and through for circulation and diffusion of the electrolyte.



COMPLETE CELL OF BIJUR HIGH-DUTY STORAGE BATTERY.

One of the important advantages claimed by the manufacturer by this form of design is that in a plate of given dimensions 20 per cent. greater capacity can be obtained with about 10 per cent. more reserve lead than in any form of plate hitherto constructed. The fine subdivision of the oxide into small masses, combined with the fact that the surfaces of the plates are composed of ribbons on edge, precludes the possibility of blistering or shrinkage that is liable to occur when plates contain oxides in large masses.

The maker claims that owing to the rapid acid diffusion full charge may be given the batteries at a voltage of 2.4 to 2.5 volts instead of 2.7 volts a cell as is usually required. This low-charging voltage results in increase of efficiency and reduces the size of boosters required to charge.

The structure of the plate forms a conducting network to all parts, insuring equality of action all over its surface, and this together with the facility for escape of gas without dislodging active material favors the ability to stand very high rates of charge and overcharge without marked deterioration.

The General Storage Battery Company of New York, which is now putting elements of this type on the market under the name of the Bijur high-duty battery, has recently equipped a factory at Boonton, N. J., with special automatic machinery for the cheap and rapid production of storage batteries, where, by reason of an abundant and cheap hydraulic power and the automatic machinery used, storage batteries of the highest grade can be produced at a very low cost a kilowatt-hour capacity.

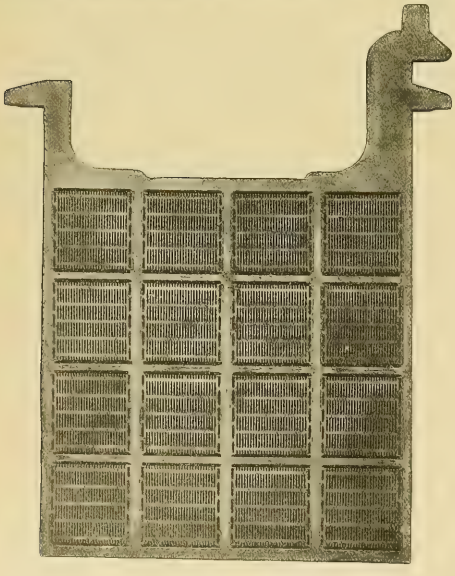
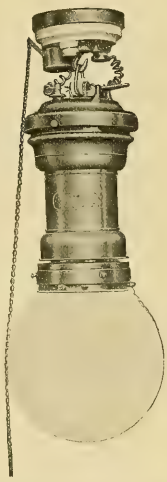


PLATE OF BIJUR HIGH-DUTY STORAGE BATTERY.



CEILING BOARD FOR ARC LAMPS.

## Chicago Meeting of the Institute.

Malcolm C. Rorty of the Bell Telephone Company in Pittsburg read the paper at the meeting of the Chicago branch of the American Institute of Electrical Engineers on April 25th. His subject was "Applications of the Theory of Probability to Telephone Traffic," and there was a good attendance of telephone men. The speaker exhibited curves of probability which are of assistance in various telephone-exchange operations. This interesting subject will receive future attention in the Western Electrician. It was discussed at the meeting by K. B. Miller, S. J. Larned, A. P. Allen of Indianapolis, A. S. Hibbard, F. J. Dommerque, J. G. Wray and F. R. McBerty.

An executive committee for the next season of the Chicago branch's work was elected. It consists of K. B. Miller, Prof. P. B. Woodworth, Prof. C. E. Freeman, H. M. Brinckerhoff, E. B. Clark, W. G. Carlton, George B. Foster, H. R. King and J. G. Wray.

J. H. Finney of St. Louis addressed the meeting briefly in the interest of the Institute convention at Asheville in June. He said that the St. Louis and Chicago members should go to the convention in force and have a special train. A rate of one fare for the round trip could probably be secured. Mr. Finney was received cordially, and a committee was appointed to take charge of the Chicago end of the arrangements.

The next meeting of the Chicago branch will be held on May 23d. The recent New York papers of George A. Damon and Theodore Varney on single-phase railways, with some additions, will be discussed. J. R. Cravath will read an original paper on "Light Electric Railways."

## Chicago Street-railway Situation.

At this writing Mayor Dunne is awaiting a report from John J. Cumming, who has been engaged in making an estimate of the cost of rehabilitating the Union Traction and City railway lines, when the first conference between representatives of the city and the street-railway companies on the subject of taking over the properties is promised.

During the week Judge Grosscup has handed down his decree in the transfer injunction suit of the Chicago City Railway Company against the city, the tone of which is considered by the traction companies as also strengthening their position on the 99-year claims. The decree says the acts of 1859, 1861 and 1865 all are in force and the City railway is operating the lines legally under these and the ordinances of the city based on them. The railway therefore has the contract right to collect a cash fare of five cents for each passenger, and is under no obligation to carry anyone by reason of having paid a cash fare on a Union Traction line and received for it a transfer to the South Side. Likewise the South Side company is by contract under no obligation to issue transfers on the lines to the Union Traction lines in question.

Local Scotch societies are arranging to give J. L. Dalrymple, traction superintendent of Glasgow, who is coming to Chicago, a hearty welcome when he arrives. A banquet is being planned among other entertainment.

## Ceiling Board for Arc Lamps.

One of the most valuable features of the improved porcelain ceiling board for arc lamps, which the General Electric Company has just placed on the market, is the use of a snap switch and a ratchet and chain, the lamp and board thus being self-contained and requiring no additional wiring to connect them with a switch. Every lamp in a circuit is made independent of the other lamps by means of standard Edison plug cut-outs, which afford a better means of protection than does the usual cut-out. The ceiling board is furnished for either concealed or cleat wiring.

The hook from which the lamp hangs is supported by a spiral spring mounted in a recess in the porcelain. This spring takes up any jarring to which the lamp may be subjected, reducing the vibration to a minimum. This ceiling board is therefore particularly adapted for use with lamps installed on wharves and in railway stations, factories and mills.

## Automatic Synchronizer for Alternators and Rotary Converters.

To start alternators or rotary converters quickly and to bring them from a standstill to full running condition within the briefest possible period is one of the essentials of modern service, and, consequently, the ability quickly to synchronize machines which are to operate in parallel is a matter of importance.

The Westinghouse Electric and Manufacturing Company, realizing the importance of an instrument that would obviate the difficulties of synchronizing, has developed and placed upon the market an automatic synchronizer which is applicable to installations using electrically operated or electropneumatic switches or to which such switches may be added. It provides a means whereby the operation of the coupling switch will not lag behind the moment of synchronism. As automatic switches require a certain period of time to close, it is necessary that the closing operation begin in advance of synchronism so that the switch will close at the instant synchronism is reached.

If the speeds of the machines vary too much, this instrument prevents the couple taking place. The adjustment of the synchronizer may be changed to coincide with the time element of any particular form of switch which may be used.

The automatic synchronizer consists essentially of a metal case in which are mounted two solenoids, the upper ends of whose cores are flexibly connected to either end of a lever which is swung centrally on a shaft. Attached to the shaft is a suitable contact arrangement which is normally open. The function of this contact device is to close a circuit through the closing coil of an electrically operated or electropneumatic switch. Current to actuate the switch is taken from a source independent of the generators, such as the exciter. Current to energize the solenoids is derived from the bus bars and from loads connected to the incoming generator or rotary converter through potential transformers.

In effect the mechanism holds the contacts of the switch-operating circuit open until the incoming machine arrives nearly at synchronism, and, taking into proper consideration the time element, causes it to close at synchronism, connecting the machines together. A controlling and relay switch are interposed in circuit with the synchronizer and electrically operated switch. By means of the controlling switch the main or electrically operated switch may be tripped, but cannot be closed, as the closing coil is normally out of circuit until the synchronizer is in the position assumed at the synchronous operation of the generators or rotaries, which closes the relay switch circuit and completes the path of the current through the controller and electrically operated switches. The relay switch is provided with carbon break and is intended to relieve the contacts of the synchronizer from excessive currents.

FIG. 1. VIEW OF SYNCHRONIZER MOUNTED ON SWITCHBOARD.

FIG. 2. CONNECTIONS OF AUTOMATIC SYNCHRONIZER WITH ROTARY-CONVERTER INSTALLATION.

A view of the synchronizer, with cover removed, mounted on a switchboard with its attendant instrument, in the power house of the Pittsburg, McKeesport and Connellsville railroad, is shown in Fig. 1. A diagrammatic view of the instrument connections with a rotary converter installation is given in Fig. 2.

Assume that it is desired to start the rotary converter (Fig. 2), which is accomplished by an induction motor not shown in the figure, and bring it up to approximate speed ready to connect in circuit. It will be seen that the primary (b) of the potential transformer is connected across the bus bars, and the primary (a) of the other transformer is connected to corresponding terminals of the rotary converter behind the electrically operated switch, that is, between the switch and rotary. It will be noted from the diagram that the coils of the automatic synchronizer are so connected as alternately to pull their cores down, the left-hand coil pulling when the phase difference is 180 degrees and the right-hand coil pulling when the phases of the machines coincide. There is an ingenious device connected to the contacts of the synchronizer which withdraws one of the contact brushes when the machines differ too much in speed. As the difference in speed becomes less this device acts in such a way as to allow the contact to be made sufficiently in advance of coincidence of phases corresponding to the time required for the switch to actuate. As the machines differ less in speed, the advance in the contact is correspondingly less. The contacts never have to break any current and when properly adjusted they will last indefinitely. The machines are coupled by this instrument without the least sparking or strain, the ammeters connected to the incoming machines showing hardly any deflection.

For rotary work a simple form of electrically operated switch has been devised to use with the automatic synchronizing system, combining the functions of switch and automatic circuit breaker, thus omitting the knife switches and fuses. For high-voltage work automatic oil switches are used. The wiring of the various devices forms a complete interlocking system, preventing coupling of the machines under unfavorable circumstances and avoiding the danger of any damage resulting.

## Proposals for Government Electrical Apparatus.

Sealed proposals are being invited until May 9th by the bureau of supplies and accounts, Navy Department, for furnishing eastern navy yards with the following: Schedule 197—generating sets, magnet wire, slate slabs, conduit fittings, thermostat springs, etc.; schedule 198—motors, batteries, etc. Blank proposals can be obtained at the navy pay office in New York or of the bureau at Washington.

The bureau is also inviting sealed proposals until May 23d for furnishing the Mare Island and Puget Sound navy yards with the following: Schedule

[illegible]

## Porcelain Insulator for Use Without Tie-wire.

The [illegible] porcelain insulator "in action," as the manufacturer puts it. [illegible] latter porcelain special is so simple that no further explanation [illegible]

As will be readily seen, the insulator is a safe one; the wire must stay in the hole, hence with it in service there can be no mysterious fires from a misplaced wire. It [illegible] with the screw hole on an incline the insulator may be attached with ease in the most inexcessible places, as between joists and in similar situations. One screw, too, does the work and prevents the knob from turning. Besides this, if it be desired, a tie-wire can be used likewise on this knob. The knob excels also where the space in which it can be placed is small. Summarizing, there is needed no tie-wire, no half hitch and no wrapping the knob.

The Snyder-Hunt Company of Belle Plaine, Iowa,

PORCELAIN INSULATOR FOR USE WITHOUT TIE-WIRE.

the manufacturer of this knob, calculates that through its use the following saving is made: One tie-wire measuring eight inches for each knob makes 8,000 inches for 1,000 knobs, which is 666 feet or more, depending on the size of wire used, which will cost more than $7; the time spent in cutting and tying the wire costs another $5 a thousand; the slanting screw or nail hole on the side (see cut) makes it easy to attach the knobs to a joist or the studding and it can be done in one-third of the time formerly required, saving an additional $2. Thus the total saving is at least $14 a thousand knobs.

## Chicago Trade Press Association.

The meeting and dinner of the Chicago Trade Press Association on the evening of April 24th at the Hamilton Club was a distinct success. Representatives of 82 class papers partook of the dinner. It was "President's Night" and the feature of the evening was the assembly of the presidents of the several trade press associations of the United States. The guests of the occasion were:

W. L. Terhune, president New England Trade Press Association, publisher of the Boot and Shoe Recorder, Boston, Mass.

James H. McGraw, president of the American Trade Press Association and also of the McGraw Publishing Company, New York city.

W. C. Edgar, President Minnesota Trade Press Association, publisher of the Northwestern Miller, Minneapolis, Minn.

Colonel Robert Mitchell Floyd, secretary of the New England Trade Press Association and publisher of the Trade Press List, Boston, Mass.

"Trade Press Organization, a Federation of Trade Press Associations," constituted the topic of the evening, and the guests of the occasion related many interesting experiences in the trade-paper field, with a recital of efforts culminating in notable achievements. The speakers were unanimous in their views as to the desirability of a national trade press organization, and steps were taken toward the attainment of this end. President J. Newton Nind presided as toastmaster in a most efficient and businesslike manner.

An announcement was made that Edwin C Madden, third assistant postmaster-general of the United States, will deliver an address before the association Monday evening, May 29th. It was voted unanimously to give Mr. Madden a special evening. The regular meeting of the association will occur on Monday, May 22d This latter occasion will be "Patrons' night," and the members of the association are to bring to the dinner as many patrons and prospective patrons as possible of their respective publications with a view to a general discussion of advertising, during which both sides of the question may be heard

Mr. Edgar in his speech extended a most cordial invitation to the association to make a visit to his home city, Minneapolis.

## Outdoor Apparatus for Alternating-current Circuits.

For some years the Westinghouse Electric and Manufacturing Company has had on the market a piece of apparatus designated as a "spark-gap protector for a secondary circuit." The name "spark-gap," although not incorrect, does not suggest the application of this device, and it has therefore been deemed advisable that it should be known as a "safety gap," since its function is to provide a safety gap or path for the escape of high-potential current from a low-potential system.

The purpose of the safety gap is to protect the low-tension windings of a transformer against any abnormal rise of static potential occasioned by grounds, switching of the high-voltage lines, etc. This type is particularly applicable to local-lighting

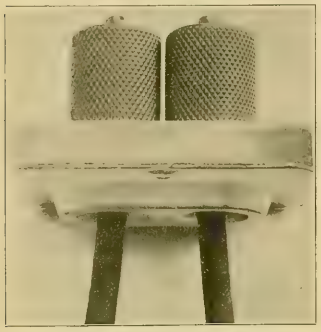


FIG. 1. OUTDOOR SAFETY GAP WITH COVER REMOVED.

and power service and can be adjusted for a wide range of voltages.

The safety gap, with cover removed, is illustrated by Fig. 1. The gap across which the arcing occurs is here clearly shown. This safety gap is neat and substantial in construction, occupies a minimum amount of space and is well insulated and rainproof. The cylinders are made of non-arcing metal, may be adjusted for any size gap by merely loosening a screw at the top of the cylinder and may be turned as desired so as to present new surfaces for action. A porcelain base supports the cylinders and the whole is enclosed in a cast-iron box.

The demand for a serviceable outdoor type of oil switch adapted for use with alternating-current series arc-lighting systems, for cutting out banks of transformers, isolating underground or overhead feeders and mains from main systems and operating inductive loads of all kinds led the Westinghouse company to design and place upon the market a switch (Fig. 2) that meets all these requirements. It is a double-pole, single-throw switch, mounted in a weatherproof case which may be easily attached to poles or cross-arms in the case of overhead systems, or may be hung in manholes.

The essential features consist of knife-blade con-

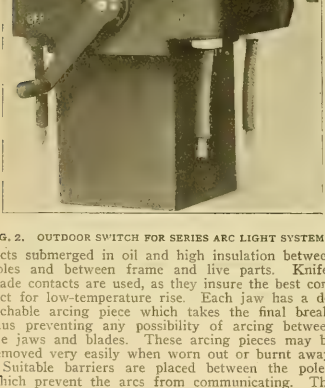


FIG. 2. OUTDOOR SWITCH FOR SERIES ARC LIGHT SYSTEMS.

tacts submerged in oil and high insulation between poles and between frame and live parts. Knife-blade contacts are used, as they insure the best contact for low-temperature rise. Each jaw has a detachable arcing piece which takes the final break, thus preventing any possibility of arcing between the jaws and blades. These arcing pieces may be removed very easily when worn out or burnt away.

Suitable barriers are placed between the poles, which prevent the arcs from communicating. The switch is compact and light, weighing but 40 pounds. When so ordered a special oil may be furnished with this switch which is especially suitable for use in cold weather, as it has a much lower congealing point than any oil now on the market which is otherwise suitable for oil-switch work. One and one-half gallons are required to fill the tank. The switch has a maximum capacity of 200 amperes at 3,300 volts.

## Annual Report of the Department of Electricity of the City of Chicago.

A complete report of the operations of the Department of Electricity of the city of Chicago for the year 1904 has been submitted by City Electrician E. B. Ellicott, giving in detail the work accomplished by each of the eight bureaus of the department during the year. The following facts taken from the report will be found interesting:

On December 31st of last year the city was operating from its municipal stations a total of 5,107 arc lights, being an increase of 100 lamps over the preceding year. The sum of $200,000 was appropriated for the new Horatio N. May arc-lighting station (see Western Electrician of April 8, 1905), which, however, did not go into operation during the year.

The report recommends that all extensions of the lighting system be followed with a view to using power from the Chicago Drainage Canal to be developed at Lockport. The City Council and civic bodies have already declared themselves for the utilization of this power for municipal lighting, though no definite arrangements have been made.

During the year an average of 5,034 arc lamps was maintained at a total cost of $273,639.24, or $54.36 a lamp, according to the method of calculation employed in presenting the report.

There is no obsolete apparatus in use, and the entire system is in good operating condition, it is said.

In 1904 a total of 252 fire-alarm boxes were put in place, the total number now in service being 1,689. There is at present in use in connection with the fire-alarms 267 miles of wire, 169 of which is copper. A system of police telegraph is maintained in conjunction with the fire-alarm telegraph.

Rewiring and equipping theaters according to the present requirements has thrown a great deal of extra work on the electrical inspection bureau. The result, however, is that there is a higher standard maintained in Chicago theaters than in any other city in the United States. The bureau of electrical inspection will try to secure some changes in the requirements for large department stores, where hundreds of people congregate and present even worse conditions than those existing in theaters. The entire rules and regulations for the installations of wire and apparatus have been revised and are to be placed in the revised code of ordinances now in course of preparation.

An interesting table is given in the report of the bureau of electrical inspection, showing the number of electric-lighting stations and lamps in the city under the jurisdiction of the department:

| | No. of Stations. | No. of Arc Lamps Operated. | No. of Incandescent Lamps Equivalent to 16 Candlepower. |
|---|---|---|---|
| Commercial companies, central stations | 59 | 17,627 | 1,208,323 |
| Isolated plants | 1,236 | 15,030 | 765,658 |
| City plants, street lighting | 3 | 5,107 | ..... |
| City plants (isolated) not including city hall and waterworks | 12 | 31 | 4,180 |
| Totals | 1,310 | 37,795 | 2,068,159 |

The total number of signs was 1,950. For this purpose 34 arc lights were used and 115,721 incandescent lamps were used, which includes those coming under the inspection of the department. The number of signs projecting over the sidewalks was 1,795 and the signs paralleling the buildings 155.

The city laid 35,420 lineal feet of conduit and other corporations 176,120 feet of conduit during the year. There has been altogether 860,419 trench-feet of conduit, containing 5,253,362 duct-feet, laid in Chicago during the last four years.

The net cost of the Department of Electricity for the year 1904 was $818,180.82.

## Everett-Moore Properties Released from Trusteeship.

The trustees of the Everett-Moore properties and securities have been discharged and the business goes back to the syndicate, to be handled as seems best. There are now six members of the syndicate, and the properties that revert to them consist largely of telephone companies, with interests in several good traction lines. The development of these properties and the liquidation of the comparatively small debt that is left to them is now in order.

Three years ago trouble came about over the affairs of the syndicate. The first 18 months after the trouble, the business was handled by a committee of bankers. Then it was turned over to a board of trustees consisting of Col. F. S. Dickson, Calvary Morris and H. R. Newcomb. It is stated that Colonel Dickson will remain as president of the telephone companies. He has been very successful in handling the affairs, and most of them are now on a paying basis.

Messrs. Moore and Everett have faith in the securities of all their properties. They will give them personal attention in every way. It is said that the work of straightening out the affairs of the syndicate has cost $300,000, all of which has been paid in cash. E. W. Moore departed for New York immediately after the business was turned over to the syndicate, to look after a large bond deal in connection with the Toledo Railways and Light Company.

## North American Company Assumes Charge of St. Louis Railways.

The North American Company has taken over the United Railways Company of St. Louis, assuming control of the big street-railway system on April 20th. No action affecting the affairs of the company other than the formation of a new board of directors has been taken. Several changes in the personnel of the board were made, but none among the officers except in the election of John I. Beggs of Milwaukee to succeed Murray Carleton as president. Capt. Robert McCulloch continues as vice-president and general manager. Murray Carleton, James Campbell and Festus J. Wade were retained on the board, and Judge H. S. Priest was made a director in addition to being continued as general counsel. President C. W. Wetmore and Treasurer George R. Sheldon of the North American Company; W. H. Thompson, president of the National Bank of Commerce, and W. V. A. Powelson, general manager of the Union Electric Light and Power Company, are new members of the board, making 10, with one place vacant.

By bringing the United Railways Company into closer relation with the Union Electric Light and Power Company and the Laclede Gaslight Company, which they also control, the directors of the North American Company expect to effect a big saving in operating expenses. Power will be obtained from the new plant of the Union company on the river front, although it is not intended to abandon the United railways power plant for the present at least. The three concerns will be operated separately in every other respect.

The United Railways Company was organized in 1898 by the consolidation of all the street-car lines in St. Louis except the Suburban. Its franchise runs until 1948. It operates 344 miles of track. In 1899 the system was leased to the St. Louis Transit Company for five years. In October, 1904, the United Railways Company again assumed control, and the finances were readjusted by exchanging $17,264,000 Transit stock for United railways stock. The capitalization and funded debt is as follows: Common stock, $24,913,800; preferred stock, issued, $12,983,200; preferred stock, in treasury, $7,000,000; general mortgage bonds, $42,000,000; Transit refunding bonds, $10,000,000.

The net earnings of the system, less all interest charges on funded debt, is given as $395,000 for 1903 and $1,840,000 for 1904. The gross earnings for the first three months of 1905 were $1,840,000, an increase of $68,000 over the same period last year.

John I. Beggs, the new president, is also president of the Union Electric Light and Power Company, director in the North America and half a dozen other public-service corporations in Milwaukee, Detroit and other cities. He is 57 years old and was born in Philadelphia. His early schooling was limited, consisting chiefly of a course in a business college, but out of it he made himself an expert accountant, and his later experience in handling power plants and street railways has qualified him as an electrical and civil engineer of ability.

In 1884 he became interested in electric lighting and succeeded in organizing an electric-light, enterprise for Harrisburg, Pa., which he managed until 1887. J. P. Morgan then secured his services as general manager of the Edison Electric Company of New York, where he remained until 1890. After that a busy career connected him with several other enterprises, among them the Edison General Electric Company of Chicago, the Cincinnati Edison Electric Company and the Milwaukee street railways. In 1903, when the North American secured control of the Union company in St. Louis, he became its general manager.

## Foreign Trade Opportunities.

The Bulgarian railway department at Sofia is open to offers for the sale of 400 tons of creosote.

The Societa Romana Tramways Omnibus of Rome has been authorized to change its horse-car line to electric traction.

The Roumanian postal department at Bukharest will purchase 52,600 insulators and 28,000 pounds of bronze telegraph wire.

The Direccion general de Correos y Telegrafes in Madrid, Spain, will receive proposals for furnishing telegraphic and telephonic supplies.

A permit has been granted to the Compania de Tranvias, at Cartagena, Spain, to introduce electric traction on the street-car lines.

The municipality of Madrid, Spain, has voted $2,522,000 for the widening of the Calle de Preciados and the building, drainage and lighting of a new street. The party obtaining the contract will have a 40-year privilege of running an electric tramway in these two streets.

Fred H. Fitch and others of Chicago are said to have purchased the electric street-railway system at Pittsburg, Kan.

## Ohio Telephone Notes.

The Prudential Telephone Company of Cherry Valley, Ashtabula County, has been incorporated with a capital stock of $3,000.

Several additional street telephone boxes have been put in by the Cuyahoga Telephone Company. This feature of the business bids fair to become quite popular.

New automatic telephone boxes are now being installed by the Citizens' Telephone Company of Columbus and it is expected that all will be in and ready for use by the time the switchboard is completed.

Telephone companies now charge 10 cents instead of five for local service, at the Hollenden Hotel, Cleveland. One of the companies says that the contract with the hotel company forces it to make this charge and the other says the rent for the space is so high that an additional charge is made to cover it.

A meeting of the managers of the Central Union Telephone Company for the Chillicothe district was held at Portsmouth on April 20th, and it is rumored that a deal is in progress for acquiring the Independent exchange at Huntington, W. Va. There is also some talk that the Bell people will attempt to purchase the plants at Ironton and Portsmouth. This would be in accord with the plans they worked out in getting possession of the Jackson County plants.

It is reported that 12 townships in Ashtabula and Trumbull counties have been developed by small telephone companies organized among the farmers. The companies are intended to operate in only one township each, but it is thought that they will all be connected with the Independent exchanges running into Youngstown and some of the other larger towns.

The reports of the subsidiary companies of the Federal Telephone Company for March all show good results. The Cuyahoga Telephone Company shows an increase of over $12,000 in gross earnings over the corresponding month of last year. The Stark County Telephone Company shows an increase of over $1,000 in gross earnings for the same period. The officers are very well satisfied with the business the companies have done.

The Bell people are constructing a large cable in the residence section of Toledo to take care of the new business and replace the present construction. It is said the company will expend $25,000 for cable and underground construction within the next few months.

The Burlington Telephone Company of Burlington has been incorporated with a capital stock of $300. C. L. Crawford and others are interested.

It is reported that a two-story business building will be erected on the Bell Telephone Company's property on St. Clair Street in Toledo. C.

## Telephone News from the Northwest.

J. W. Scott of Grand Forks, N. D., has secured a controlling interest in the Benson County Telephone Company at Minnewaukon, N. D.

A. B. Bickford, T. O. Hunter and A. C. Wiper have been granted a franchise at Bowbells, N. D., for a telephone exchange.

The Farmers' Mutual Telephone Company of Souris, N. D., has been incorporated with $20,000 capital.

The Union Telephone Company of Hope, N. D., has increased its capital stock from $50,000 to $100,000.

The Davison County Telephone Company of Ethan, S. D., is preparing to start construction work. A line will be built to Hillside.

The Home Telephone Company of Ashland, Wis., has announced a raise in rates for business instruments from $2 to $2.50 a month. The company's franchise provides that when 1,000 instruments are in use, such raise can be made, and the company now has 1,050 connections.

The Dakota Central Telephone Company is about to install a central-energy system at Aberdeen, S. D.

The Clarence (Iowa) Telephone Company is preparing plans for a new exchange building.

The Vincennes and Wayland Telephone Company has been incorporated at Vincennes, Iowa, with a capital stock of $3,000. G. L. Sargent is president and F. D. Newberry secretary.

F. M. Currie has purchased a controlling interest in the Central Telephone Company of Broken Bow, Neb., from J. E. Adamson. It is planned to spend about $1,000 in improvements at once.

The Iowa Telephone Company is negotiating for a site for a new exchange building at Sioux City, Iowa. It is planned to spend about $150,000 in improvements in that city this season.

The Tri-state Telephone Company has been granted a franchise at Milan, Minn.

A telephone franchise has been granted at Rugby, N. D., to A. H. Jones.

The Hastings (Neb.) Independent Telephone Company has let the contract for the erection of a new exchange building to L. Ellis. R.

## Indiana Telephone Items.

The Wilson Home Telephone Company of McGrawsville has been incorporated to construct and operate a telephone system and exchange in McGrawsville. W. [illegible] head the board of directors.

The Union Telephone Company of [illegible] County, has filed articles of incorporation [illegible] capital stock [illegible] $5,000 [illegible] and Samuel [illegible] are the directors.

The annual meeting of the directors of the South Bend Home Telephone Company was held on the 20th inst. The company has nearly [illegible] million dollars invested and has over [illegible] telephones connected. The officers elected were: President, Theodore Howard, vice-president, [illegible]; secretary, Elmer Stone.

The Lafayette Home Telephone Company and the Bell Telephone Company will each spend over $200,000 during the coming year, it is said, in an effort to get a majority of the business in the Lafayette field. It is charged that years ago the Bell company had all the telephone service in Lafayette and for lack of competition it "boosted" the prices. Several times local companies were formed, with the purpose of reducing the rates, but the Bell company forced them out of business by dropping for the time to so low a rate that competition was impossible.

Charles F. Belman of New Albany has patented a device to displace the familiar glass insulators on the crossarms of telephone and telegraph poles. The device is of iron and the wire is held by a clutch which prevents its slipping. The contrivance rests in a socket in the crossarm.

Mark P. Boone, superintendent of the Peru Home Telephone Company, has applied for a patent on a lock-out device, intended to overcome the lack of privacy on party lines. The device can be placed on any central-energy telephone and can be manipulated with as much ease as a telephone on an independent line. The officials of the Peru Home Telephone Company will at once introduce the lock-out system on its country lines, thereby, it is hoped, affording country patrons as much privacy as if they were on an independent line. S.

## Bell Telephone Output.

The American Telephone and Telegraph Company reports that the net addition of instruments for the month of March was 121,514, or 30,000 more than in the corresponding month of 1904. In the first quarter of 1905 the net gain has been 301,372 instruments, or 50 per cent. more than in the corresponding quarter last year. The company's reports show that there are 800,000 more instruments earning rental now than there were a year ago; 1,400,000 more than two years ago, and 2,000,000 more than three years ago. The percentage of returns compared with output is smaller, and the net gains, therefore, make a good exhibit. Following are comparative figures reported for March:

| March— | 1905. | 1904. | 1903. | 1902. |
|---|---|---|---|---|
| Gross output | 169,159 | 126,522 | 84,280 | 96,557 |
| Returned | 47,645 | 35,043 | 38,172 | 42,847 |
| Net output | 121,514 | 91,479 | 46,108 | 53,710 |
| Outstanding March 31 | 4,781,736 | 3,972,095 | 3,339,635 | 2,691,065 |

## NEW COMPANIES.

The North Table (Neb.) Telephone Company has been incorporated with a capital stock of $5,000 by R. T. Pettycrew, C. M. Van Meter and others.

L. N. Douthit, James Stewardson and W. H. Brown have incorporated as the Richland and Shelbyville Township (Ill.) Mutual Telephone Company. The headquarters will be in Richland Township.

The Streator Telephone and Telegraph Company has been incorporated under the laws of New Jersey with a capital of $200,000. The incorporators are Charles N. King, L. G. Bouker and J. J. Reilly.

Articles of incorporation of the Bear River Valley Telephone Company have been filed with the secretary of state at Salt Lake City, Utah. The headquarters of the company, which has a capitalization of $25,000, are at Tremonton, Utah.

The following-named telephone companies have been incorporated recently: Twin Valley Telephone Company, Morrison, Okla.; Farmers' Mutual Telephone Company, Moulton, Iowa; Richland Telephone Company, Richland, Kan.; Berthra Telephone and Telegraph Company, Opelousas, La.; Burlingame Independent Telephone Company, Burlingame, Kan.; Butler County Telephone Company, Brainard, Neb.; Oklahoma Northern Mutual Telephone Company, Hunniwell, Kan.; Farmers' Telephone Company, Wausa, Neb.; Hesston Rural Telephone Company, Hesston, Kan.; Russell Gorman Telephone Company, Russell, Kan.

Speaking of automatic telephony at a recent lecture in London, Herbert Laws Webb said that the probable future development would be to use automatic devices where they would be under the control of experts, and to keep the sub-station in its present state of simplicity.

## Office Equipment for Long-distance Telephone Service.

[illegible] this business [illegible]

It [illegible] any service trunks, [illegible]

When [illegible] plied at each section.

It is considered that [illegible] line and cord circuit are best for toll boards. Good results, however, can be obtained by using two-wire circuits with made contacts in the jacks for operating cut-off relays.

For line and clearing-out signals in connection with the toll lines, it is recommended that tubular hand-restoring drops be used. We consider these signals better than any form of lamp or visual signal, from the fact that they are more sensitive, they will not confuse the operator on account of false signals, and when there are two or more stations on a line, necessitating code ringing, the operator can tell what station is being called.

It is recommended that busy signals be used in connection with toll-line multiples and answering jacks. There are certain magnetic busy signals that can be used satisfactorily; also a lamp having a considerably higher voltage than the battery on which it is operated, will give very good results.

In connection with the cord circuits at a toll board, it is desired to recommend against having cord circuits of different kinds, or cord circuits that can be changed from one condition to another by the operation of keys. The best arrangement is to have all cord circuits alike; this, however, cannot always be done. It should be possible in most cases to restrict the kinds of cords to two kinds, as toll to toll, and toll to local. It is recommended that when two kinds of cords are necessary, that a division be made between the two kinds of cords which will be permanent, and no keys be used for changing from one to another.

Usually it is good practice to have repeating coils wired in connection with the cords, so that they can be cut in or out by means of these keys. The number of these coils should be restricted, in most cases not more than two or three at a position, and they should be used only when absolutely necessary.

## Growth of a Rural Telephone Exchange.

What is known as the Marquis Independent telephone exchange of Norwich, N. Y., which was started in that city in January, 1895, with three telephones by Mr. Marquis, who is at present exclusive owner of the system, is now said to be one of the largest rural Independent exchanges in New York state. It has grown to a system of 620 instruments, and this with strong Bell competition. For the first eight years Mr. Marquis strung nearly every foot of wire himself and placed every telephone. For five years he not only worked all day outside, but slept in the office nights and answered all night calls. When he installed and put in operation his first three telephones Mr. Marquis, strangely enough, had never even talked through a telephone, or had a receiver at his ear. Last year Mr. Marquis doubled the switchboard capacity and he is now stringing new cables. About June 1st he will connect with Binghamton and Elmira, making a continuous line from Utica to Elmira.

## Struggle for Telephone Competition in Connecticut.

The legislative contest to break the Bell telephone monopoly in Connecticut which is exercised through the agency of the Southern New England Telephone Company is assuming large proportions. Under the present law it is practically impossible for a rival company to get the required authority to start in business. Pending bills provide for the repeal of the restrictions which were established for the safeguarding of the Bell corporation. The contest against the present monopoly is being pressed both by the mercantile interests of the state and also by the Independent concerns that seek to enter Connecticut and establish competition with the Bell. The State Business Men's Association has taken a hand in the contest favoring the anti-monopoly bills.

The sixth rural telephone line has been built out from Beulah, Kan., and is called Beulah No. 6. Hugh Gregg has been elected president of the company.

## GENERAL TELEPHONE NEWS.

W. W. Finney has put in a new telephone exchange in Emporia, Kan.

The Interstate Telephone Company of St. Joseph, Mo., has increased its capital stock to $1,000,000.

The Douglas Telephone Company lost its office and equipment in a $125,000 fire at Tuscola, Ill., on April 22d.

The Home Telephone Company of Hebron, Neb., has been sold and the system will be thoroughly overhauled by the reorganized company.

The Independent Telephone Company of Salt Lake City, Utah, has recently been granted franchises by the councils of Provo and Brigham City.

If a bill which has passed the Senate of the New York Legislature becomes a law the use of profane or indecent language over the telephone will subject the user to fine or imprisonment.

N. E. Gibboens, manager of the Yankton (S. D.) office of the Northwestern Telephone Exchange Company for 17 years, has resigned to accept a similar position with the Yankton Independent Telephone Company.

It is reported that the Federal Telephone Company of Pennsylvania has decided to cease business and has asked for the repeal of its franchise in East McKeesport, Pa., and the surrender of its bond. The company has sold its poles, but the name of the purchaser has not been given.

Clarence Anderson and William Hegstrom of Lindsborg, Kan., have invented a selective device for use on the rural telephone lines which not only cuts out all the other telephones on a line when two telephones are busy but shows by a small indicator on each telephone that the line is busy.

The Independent Telephone Company of Emporia, Kan., is preparing to fight the recently passed Kansas law which provides that 50 cents per month shall be the rental for all rural telephones where the farmers buy their own telephone. This company has been charging $1 and says that the law is unfair.

The Home Telephone Company intends to extend its lines to Escondido, National City, Corona, Chula Vista, Paradise Valley and other sections of San Diego County, Cal. From Escondido the line will be extended northward to Santa Ana, where connection will be made with the long-distance service of Los Angeles.

The Rock Hill (S. C.) Telephone Company has been granted a 10-year franchise by the town of Rock Hill. The city reserves the right to buy the plant at any time at the figure that may be offered by any other person or concern. Maximum rates of $2 for residences and $3 for business houses per month are also established.

The City Council of Woodbury, N. J., has passed an ordinance governing the operation of the Delaware and Atlantic Telephone Company (Bell) in that city. The ordinance gives only a 20-year limit to the franchise and makes the maximum service charge in the city $12 a year. It must be accepted by the corporation within 30 days or the city may proceed to remove the poles and wires from the streets.

Allison W. Stone, for the last nine years in the employment of the New England Telephone and Telegraph Company, has been advanced to be inspector of private-branch exchanges, a newly created position. He will have the supervision of about 700 private-branch exchanges, located in large mercantile houses, hotels, theaters, newspaper offices and other establishments having that class of telephone service in Boston and its suburbs. Mr. Stone is a graduate of the Massachusetts Institute of Technology.

Division Manager L. H. Jacobi of the Pacific States Telephone and Telegraph Company says that it is the intention of his company to speedily put underground in Berkeley, Cal., all the wires where the heaviest leads are located, to install a number of extra aerial cables and to substitute copper for iron wire throughout the Berkeley circuits. The company is further improving its service by replacing 10-party lines with four-party, two-party and direct lines, and it will also enlarge its central switchboard to accommodate the increased number of subscribers.

The Norton (Mich.) Fruit Growers' Association has decided to investigate the cost of installing the township telephone system. The system has been very successful in other points in Michigan, the lines being organized and equipped by the farmers who patronize them. They can be operated at less expense, it is said, than would be required by subscribing to the city telephones, although the first expense of equipping is greater. Norton Township is adjacent to Muskegon, and arrangements will be made with either the Bell or the Citizens' (Independent) company at that point for outside connections.

## Puzzling "Wireless" Decision.

Both sides see a victory in the decision handed down recently by Justice Townsend in the United States District Court in an action brought by the Marconi Wireless Telegraph Company against the De Forest Wireless Telegraph Company for alleged infringement of basic patents.

The suit was begun in the summer of 1902 and was directed against the De Forest system of that date, which, counsel for the defense says, was crude and inefficient as compared with the present De Forest system. This suit was brought on the Marconi reissued patent No. 11,913, dated June 1, 1901, of the original Marconi patent No. 586,193, dated July 13, 1897. The application for the reissue was filed on April 1, 1901.

The Marconi company was represented by Betts, Sheffield & Betts, while the defendant's counsel were Francis X. Butler and Philip Farnsworth. So involved in character is the 50-page typewritten opinion that plaintiff and defendant alike announce a sweeping victory.

The contention of the Marconi company was based upon six claims, two of which Judge Townsend sustains and four of which he dismisses. Upon the two sustained the court allows an injunction and an accounting, holding that so far as those two separate claims are concerned the defendant infringed them. The defense, however, declares that as to the devices specified in the two sustained claims it matters nothing, as it has long since abandoned their use.

Plaintiff's counsel, on the other hand, assert that the contention of the Marconi company is upheld by the court in the two sustained claims, and that the devices mentioned in the four dismissed claims are of no special significance.

With equal assurance Mr. Farnsworth declares that claim No. 1 of the plaintiff, if allowed, would have given Mr. Marconi an absolute monopoly in wireless telegraphy, but that by the four dismissed claims the De Forest company has won a great, sweeping and substantial victory.

Claims Nos. 1 and 24 are considered by the defendant the important ones in the patent in suit, and as these are held not to infringe, Mr. Farnsworth says: "The operations of the De Forest company, in installing its system, will never be interfered with or harassed in the slightest degree by this hitherto so-called basic patent of Marconi, unless, of course, the patent should be given a broader scope on appeal. Inasmuch as the Marconi company lost the one great thing for which it was contending, it is my opinion that that company will make the one appeal which is permitted. It is not likely that the De Forest company will appeal, because it won its victory, which consisted in invalidating the one dangerous claim of the patent. There is not a word in Judge Townsend's decision which indicates that he believed that Marconi was entitled to a monopoly of the aerials described and used since 1882 by Dolbear, Edison, Kitsee and others."

## "Pertinacious Current" and the Mercury-vapor Rectifier.

A "pertinacious current," according to the definition of Sir Oliver Lodge, is a "continuous, unidirectional discharge of electricity, obtained without cells, and under an electromotive force so high that ordinary big resistances are easily overridden." Sir Oliver gave a lecture upon this subject before the Royal Institution in London on March 24th. According to the London Electrician, a magnetic method of producing the current consists in using a mercury rectifier to trap in a reservoir the surges from an induction coil. The rectifier operates like a valve controlling the inlet of a cistern into which water is intermittently pumped. In this analogy the water stands for electricity, the pump for the induction coil, and the cistern for the Leyden jar of the electrical case. It was in the explanation of the internal action of the rectifier the interest of the lecture mainly centered.

It has been found that as the vacuum in a vacuum-tube rectifier is increased the positive ions have more and more difficulty in traveling to the cathode, and as the bombardment becomes more terrific may be driven from the tube entirely, producing a still greater vacuum. When no positive ions are left conduction becomes very difficult. To insure good conductivity, therefore, the positive carriers must be protected from the negative bombardment and must be given plenty of chance to reach the cathode, showing not only the main function of a mercury rectifier, but, besides, the action of that small but very necessary adjunct to the mercury-vapor tube—namely, the conducting coating outside the glass around the edge of the liquid mercury, which acts as cathode at the bottom of the tube.

The theory proposed suggests new and efficient forms of rectifier. One such was described and exhibited by the lecturer. In it advantage is taken of the rectilinear propagation of the cathode rays, when they are free from the deflecting influences of a strong electric or a magnetic field. Here the cathode is a wire stretching vertically the length of the tube. The anode is a smaller electrode, surrounded by a horizontal narrow glass cone or cylinder. In this cone the positive carriers may reside in large numbers, well protected from the cathode-ray bombardment, and, as fast as may be, escape from the open end of the cone, with a fair chance of reaching the extended cathode.

## Application of Electricity to Heavy Freight and Trunk-line Railways.

Mr. J. H. Hallberg delivered an illustrated lecture on the "Application of Electricity to Heavy Freight and Trunk-line Railways" before the Electrical Engineering Society of Columbia, at the Columbia University, on April 18th.

The lecturer described in detail all electric systems which have been proposed and tried for trunk-line service, and a number of lantern slides, illustrating the 15,000-volt single-phase railway developments carried on by the Oerlikon Electric Company of Zurich, Switzerland, under the direction of Mr. Emil Huber, were the subject of an interesting description and discussion.

The electrical equipment for the New York Central railroad, now being manufactured by the General Electric Company, was also illustrated by lantern slides, and an enthusiastic discussion followed the description of this system.

Mr. Hallberg also had prepared for the occasion a number of special slides, illustrating the Siemens & Halske locomotive, used for the high-speed electric-railway tests between Marienfeld and Zossen, and others, showing in diagrammatical form the power and distribution equipments required for the various systems.

One of the most interesting subjects discussed during the evening was the single-phase to polyphase electric-railway system which has recently been invented by Mr. Hallberg. The important advantage of this system is that it is possible to build very powerful locomotives, which can be operated with only one contact wire, delivering high-voltage single-phase current to the locomotive, on which the current is then converted by means of a motor-generator set, into polyphase current suitable for the polyphase induction motors, which are mounted on the driving axles.

As all generating and transforming apparatus is of the alternating-current type, no commutators will be required, and the use of induction motors on the locomotive eliminates altogether the use of commutators for any of the main generating or driving machines for this system, which was considered an important feature.

Considerable attention was also given to the various forms of construction for overhead contact wires for high-speed trunk-line railway service, and the inverted catenary construction, developed by Mr. Huber of the Oerlikon company, was favorably commented upon, and the general opinion was that it would be preferable to make contact on the top of the contact wire, as suggested by Mr. Huber, instead of using the ordinary catenary suspension, which makes it necessary to collect current from the under side of the contact wire.

The speakers also agreed with Mr. C. O. Mailloux and Mr. Damon in that nothing less than 15,000 volts should be used for heavy trunk-line traction, and it was also thought that the use of more than one wire for each track would be prohibitive. In other words, the straight three-phase system, requiring either two or three trolley wires for each track would not be considered as a general proposition.

Mr. Hallberg also commented favorably upon Mr. Mailloux's suggestion to generate current at about 15,000 volts, which could be distributed directly to the contact wire wherever necessary, instead of generating current at a low voltage and then stepping up to a very high voltage for the transmission lines and again reducing the pressure at sub-stations for the contact wire. Where large amounts of power are generated, as for a large trunk-line railway system, it would perhaps be more economical to generate and distribute directly to the contact wire without the use of high-potential transmission lines and sub-stations.

Prof. Fitzhugh Townsend took active part in the discussion, and several interesting references were made by him to the bipolar motors designed for the New York Central locomotive, and he explained very clearly why these motors operate under greatly varying loads and other unfavorable conditions without sparking. He also pointed out several advantages of Mr. Hallberg's single-phase to polyphase railway system.

Mr. Karl Wersall, an electrical engineer, until recently in the employment of the Oerlikon company at Zurich, also participated in the discussion, and he pointed out several of the advantages of the Huber inverted catenary contact-wire support, and he also referred to the successful operation of the Oerlikon 15,000-volt single-phase locomotive, which is equipped with the Ward Leonard system of control, and which has been in daily successful operation during the last few months on a section of the state railway in Switzerland.

# CORRESPONDENCE.

## Great Britain.

London, April 12. The annual bill in Parliament by the London County Council for the construction of a new tramway on the conduit system over two of the Thames bridges and along the Victoria Embankment, thus forming a through route from the north to the south of London, has gone a step further than it ever has before. For many years the London County Council has endeavored to secure parliamentary powers to construct these lines, but invariably the proposal has been defeated at the first stage in the House of Commons. This year, however, the voting in the House itself on the first stage resulted in a tie and the speaker gave his casting vote in favor of the bill. It will thus be considered by a committee of the House of Commons for the first time, although, should it pass this stage, there are at least three other periods in its parliamentary career at which it can be rejected.

A matter of even more importance to London as a whole is the conversion of the horse lines in the north of London to electric traction. The past history of tramways in the north of London is a large question to discuss, but, as I have previously mentioned, they are leased to a company whose concession has still four years to run. Ever since the County Council took in hand the question of electric traction it has been negotiating for the conversion of the northern lines, but there being a tri-party consent necessary, it is easy to imagine that we have not advanced one step nearer a solution of the problem. On the one hand, the company, with such a short tenure cannot be expected now to take much interest in the matter, but several years ago it was willing that the lines should then be converted to the overhead-trolley system. The borough councils, through whose districts the lines pass, having an absolute veto in the matter, have stipulated that only the conduit system shall be adopted, while the County Council itself is in favor of a combined trolley and conduit system. In order to expedite matters somewhat a report has been presented to the County Council recommending that the company shall be purchased at a cost of $2,180,000. But even this would not seem to clear the way, for the council still estimates the cost of the conversion of these horse lines to partly conduit and partly trolley, while if the borough councils persist in their attitude that the system shall be conduit, north London may have to wait another 10 years.

Last year considerable time was spent by a committee of the House of Lords in perfecting a bill to amend the electric-lighting acts of 1882 and 1888, which contained many excellent alterations and modifications of the existing legislation which has irritated and retarded the industry for several years. Much regret and disappointment were therefore expressed when it became known that owing to the late period at which the measure was introduced it would be impossible to pass it into law, because there would not be time for the House of Commons to consider it. Last week this bill, as amended by the House of Lords last year, was introduced into the House of Commons, and there now seems every prospect that it will at last be placed upon the statute book, for, provided there are no drastic alterations in the House of Commons, the bill should pass the House of Lords unopposed, seeing that its form will be identically that as settled by the House of Peers in 1904.

A little peculiarity of the laws in London is the fact that on the occasion of every fire an inquest is held quite apart from the question of whether any lives are lost or not. Therefore an inquest has been held upon the fire at the National Telephone Company's exchange in the city. The origin of the fire was a somewhat unusual one and was partly suggested at the time. The official account is that some tests which were being carried out upon the newly electrified Metropolitan District railway necessitated a change in the position of many of the telephone cables which run through the railway tunnels. In the removal one of the telephone wires received current at 600 volts from the third rail, which carried along the telephone wire and set fire to the test room at the exchange.

Explosions in street boxes—electric-light, telegraph and telephone—have been a source of constant worry to engineers for several years. For instance, in electric-light inspection boxes gas percolates into the chambers frequently from an escape from a neighboring gas main, and should an arc occur in the box an explosion immediately follows. In connection with telephone boxes, explosions from a similar cause are caused by the lamps which the men carry when out testing or repairing. Ventilated covers do not appear to give the protection they should from mud and rain, and householders object to a short ventilating pipe being laid from the boxes and run a short way up the side of adjacent houses. To meet the difficulty the postmaster-general is proposing to formulate some rules to be followed when the presence of gas in these chambers is suspected.

The huge $25,000,000 electric-power scheme for London has now been considered by a select committee of the House of Lords, but no decision will be given until the eight bills which purpose to compete over various part[illegible] considered. [illegible] a strong case [illegible] scheme. G.

## New York.

New York, April 22. The [illegible] with the official investigation into the cost of public lighting in New York [illegible] day after four weeks' work. Details of the final hearings are reported elsewhere in this issue.

After months of delay the Board of Aldermen has rejected the application for a franchise for the New York Connecting railroad, which was designed to connect the Bronx with Long Island in the interests of the Pennsylvania railroad. It is most interesting to note that the aldermanic committee recommended that it should be made an imperative condition that this road, if finally allowed, should be operated by electricity at a five-cent fare.

A few public and private interests are at work to defeat the proposed moving-platform subway under Thirty-fourth Street and to substitute a four-track electric line which would allow of through traffic between the upper east and the lower west sides. It is especially noticeable that prominent department-store owners have changed their view and that the Metropolitan company endorses the four-track subway.

The Brooklyn Rapid Transit Company has received a number of 37-foot cars for the use of the subsidiary Bridge Operating Company which will run the local traffic over the Williamsburg Bridge. The new cars have a seating capacity about double that of the 29-foot cars which have been in temporary use.

Power cables for the high-tension currents for operating the Long Island railroad are now being strung between Jamaica and Long Island City. The poles carry about 15 copper conductors designed to serve five sub-stations. The lack of any apparent extra insulation has led to complaints as to the safety of the cables when crossing highways. The large storage-battery plant of the Long Island road at Hammels, Rockaway Beach, is nearly completed. The combined battery will have a capacity of 4,000 horsepower and will comprise about 250 elements. The storage battery will only be used to supplement the generators during periods of heavy traffic. This company has received a few of the order of 135 steel cars for its forthcoming electric service. Each car has two 200-horsepower motors and externally resembles the steel cars now used in the New York subway.

The Central Long Island Electric Railroad Company is applying for a franchise to build and operate a trolley line in the northern part of Nassau County. The local authorities are much opposed to this scheme in its present form.

Bids for the lighting plants planned to be put up by the city for the lighting of the Williamsburg Bridge and intended also as an experiment in city ownership were opened on Thursday. The lowest bid was that of Ralph E. C. Kerstle, whose quotation was $49,361.

As a result of a threat on the part of some influential inhabitants at Wave Crest, Rockaway Beach, L. I., to install a private lighting plant for street lighting, the lighting committee ordered that incandescent lamps should be put up, and the work has been carried out by the Queens Borough Electric Company.

The Dynelectron Company of 68 William Street is putting in a 500-horsepower electric power plant at the Herald office, Boston, Mass.

Electric equipment is to be put in at the Commercial High School, Albany Avenue, Brooklyn.

Nikola Tesla, who is now living at the Waldorf-Astoria, is one of the directors of the newly incorporated Tesla Machine Company, which has a capital of $300,000. The company will manufacture air compressors.

W. H. Scott, S. G. Waterman and others have incorporated, under the laws of the state of New Jersey, the Germania Electric Lamp Company, with a capital of $125,000. D. W. W.

## New England.

Boston, April 22.—The latest move in the attempt of the Boston and Maine Railroad Company to block the new Haverhill and Boston electric line came this week in the form of an application to the Supreme Court of this state for an injunction against the building of the road. The novel plea is made that the locations of the companies which have been granted charters will "form a parallel line with the Boston and Maine road, which the public interests do not require." The court has issued a temporary injunction as prayed for.

The $7,500,000 bond issue of the Boston Elevated Railway Company, recently authorized, was sold on Monday to Kidder, Peabody & Co., Boston bankers, representing a syndicate of local and New York banking houses.

The Boston and Worcester Electric Railway Company has bought, at $205 a share, a controlling interest in the Hartford, Manchester and Rockville Tramway Company. This has been done with a view to securing a line from Hartford through to Boston, the new acquisition connecting with the projected Stafford Springs line, from Rockville to [illegible] plan. From [illegible] Hartford company. The [illegible] pany.

Arrangements have been made for the consolidation of [illegible] gor and adjacent territory in Maine. The Bangor, Orono and Oldtown Railway Company, the Oldtown Electric Light Company, the Bangor, Hampden and Winterport Railway Company and the Public Works Company will be merged in the Bangor Railway and Electric Company, with an authorized capital of $1,000,000. The officers of the new company are: President, John R. Graham, Bangor; treasurer, F. D. Oliver, Bangor; clerk, George T. Sewall, Oldtown; directors, Herbert L. Clark, Philadelphia; Frank Sullivan, Jr., Scranton; John R. Graham, Charles P. Woodward, Franklin A. Wilson, Charles D. Stanford and Charles V. Lord, Bangor. B.

## Dominion of Canada.

Ottawa, Ont., April 22.—An important epoch in electrical development in Ontario has been marked by the action of the railway committee of the provincial Legislature. A government clause has been inserted in a bill retaining to the government the right to transmit electricity from waterpowers to the municipalities. This step probably foreshadows an advanced policy on the part of the government for the development of water resources in the interests of municipalities. Public ownership of public utilities seems to be the object in view.

The statement exhibited at the annual meeting of the Demerara Electric Company, held in Montreal, showed that after paying all charges and interest the company had available upward of $53,000 surplus for dividends, and no floating debt. The new board elected consists of W. VanHorne, George Drummond, W. B. Chapman, David McKeen, James Hutchison and E. Alexander.

Louis Cote, engineer of the Department of Marine at Ottawa, says that the submarine bells which have been placed in position on the Nova Scotia coast are working admirably. One of them is located off Sambro and the other off Egg Island. The bells can be heard at a distance of five miles. These submarine telephone signals will be established at several other points on the Atlantic coast and in the Bay of Fundy. The Marine Department has made a contract for a large number of these aids to navigation, and they will be installed as rapidly as possible.

After three weeks of inaction, with the cars lying motionless in the barns, the bondholders of the street railway of the city of Kingston, Ont., have offered the plant to the city for $125,000, which is $75,000 less than the bonds. They also offered to keep the road running if granted a low rate for power until the city could take the railway over. It is thought that the road will ultimately be sold at auction.

The Montreal street railway will shortly issue $1,000,000 additional bonds for extensions, improvements, increased electrical power facilities, etc. A general meeting of the stockholders will take place on May 8th next, when the directors will ask for the necessary permission. The last bond issue of this concern was made in 1902, when $1,500,000 were sold. The bond issue at present amounts to $2,473,000, and the capital stock to $6,600,000. The new bonds, running for a period of 20 years, will be issued at par to the shareholders pro rata to their holdings of stock. W.

Winnipeg, Man., April 22.—The directors of the British Columbia electric railway have approved of an agreement providing for the electrical operation of a railway line between Vancouver and the town of Stevetson and an increase of capital of $1,000,000.

Aldermen Fry and Gibson, the committee appointed by the City Council to arrange with the Winnipeg Street Railway Company upon terms to run Sunday cars, are making good progress, although the trades and labor council has decided to oppose Sunday car-running unless the ordinance shall protect the street-railway employes by prohibiting more than six days' consecutive work. As this question has been provided for there is no doubt that Sunday street cars will shortly be running on the streets of Winnipeg.

The Western Central Electric Railway Company's

bill has passed the House of Commons. The road will run from London to Guelph, through the counties of Middlesex, Oxford, Perth, Waterloo and Wellington. H. M. Mowat, K. C., of Guelph, is one of the provisional directors, and appeared for the bill before the House.

In the railway committee of the Ontario Legislature the Hon. Adam Beck stated that the government has under consideration a plan by which it might construct transmission lines for conducting electric power to various municipalities from Niagara for railroad traction and other purposes.

James Kent, the manager of the Canadian Pacific railway telegraphs, states that extensive additions are contemplated this year. Two heavy copper wires will be strung south over the new "Soo" line to Minneapolis, which will give Winnipeg direct connection with Minneapolis and Chicago. Further extensions on the main line west of Winnipeg will be an additional heavy copper wire to the Pacific Coast and additional wires west of Brandon, also additional wires between Calgary and East and West Kootenay points along the Crow's Nest. At Winnipeg the company will shortly have one of the most complete telegraph terminals on the continent. All wires entering the city have been put underground. The reconstruction of the old pole line will be continued, and it is expected that by the end of the present season there will be practically a new pole line from Montreal to Vancouver. H.

The Niagara-Welland Power Company (Ont.) has secured a charter to generate and distribute power all over the province of Ontario. It has an authorized capital of $5,000,000 and unlimited bonding privileges. The company has obtained permission by its charter to expropriate land for a power canal and transmission lines. General plans of the proposed routes were filed at Ottawa and have been approved of by the minister of railways and canals. Harry Symons, K. C., is the president, and Roderick J. Parke the consulting engineer. The purpose of the company is to utilize the waters of the Niagara and Welland rivers and bring them by means of a canal, about seven miles in length, to the escarpment just east of the city of St. Catharines, where a fall of 210 feet is to be had, and the water will then escape by an almost natural raceway to Lake Ontario. Below the escarpment the company will also be able to use the waste water at the other power stations, where falls of 40 and 60 feet are to be had. It is claimed that the whole scheme will be the most economical one yet developed. It is intended to develop 100,000 horsepower at the outset and to install hydraulic and electrical machinery for 50,000-horsepower capacity. The power will not come direct from Niagara Falls, but will be taken from the wide part of the Niagara River, about four miles above the falls, so that it will in no way affect the grandeur of the Niagara Falls. Municipal service will be a special feature, and in laying out the transmission lines care is being taken to meet local requirements, the company being prepared to submit tenders for the service whenever called for by the government or by the municipal power commission or by the municipalities themselves or any probable customer. The company proposes to do nearly all the electric-light and power business as well as electrical transmission for electric railways for some 300 miles from Niagara Falls throughout the province of Ontario.

## Niagara Falls.

Niagara Falls, N. Y., April 22.—Steps have been taken to reorganize two of the companies that have plants located on the lands of the Niagara Falls Power Company at Niagara Falls, N. Y. One of these is the Electrical Lead Reduction Company, whose plant was sold at public auction on April 11th by an attorney who represented Pedro G. Salome of Philadelphia, the assignee of the company. The purchaser was Frederick Deacon of Philadelphia, who is understood to represent the men headed by Pedro G. Salome, the patentee of the processes used by the company when it was in active operation. It is now believed that the company will be reorganized, and that in the future the company will devote its efforts to the manufacture of one product, to produce which the interior equipment will be greatly enlarged. Samuel Weil is superintendent of the works. The plant had not been in operation for some months.

On April 13th Justice Childs of the Supreme Court placed the By-products Paper Company of Niagara Falls in the hands of a receiver, the action being one of voluntary dissolution. Emmons Bryant is the receiver named, he having been secretary and manager of the company. The plant is located on the lands of the Niagara Falls Power Company, adjoining the plant of the Electrical Lead Reduction Company. The coompany is capitalized at $2,000,000. English and New York capital is interested in the company, which, it is understood, will be reorganized.

It is announced that a new electrochemical industry is about to locate on the lands of the Niagara Falls Power Company at Niagara Falls, but the name of the concern is not yet given to the public. About 1,000 electrical horsepower will be used at the start, and this will be increased as the demand makes necessary. Its products, it is understood, will be in the alkali lime, but what process will be employed is not known. D.

## Southeastern States.

Charlotte, N. C., April 22.—It is rumored that the Huntsville (Ala.) Railway, Light and Power Company, controlled by T. C. DuPont and J. H. Waters of Wilmington, Del., will shortly pass into the hands of a corporation contemplating extensive improvements.

The Seaboard Traction Company of Suffolk, Va., will start work simultaneously from Norfolk, Suffolk and Smithfield.

A charter has been granted to the Chapel Hill (N. C.) Construction and Supply Company, the principal object specified being the building of an electric railway from Chapel Hill to Durham, N. C. J. H. Pratt and C. B. Mangum are among the incorporators.

The Tidewater Construction Company of Suffolk, Va., has been incorporated by W. H. Robinson of Norfolk president, and G. L. Barton of Suffolk, Va., secretary and treasurer, to build railroads, power houses, bridges, etc.

The town of Dickson, Tenn., has voted $6,000 bonds for a municipal electric-light plant.

It is given out that improvements amounting to $100,000 will be made at once at the power plant of the Nashville (Tenn.) Railway and Light Company. Three large boilers and a new generator have been ordered for the big plant on Cumberland River.

It is stated that the Southern railway will install motor cars between Aiken, S. C., and Augusta, Ga., to carry 100 passengers and make a speed of 75 miles an hour.

The town of Spencer, N. C., will vote in May on the question of a $70,000 bond issue for electric lights, water and other improvements.

The City and Suburban Electric Company of Charlotte has organized with a full board of directors and officers, with B. D. Heath, president, and P. M. Brown, secretary and treasurer, both of Charlotte. The financial plans of the company will be made public soon.

The Greensboro Railway and Light Company has taken out a charter, capital $750,000, at Greensboro, N. C. F. R. Williamson of Greensboro is among the stockholders of the company.

The High Point Ice and Fuel Company, High Point, N. C., has been chartered to do a general electric-light business besides operating ice and fuel plants. The capital is $21,000. Wescott Robberson is interested.

John M. Spotts and associates of Staunton, Va., have bought the local street-railway property for $20,500 from A. C. Braxton and others, commissioners. It is understood that the new owners will operate the system.

The Saluda Power Company of Greenville, S. C., has been chartered with a capital of $300,000. A. G. Furman is president; A. L. Scott, secretary, and E. F. Green, treasurer.

The city of Hawkinsville, Ga., has rescinded a contract for 10 years offered by the Hawkinsville Cotton Mills to light the streets, and an election will probably be held on the question of issuing bonds for a municipal electric-lighting plant for the city.

The Fayetteville (N. C.) Gas and Electric Company has been sold to J. H. Martin of New York.

The Suburban Electric Company of Charlotte, N. C., has practically completed all its plans for building to Gastonia.

Dallas, N. C., is installing a new lighting system, the power to be furnished by the Dallas Cotton Mills. L.

## Ohio.

Cleveland, April 22.—The steamers plying between Cleveland and Detroit have made a rate of $1.25 one way and $2 for the round trip. It is said this has been done to compete with the trolley line on which the fair is $1.75 one way and $3.40 for the round trip. The steam road fare, of course, is much higher, but some very low rates are made during the summer on an excursion basis. It is probable that a spirited contest will be kept up through the summer for business. The boats are just getting started for the season.

J. E. Monnett is in charge of the selection of a route for an electric railway between Canton and Youngstown. One survey has been made. It is thought that construction work will be begun before long.

The Electric Wiring and Fixture Company has been organized at Youngstown with the following officers: President, W. W. Ellenberger; vice-president, James E. Nutt; secretary and treasurer, H. H. Cohen. The company will deal in electric supplies, do general electric work, steam piping and engine fitting. Walter E. Fownes is the manager.

Engineer T. H. Loomis is in charge of a corps of men making a survey for the proposed line from Steubenville to Canton.

It is reported that the Hamilton Gas and Electric Company of Hamilton will spend $500,000 in extensions and improvements. A new electric plant will be built and new overhead construction put up. Some of the money will go to improvements in the gas plant and the coke works which were taken in some time ago in the way of a merger.

Specifications are being prepared for an addition to the electric-light and hot-water heating plant of the Public Service Company at Columbus, which will double its capacity. The increase in the business of the company necessitates the additional capacity. At the adjourned meeting of the board of directors at Newark, N. J., on May 10th, the company will be authorized to issue $300,000 preferred stock, the proceeds of which will be used to make the improvements. The common stock now aggregates $1,500,000 and there are $750,000 bonds, about $60,000 remaining in the hands of the underwriters.

D. W. Washburn of Greenwich has applied to the commissioners at Norwalk for a franchise for an electric railway through Greenwich and along the highways of the county.

The Avon Beach and Southern Railroad Company of Cleveland has been incorporated by T. H. Hogsett, H. H. Johnson and others.

Judge Harter of the Stark County Common Pleas Court has issued an injunction against the Alliance Gas and Electric Company of Alliance compelling it to furnish gas at 90 cents a thousand and electricity at six cents a kilowatt, as provided in its franchise. The company had endeavored to charge $1.20 a thousand for gas and 10 cents a kilowatt for electricity.

Students of the engineering class of the Ohio State University made an efficiency test of the Scioto Valley Traction road a few days ago, beginning at four in the morning and continuing until midnight. The material will be used in the senior theses.

Rumors have been circulated in Toledo to the effect that the Toledo Railways and Light Company will purchase the Point Place and Ottawa Park lines, which will give it complete control of the city business. O. M. C.

## Indiana.

Indianapolis, April 22.—The Evansville and Mt. Vernon Electric Railway Company has filed articles of incorporation. The preliminary capital stock is placed at $10,000. The directors are Fred P. Leonard, W. M. Ford and J. M. Funk.

A. F. Ramsey, president of the Consolidated Traction Company, has returned to Crawfordsville from the East and gives out the information that the contracts for the construction and completion of the road between Crawfordsville and Indianapolis have all been let.

A company composed of J. E. Jeffries of Alexandria and W. E. Lowe, G. C. Florea, L. O. Burgess and R. N. Burgess of Connersville has organized to build street-railway lines in Connersville and to Robert's Park, north of the city. The company will incorporate with a capital of $100,000. franchise is asked of the City Council.

A cross-country electric railway is proposed by a company organized to build from Fortville to Shelbyville. The promoters are M. B. Walker of Fortville, J. M. McCreery of Indianapolis, Arthur Jones of Alexandria, and W. A. Hough of Greenfield.

W. H. Schott of Chicago, who built the Terre Haute hot-water heating plant and who has just obtained a franchise for a traction line from Terre Haute to Sullivan, is now in Philadelphia to finance a traction line of 26 miles connecting Vincennes and Loogootee. He has reported to the stockholders that it will cost $1,040,000. The route is through Frichton, Wheatland, Montgomery, Washington and Cannelsburg.

Trouble has broken out in the company formed to promote and build the traction line from Indianapolis to Celina, Ohio, known as the Indianapolis, Hartford City and Celina Traction Company. The line was first promoted by J. P. McGeath of Hartford City, and his friends claim that an effort is being made to "freeze" him out.

The Indiana Hydraulic Company has been organized in Frankfort, officered by Eugene Rush and N. W. Hanna as president and general manager and secretary, respectively. The company will be incorporated with a capital stock of $200,000 and proposes to manufacture electricity, having already arranged for the sale of the output. The plan is to build a dam 30 feet high and 368 long, of solid cement, in the Wildcat River.

The annual meeting of the Indianapolis and Martinsville Rapid Transit Company was held on the 21st inst. and the old board of directors, headed by John H. Holiday, was re-elected. The directors in turn elected Harry S. New president of the company to succeed Charles F. Smith, who is giving his time to business in Texas. Gaven L. Payne was elected secretary and Paul H. White general manager.

The contract has been let and the work of construction has begun on the new automobile-testing plant at Purdue University. The idea of installing such a plant originated with Prof. J. R. McCall, associate professor of steam engineering at the university.

Application for a franchise to operate a line of passenger and freight automobiles in St. Joseph County has been filed with the county commissioners at South Bend by the Oliver Trackless Car Company, an organization capitalized at $5,000,000. The company proposes to operate cars between South Bend and Plymouth, but eventually between Buchanan, Mich., and Indianapolis and intermediate towns and cities. F. W. Oliver, president of the

company, [illegible] he will have the line in operation by July 1st. S. S.

## Northwestern States.

Minneapolis, April 22.—The Black Hill[s] Traction Company of Spearfish, S. D., has been incorporated with a capitalization of $400,000. It is proposed to construct a trolley line from Deadwood to Lead and Belle Fourche. R. B. Hughes heads the list of stockholders.

The Rhinelander (Wis.) Paper Company has let the contract to the Bullock Electric Manufacturing Company of Cincinnati for equipping a new pen-stock at the Hat Rapids power station.

Work has been started at La Crosse, Wis., on the new power plant for the Wisconsin Light and Power Company. The contracts are being let for the machinery. The company has applied for a franchise at Onalaska, Wis.

Fred Johann, lineman for the People's Power Company of Davenport, Iowa, was instantly killed on coming in contact with a live wire at the power plant.

The machinery in the new power plant of the Union Electric Company of Dubuque, Iowa, has been installed and the plant has been placed in operation.

The contract for supplying the electric-light plant at Lake City, Minn., with a 30-kilowatt alternating current dynamo has been let to B. Y. Yost of Minneapolis at $1,285.

J. B. Mikesel has sold the electric-light plant at Mitchell, S. D., to the Mitchell Gas Company.

S. W. Rhine of Sioux Falls, S. D., and others have incorporated as the City Railway Company with a capitalization of $500,000. A city and suburban line is proposed.

The Edison Sault Electric Company has let the contract for the erection of a new power house at Sault Ste. Marie, Mich., to the McArthur Bros. Company. About 4,300 horsepower is to be developed.

The Duluth Electric Company has agreed to continue the present street-lighting contract at Duluth, Minn., for another five years. The present rates are very low, and it is probable that the offer will be accepted. An effort was made to secure the passage of a bill in the state Legislature allowing the city to issue bonds for $400,000 for the erection of a municipal plant, but the project is likely to be dropped.

A bill has been introduced into the Minnesota Legislature providing that the maximum charge for a telegram of 10 words anywhere within the state shall be 25 cents. The bill has been recommended for passage.

The Iowa Falls (Iowa) Electric Light and Power Company has sold its plant to the Peterson Heat, Light and Water Company of Des Moines.

The Hawkeye Electric Company of Manning, Iowa, has been incorporated with $50,000 capital. A. K. Resner heads the list of stockholders.

William McFall of Anoka, Minn., has accepted a position as manager of the electric-lighting plant at Forsythe, Mont.

Bonds for $18,000 were voted at Fairmont, Minn., for the improvement of the electric-light and waterworks plant.

A franchise has been granted at Spring Valley, Wis., to R. D. Harrison for an electric-light plant.

A franchise for the construction of a street-railway system at Valley City, N. D., has been granted to O. A. Beeman.

C. C. Dalrymple has been granted a franchise at Enderlin, N. D., and will start at once on a new electric-light plant. R.

## Michigan.

Detroit, April 22.—A bill has been introduced in the Michigan Legislature by the electric-railway interests of the state giving the electric lines the right to establish their route without permission from the local authorities. This will give the street-railway companies the same right of condemnation as is now enjoyed by the steam roads. A great many of the electric lines are now organized under the steam-railway act and the passage of this bill will obviate this necessity.

It is stated that the contract for constructing the Lansing-Jackson electric railway has been awarded to the L. E. Myers Company of Chicago and that work will be commenced at once.

It is understood that the bonds of the Detroit, Ypsilanti, Ann Arbor and Jackson electric line, just issued, are selling in the East for 99. The reason for this increase in value is the talk of closer combination with the Jackson Consolidated Traction Company.

The Washtenaw Electric Light Company's contract with the city of Ann Arbor for street lighting expires this year, and it is understood that the Ann Arbor Gas Company is going to try for the next contract. The Welsbach people have put up sample lights in order to make a display for comparison with the electric light.

The Grand Rapids-Muskegon Water Power Company is building an extensive dam in the Muskegon River near Big Rapids and about 50 miles from Muskegon and Grand Rapids. A concrete dam 38 feet in height will be built and also a power house at the site of the dam. [illegible] by N. F. Johnson of [illegible] [illegible] to furnish electric light and power to the cities of Muskegon, Grand Rapids [illegible]. Two other sites are owned by the company on the Muskegon River and these will [illegible] built and power houses erected as the demand for power will warrant.

Traverse City is investigating municipal [illegible] and has appointed a committee to visit plants in Detroit, Grand Rapids, Lansing and other Michigan cities and to prepare a report for the [illegible] of the council. The present cost to the city is [illegible] a year for street light[s] and [illegible] for private consumers, power being [illegible] from Boardman River.

The Ann Arbor council has decided to bring suit against the Ann Arbor Water Company to determine the rights of the city under the contract with that company. It is also voted to ask the Legislature for power to bond the city for a sum not to exceed $500,000 for the purchase of the waterworks or for the building of a new plant.

A bill has been introduced in the Legislature enabling electric railways to own steamboat lines for connections. It is thought that this legislation will be in the interests of boat lines now running between South Haven and Benton Harbor and Chicago, as both of these lines propose to build electric railways to Kalamazoo. The Dunkley-Williams line runs out of South Haven and the Graham & Morton line out of Benton Harbor. The Graham & Morton line is interested in building an electric railway from Benton Harbor to Paw Paw via Hartford.

The Detroit municipal-lighting commission asks $36 an arc light for the coming year, a decrease of $4.36 a light. The Legislature has passed an enabling act allowing the adding of an electrical unit and other machinery to the plant at a cost of about $150,000. A demand has been made on the commission for 1,000 more street lights.

The proposition of Mayor Codd of Detroit to the Detroit United Railway Company that the railway rent from the city a $10,000 piece of track, which it is proposed to build, does not meet with the approval of the company. President J. C. Hutchins also refuses to enter any combination with the city whereby the fares on his road be reduced to three cents. It is pointed out that in Detroit 10 years ago there was an inadequate, poorly constructed street railway. The Detroit United Railway Company took hold of this property and built it up from 80 miles of poorly constructed track and poor service to over 550 miles of first-class system. It is generally conceded by outsiders that Detroit has a first-class street-car system, but the attitude of the people is such that nothing will satisfy them except municipal ownership.

The Detroit Steel Casting Company has completed its plans for a modern plant which will turn out 800 tons a month when working. A new power house will be built and electricity will be the motive power. Four five-ton, three 10-ton and one 30-ton crane will be operated by electricity.

The Detroit automobile ordinance, which requires the registration and numbering of automobiles, is held by the Supreme Court, in a decision rendered this week, to be a justifiable exercise of the police power in the interest of the safety of the traveling public.

The Wheeler Electric Company of Wheeler has been incorporated with a capital of $10,000. C. G. W.

## Rocky Mountain States.

Salt Lake City, April 20.—At the Salt Lake offices of the Rocky Mountain Bell Telephone Company, F. A. Pickernell of the American Telephone and Telegraph Company made the announcement that $500,000 would be expended during the coming year in improvements of the Bell systems in the inter-mountain states. Of this sum $250,000 will be expended in Utah, $150,000 in Montana, $70,000 in Wyoming and over $50,000 in Idaho.

The new plant of the American Falls Power, Light and Water Company has been completed at American Falls, Ida., and Pocatello and other Idaho towns are now being supplied with electrical energy from this source. The new plant has a capacity of 2,500 horsepower, although only half that amount is being utilized at present.

A franchise for an electric street railway at Missoula, Mont., has been granted by the City Council to J. R. Wharton, Senator W. H. Clark's representative. Construction work will be commenced within a few weeks.

The City Council at Payette, Idaho, has granted to William Mainland a franchise for an electric railway.

The county commissioners at Great Falls, Mont., have acted favorably on the petition of Ernest Crutcher for a franchise for the construction of an electric-railway system covering a large portion of the county. Mr. Crutcher will ask for similar privileges in other counties in Northern Montana, and announces that the construction of a road to Lewiston and Choteau is contemplated.

The Walker River Electric Company has been organized at Carson City, Nev., where a telephone line will be established. G.

## PERSONAL

[illegible]

[illegible]

[illegible]

W. [illegible] [illegible] Ste. Marie, Mich.

Prof. [illegible] [illegible]

Ralph Peters [illegible] Island railroad, [illegible] came superintendent [illegible] railways and subsequently served on important railroads in the East and Middle West [illegible] his new position from the [illegible] of the southwestern [illegible] railroad. He announces that his chief effort will be to bring about traffic facilities between the Long Island railroad and the [illegible] scheme.

Walter A. Schalck of [illegible] brother of Frank R. Schalck [illegible] of the Western Electrician, was accidentally shot and killed by a companion [illegible] last week. The electrical friends of Mr. Frank Schalck, including his associates on the Western Electrician, extend to him and the bereaved parents their deepest sympathy in the loss of a brother and son, who was just entering upon a career that promised much. The funeral services were held on Monday, April 24th.

C. N. Wilcoxen has taken up his duties as superintendent of the Cleveland and Southwestern Traction Company. He was formerly with the Western Ohio in a similar position and made this one of the best high-speed roads in the country. Prior to his connection with the Western Ohio he was with the Decatur Traction and Electric Company of Decatur, Ill., and before that with the Citizens' Traction Company of Muncie, Ind. Mr. Wilcoxen had a successful career in the steam-road business before identifying himself with electric roads.

A bronze memorial of James Prescott Joule is to be erected at Sale, England. It is expected that the unveiling ceremony will take place in the course of the next few weeks. Joule was born in Salford, England, not far from the site of the present Manchester Town Hall, in 1818, and died at Sale [illegible] years ago. There is already a statue of Joule at the main entrance to the Manchester Town Hall, and near it is one of Dalton, under whom he was a student. The Sale memorial will be 11 feet high. Above the pedestal will rise, four feet in height, the half-length figure in bronze. The sculptor represents Joule as reading to an audience a scientific paper.

## ELECTRIC LIGHTING.

The General Light, Heat and Power Company of Kansas City, Mo., has been incorporated with a capital stock of $100,000.

J. D. Bowersock has begun the construction of an electric-power plant at Lawrence, Kan., to make use of his dam across the Kaw River, and will supply power for manufacturing purposes as well as the electric lights for the city.

The Chinese government, according to German papers, has granted its first patent. It is for an electric lamp, the inventor of which is an inhabitant of Nankin, the old capital of the Chinese Empire, who calls his lamp the "bright moonlight," and asserts that it is far superior to foreign glow lights that have hitherto been sold at Shanghai and other Chinese cities. The fact that China has entered upon the granting of letters patent is perhaps of more importance than the invention.

Commander W. B. Caperton, inspector of the St. Louis lighthouse district, which embraces the Mississippi River from Cairo to St. Paul, and the Missouri and Illinois rivers, contemplates overhauling the navigation lights on river bridges. Defects in the present system, sufficient at times to be a menace to steamboats, have resulted in complaints from river pilots. Oil lights are used on most of the bridges to mark the channel and piers, and it is claimed that they are not of sufficient power to show in hazy and foggy weather. Where arc lamps are used on the roadway of a bridge, it serves to make dim the oil guide lamps. Electric lamps of the searchlight type probably will be

adopted wherever a current is available, and in other places strong reflectors will be put on. There may also be a change in the color and the system of arranging the lights.

The Creston Mutual Electric Light, Heat and Power Company of Creston, Iowa, has been organized and incorporated by 150 business men of that city to do a business indicated by the title. Prominent in the company is J. C. Sullivan, who is mayor of the city and ex-president of the Iowa Telephone Association. The company has a 25-year franchise and a contract running the same length of time to supply 40 arcs and 45 32-candle-power incandescent lights to the city for street lighting. It will erect an alternating-current station, to be equipped, probably, with one 100-kilowatt generator and one 300-kilowatt generator.

## ELECTRIC RAILWAYS.

Surveys have been completed for the proposed electric railway which is to be built from San Marcos to Luling, Texas. Application is about to be made for a charter for a company which, it is said, will build the line at once. A. T. Fisher is the chief engineer of the project, and has his headquarters in San Marcos.

The San Francisco Chronicle says that, after controlling the affairs of the United Railroads for three years, the New York banking house of Brown Bros. & Co. is understood to have decided to relinquish the control and management of San Francisco's big street-railway combination to Ladenburg, Thalmann & Co. of New York. Their clients' experts, it is said, have been in San Francisco for some time past examining the properties.

A new Illinois incorporation is that of the Peoria, Bloomington and Champaign Traction Company, which has its principal office in Champaign, Ill., and has a capital of $5,000. According to the papers filed an electric road will be constructed from Peoria, Ill., through the counties of Tazewell, McLean, De Witt, Platt and Champaign to Champaign, Ill. The incorporators and first board of directors are D. R. Stephens, Charles Zilly, H. J. Pepper, S. A. Power, and W. B. McKinley of Champaign, Ill.

It is said that officials of the Chicago, Rock Island and Pacific railroad have under consideration a proposition to use electricity on some of its lines running out of Des Moines, Iowa. The plan is to use the trolley system for passenger, mail and express and light freight service and to continue the use of steam for the heavier freight traffic. The line would use electricity on the 42-mile stretch between Des Moines and Winterset, six miles between Summerset and Indianola, about 18 miles of proposed new road between Indianola and Knoxville and about 50 miles between Des Moines and Oskaloosa.

The Sandusky, Norwalk and Mansfield electric railway, with headquarters at Norwalk, Ohio, will add to its equipment three sub-stations. Each of these stations will be equipped with one 300-kilowatt compound-wound Bullock rotary converter, three 110-kilowatt static transformers and complete switchboard apparatus, including lightning arresters. Five car equipments, each consisting of four 50-horse-power railway motors, with controllers, etc., have also been ordered. The road is to extend from Plymouth to Norwalk, O., where passengers can be transferred to the electric railway extending to Sandusky, and there make connections with the Lake Shore electric railway for both Toledo and Cleveland. Eventually there will be uninterrupted service between Mansfield and Toledo.

## PUBLICATIONS.

The Crocker-Wheeler Company's latest bulletin is devoted to small belted machines, either motors or generators, which meet the demands of a wide variety of industrial plants where small motors are needed.

The Bryant Electric Company of Chicago has issued the ninth edition of its catalogue on Bryant specialties. The book marks an advance, typographically, over the previous editions, and in quality, appearance and design the goods described represent the most modern practice.

The Chicago House Wrecking Company of Chicago has just issued a new catalogue giving a list of the electrical material secured in the purchase of the Louisiana Purchase Exposition. As is well known, this enormous deal enables the company to supply almost anything in the electrical line, including copper wire, lead-covered cables, incandescent lamps, instruments, sockets, fans, etc. The company will be pleased to mail its catalogue on request.

Two interesting catalogues issued by the Westinghouse Electric and Manufacturing Company are devoted to fan motors. One takes up alternating and the other direct-current fans, and the covers and general design of the two booklets are artistic and pleasing to the eye. The company states that it has spared no expense in developing its 1905 fan motors, and by glancing over the descriptions in the catalogues it would seem that the statement was made in good faith.

Catalogues upon the subject of fan motors are as a rule gotten up in an attractive and breezy manner, and the little booklet of the Fort Wayne Electric Works of Fort Wayne, Ind., is no exception to the rule. "Summer Comforts," as the booklet is called, attracts the eye, the first requirement, and few will pass it by without looking between the covers. When once this far the attractive style in which the reading matter has been prepared will accomplish the rest, and the booklet will be given careful consideration.

Pictures are oftentimes more expressive than words, and realizing that fact the National Electric Company of Milwaukee, Wis., has prepared a very handsome booklet devoted to "Plants and Types" of National apparatus, consisting almost entirely of fine half-tone illustrations of actual installations and cuts of some of the individual types of machines manufactured by the company. The object of the booklet is to give a general idea of the products rather than detailed descriptions, which may be obtained from the bulletins.

A few words about Stombaugh guy anchors, "the anchors that hold," are contained in a very handsome booklet issued by the manufacturers, W. N. Matthews & Bro. of St. Louis. Some interesting tests have been made by Prof. R. C. Carpenter on the holding power of these anchors, and the booklet explains how these tests were made, showing some fine pictures of the apparatus set up in the field. Those interestel in guy anchors will find pleasure reading this booklet, in the production of which much care has evidently been taken.

Bulletin No. 7 of the Cooper Hewitt Electric Company, New York, is devoted to the general illuminating properties of Cooper Hewitt mercury-vapor lamps for direct-current circuits. Numerous applications of these lamps are cited in the bulletin, prominent among which is their use for photographic purposes. The fact that the light is well diffused and radiates but little heat adds much to their value in photography. The absence, too, of red rays and the predominance of actinic, or chemically active, rays also make the lamps particularly valuable for this work.

## AUTOMOBILES.

With the more general use of automobiles in European countries, the desirability of giving special instruction and training to chauffeurs and others concerned with the manipulation and construction of automobiles has been considered by the directors of technical schools. Already there are two special courses of instruction provided for automobilism, one at Aschaffenburg, Germany, and the other at Brussels, Belgium. A third school is to be established in Vienna next October, in connection with the Technological Trade Museum, which is the most advanced trade school of the city. The Automobile Club of Vienna has taken special interest in the proposed school, and the Ministry of War has offered to place a special road or track at its disposal for the operation of automobiles.

## SOCIETIES AND SCHOOLS.

The International Brotherhood of Electrical Workers, under the auspices of Local 49, will hold its annual picnic at Kolze's Electric Park, located at Sixty-fourth Avenue, North, and Irving Park Boulevard, Chicago, on Sunday, June 4, 1905. All who attend are assured a good time.

The number of unanswered questions for the 1905 "Question Box" of the National Electric Light Association is still large, as shown by the printed list sent out by the editor, Mr. Homer E. Niesz of Chicago. Many want exactly the information asked for in these questions, and members are reminded that answers must be in by April 29th at latest to be of service.

The tenth annual convention of the Massachusetts State Association of Stationary Engineers will be held in Fall River, Mass., on July 7th and 8th. Following the custom employed in past years an exhibition of supplies and appliances used in the engineering business will be held, and all manufacturers of and dealers in machinery and supplies are invited to display their goods during the convention. Ernest Place, 172 Eastern Avenue, Fall River, Mass., is secretary of the committee on ways and means.

The papers to be presented at the tenth annual convention of the International Association of Municipal Electricians to be held at Erie, Pa., on August 29th, 30th and 31st, are as follows: "Electrical Induction, Its Effects, and the Application of Methods Used to Counteract It;" "Advisability or Inadvisability of Fusing Fire and Police Telegraph Boxes;" "Suggested Improvements in Fire-alarm Telegraphs;" "Underground Construction;" "The Necessity of a Rigid Inspecton by the Municipality;" "Electric-light Engineering;" "Electric-light Plants." Secretary Frank P. Foster, Corning, N. J., will be pleased to send application blanks to any municipal electrician who has not yet become a member of the association.

George F. Porter, master of transportation for the National Electric Light Association, has appointed Charles H. Hodskinson of the Boston Edison Company to look after transportation matters in New England for the twenty-eighth convention of the association, to be held at Denver-Colorado Springs, June 6th to 11th. Those in attendance at the Boston convention last year will remember Mr. Hodskinson's untiring and efficient work in every direction, so that they will not be surprised if he succeeds in taking to the Colorado meeting many electrical men from New England.

An International Congress of Mining, Metallurgy, Mechanics and Applied Geology will be held at Liege from June 26th to July 1st in connection with the Universal Exhibition. It is convened under the patronage of the government and organized by the Union of Collieries, Mines and Ironworks in the Province of Liege and by the Liege Engineers' Association. The complete text of the questions set down for discussion, which includes questions on electrical subjects, together with other information concerning the Congress, may be obtained on application to the general secretary, Henri Dechamps, 16 Quai de l'Universite, Liege, Belgium.

## TELEGRAPH.

A severe snowstorm in the vicinity of Cheyenne, Wyo., on Wednesday of last week broke down all the telegraph lines in the vicinity. The breaks in the lines between Cheyenne and Denver were so numerous as to require the stringing of new wire. Service was restored temporarily by splicing the broken ends of the wire to barbed-wire fences, over which messages were successfully transmitted.

The Western Union Telegraph Company has announced the extension of its money-transfer service to the following countries: Great Britain and Ireland, France, Switzerland, Germany, Austria-Hungary, Italy, Sicily, Spain, Portugal, Belgium, Holland, Denmark, Sweden, Norway, Russia in Europe, Turkey in Europe, Roumania, Bulgaria, Servia, Greece, Corsica, Sardinia, Alaska, Cuba and the Philippines.

## SPACE TELEGRAPHY.

The stockholders of the Marconi Wireless Telegraph Company met in the office of the Corporation Trust Company, in Exchange Place, Jersey City, recently, and elected Eugene H. Lewis, John Bottomby and Alfred B. Trigge directors for five years.

The Canadian government has decided to install space-telegraph equipment at Sable Island and on Chebucto Head, at the entrance of Halifax Harbor. Sable Island is about 30 miles long and is 175 miles east of Halifax. The distance from the nearest point of the mainland is 100 miles.

## MISCELLANEOUS.

The Chicago Tunnel Company has asked permission to build six connecting tunnels, from 70 to 325 feet in length, for the connection of the underground freight transit system with the Union Depot at Canal and Adams streets. By its franchise permits for extensions may be granted by the council or the mayor. In this case the mayor refused to sign any more permits until the council might have a chance to pass upon them.

The Union Pacific railroad has placed in service on its branch line between Grand Island and St. Paul, Neb., a gasoline motor car which railroad officials who were present at the trial say may revolutionize suburban and branch-line freight and passenger service. The idea of such a car was conceived by Vice-president Mohler of the Union Pacific. It seats 20 persons and space is reserved in the motor compartment for baggage.

The instructions to the Canadian section of the international commission to investigate and report upon the conditions and uses of the waters adjacent to the boundary line between the United States and Canada have been framed by the Dominion government. Among the subjects that may come up for consideration by this commission appears the following interesting one: "Inquiry into the effect of the construction of the Chicago Canal on the levels of Lakes Huron and Erie."

Under the new valuation tariff of Argentina the following electrical goods will pay duty at the rate of 25 per cent. ad valorem: Amperemeters, voltmeters, lamp globes, insulated copper cable, carbons for arc lamps, electric motors for fans, complete or not, and insulating tubes of iron, cast or wrought, with accessories, varnished or not; wire or cables, strengthened for laying underground with interior envelope of lead and outer sheathing of iron or steel, five per cent. ad valorem.

Stories concerning the severe shocks which electric eels are able to administer are generally discredited to a large degree by those who have never had the "pleasure" of the experience. Nevertheless, precautions are taken, it is said, thoroughly to insulate divers' suits which are to be used where the eels are known to be numerous. It is asserted that shocks may be transmitted

through the metal helmet which are severe enough to render the diver insensible if perfect insulation is not insured.

A danger which has always been present in ballooning but which has generally been attributed to carelessness on the part of the aeronaut is due to the production of sparks of static electricity which ignite the gas and cause an explosion. Different atmospheric levels have different potentials, as is well known, and at distances of a mile or more above the surface potentials differing as much as 10,000 volts from that of the earth have been known, which will produce a spark six centimeters long.

The new Allan Line steamer Victorian arrived recently at Halifax, N. S., from Liverpool, being the first steamer driven by turbine engines to cross the Atlantic. The vessel encountered bad weather, but the engines generally worked well in the high sea and the absence of vibration was noteworthy. Captain McNicholl is said to have expressed entire satisfaction with the turbine system. He expects to cut down the time between Halifax and Moville (Ireland) to six days and six hours. The turbines on the Victorian are of the parallel flow type of special design. They operate three shafts with one propeller each.

Electric cable building has made marked progress of late years and this progress has been manifested principally in the insulating qualities, some cables having recently resisted tensions of 90,000 volts. Such cables have been furnished by the Allgemeine Electricitäts Gesellschaft of Berlin to the Underground Railway Company of London. The cables are composed of three conductors, each having a cross section of 195 square millimeters. Each conductor is insulated by a layer of paper 11 millimeters (0.433 inch) in thickness, and the three conductors collectively are covered with a layer of paper 11 millimeters in thickness and an outer casing of lead. The diameter of the cable thus becomes 72 millimeters (2.834 inches).

## TRADE NEWS.

Kohler Brothers, contracting electrical engineers of Chicago, announce the opening of their New York office in the Metropolitan Life Building, No. 1 Madison Avenue. Mr. Thomas H. Rodman is the manager.

The New York Safety Steam Power Company of New York city has moved into new offices at 114 Liberty Street. It also maintains an erecting and repair department store in New York containing a complete [illegible] diate shipment.

E. W. [illegible] incorporated the U. S. Electric Porcelain Company, [illegible]

The [illegible] as the Doxsee-Barre Electric Company, with a capital [illegible] the personnel of the company.

William J. Driver of Newark, N. J., [illegible] that he has disposed of his interests in the Driver-Harris Wire Company and has resigned as president of the company. He will now devote himself to the development of special materials to meet particular requirements, and expects in a short time to offer some new and improved resistance wires.

The George Cutter Company, the president of which, Mr. George Cutter, and the secretary, Mr. Albert Scheible, are widely known to the electrical trade, now occupies its new factory at South Bend, Ind., having moved there from Chicago. The company, as is well known, makes arc-light specialties, the work now being carried on in a fine new factory of pressed brick 80 by 200 feet inside dimensions, part being two stories in height.

Clifton H. Wheeler, the former president and general manager of the Wheeler Condenser and Engineering Company, is now solely identified with the C. H. Wheeler Condenser and Pump Company. The personal services of Mr. Wheeler, as secretary, ample capital, modern works, and up-to-date engineering staff place the company in a position of unusual strength in the condenser and pump business. The company's works and principal office are in Philadelphia, with a branch office at 26 Cortlandt Street, New York. The president of the company it John Pitcairn; vice-president, George Burnham; treasurer, W. H. Rometsch, and works manager, Otto W. Schaum.

## BUSINESS.

H. M. Byllesby & Co. of Chicago have been appointed managers and engineers of the gas and electric properties of the San Diego Consolidated Gas and Electric Company of San Diego, Cal.

Frederick Bissell, president of the F. Bissell Company, Toledo, Ohio, dealer in electrical supplies and machinery, was in Chicago last week in the interests of his company. Mr. Bissell is one of the best-known men in the electrical field. He reports business flourishing.

[illegible] heavy machinery, etc.

[illegible] ply the whole of London with current.

[illegible] mers Company the complete machinery equipment, which includes two 750-kilowatt Bullock alternating-current generators, for direct connection to Reynolds Corliss [illegible] inches in diameter and they will have a 48-inch stroke. The two large generators are designed to operate at 120 revolutions and the smaller at 277 revolutions a minute. The electrical apparatus is to be built at Cincinnati, and the engines will be furnished from the West Allis, Milwaukee, plant of the Allis-Chalmers Company.

The Western Electric Company of Chicago recently placed with the American Electric Fuse Company of Chicago an order for Allen-Bradley electric controllers to equip all the new cranes being installed at the Hawthorne plant of the Western Electric Company. This is reported to be one of the largest single orders for electric crane controllers ever placed in Chicago, and the American Electric Fuse Company states that the order was given after a six months' thorough and rigorous test of Allen-Bradley controllers in the Chicago factory of the Western Electric Company. The controllers are all standard-type machines, ranging from 3½ horsepower to 50 horsepower in size, and are adapted for use with Niles-Bement-Pond cranes. A number of the controllers are arranged to be set in the rear of the controller cage and to be operated by extension levers from the front.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued (United States Patent Office) April 18, 1905.*

787,361. Telephone Transmitter. John Erickson, Chicago, Ill., assignor to the Strowger Automatic Telephone Exchange. Application filed May 4, 1903. Renewed October 3, 1904.

One of the transmitter electrodes is stationary and the other one is cup-shaped and secured to the diaphragm with its cup surrounding the stationary electrode with an interspace between. The space between the electrodes is filled with granular material.

787,371. Lightning Arrester. Lara M. Gates, Chariton, Iowa. Application filed August 16, 1904.

Combined with a base to be secured to the wall and formed with an opening is a body portion connected with the base and comprising a metallic inner end. A service wire connects with the metallic part. A ground wire is connected with the apparatus.

787,372. Burglar and Fire Alarm. William Giles and Henry Ramsey, Mammoth, W. Va. Application filed September 30, 1904.

Electric circuits are arranged so as to be closed by contact points on the windows and doors. The circuits are connected with an alarm.

787,386. Support for Telephone Receivers. Eldridge H. Little, Oskaloosa, Iowa. Application filed August 24, 1904.

A supporting member is adapted to hold the receiver to the ear when the head is in a position to speak into the transmitter.

787,393. Signal System and Apparatus Therefor. Frank P. J. Patenall and George H. Dryden, Baltimore, Md. Application filed January 23, 1905.

Oppositely arranged magnets are located in different planes and an armature lever is placed between the magnets carrying armatures for both magnets and pivoted at one side of its center of gravity and at a point intermediate its length. Contacts are controlled by the lever whereby the lever will be moved in one direction by gravity and in the opposite direction by the simultaneous action of both magnets.

787,412. Art of Transmitting Electrical Energy Through the Natural Mediums. Nikola Tesla, New York, N. Y. Application filed May 16, 1900. Renewed June 17, 1902.

An improvement in the art of transmitting and utilizing electrical energy consists in establishing in the natural conducting media, stationary electrical waves and varying the length of the waves.

787,419. Electric Block Signal. Walter Williams, Wadesville, Ind. Application filed October 1, 1904.

In an electric railway signaling system there are embodied a third rail or conductor and a traffic rail constituting a non-energized circuit. An alarm is connected in the circuit and a battery normally cut out of the circuit is connected by a tappet-actuated member. Means controllable by the direction in which the train is traveling determine the length of time the circuit is held closed.

787,422. Whistle Valve. Frank L. Wolfe, Medford, Mass., assignor to the Crosby Steam Gage and Valve Company, Boston, Mass. Application filed February 15, 1904.

Electromagnets, operable from a distance, actuate the valves which admit steam to the whistle.

787,428. Incandescent Electric Lamp. Frank H. Blackburn, Fostoria, Ohio, assignor to the National Electric Lamp Company, Cleveland, Ohio. Application filed January 6, 1904.

In an incandescent electric lamp are a bulb having a depression in its neck and the tip projecting out from the depressed portion and a base having a shell which embraces the neck and covers the depressed portion thereof and thereby conceals and protects the tip.

787,442. Insulator for Electric Wires. Samuel B. Flynt and Leaman A. Maiden, Meridian, Miss. Application filed August 1, 1904.

A protective casing for insulators comprises similar sections grooved externally to receive a binder. Oppositely arranged pairs of lugs are situated upon one section and a single lug at opposite sides of the other section, the several lugs being arranged adjacent to the joint of contiguous sections. A flexible strip extends from the single lugs of the last-mentioned section and is adapted to pass between the pairs of lugs of the first-mentioned section to be bent about one of each of the pairs of lugs.

787,482. Back-geared Motor. Leonard A. Tirrill, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 5, 1904.

An end plate is formed with an undercut channel and the armature shaft is journaled in the plate. A countershaft, a supporting member adjustably secured in the channel, a gear wheel mounted on the armature shaft and a gear carried by the adjustable shaft meshing with the first-mentioned gear wheel complete the apparatus.

787,507. Automatic Annunciator Restorer. James I. Gemmill, Cleveland, Ohio, assignor to the Gemmill Telephone and Manufacturing Company, Orrville, Ohio. Application filed December 22, 1902.

Combined with a jack are a drop, a connecting plug, a rolling, drop-restoring member between the plug and drop, and means whereby the member moves back by its own weight to position to permit the drop to be released.

787,527. Trolley Retriever. Francis M. Miller, Arcadia, Ind. Application filed February 2, 1905.

Secured to the car is a casing containing a continuously revolving pinion and a drum revolubly mounted and provided with ratchet teeth. Means automatically throw the pinion and ratchet teeth into engagement, other means automatically locking the drum when the trolley pole has been drawn down.

787,561. Electrostatic Apparatus. Eugene W. Caldwell, New York, N. Y. Application filed February 3, 1905.

Electrostatic apparatus [illegible] generator, an inductive [illegible] circuit, an arm movable [illegible] electrically connected with [illegible] coil and actuating the switch [illegible] arm adjacent to a contact [illegible] an initial charge.

787,583. Telephone Receiver. Charles T. Mason, Sumter, S. C., assignor to the Sumter Telephone Manufacturing Company, Sumter, S. C. Application filed February 27, 1905.

The magnet structure is supported with [illegible] front end and a block at its rear end [illegible] on the cup, with the diaphragm clamped [illegible] shell incloses the magnet structure and has locking engagement at its front end with the cap [illegible] piece is removably secured to the block [illegible] end of the sleeve.

787,595. Electric Train Signal. Albert W. Sullivan and William Renshaw, Chicago, Ill. Application filed August 5, 1904.

An automatic signal for railway trains contains a signaling device arranged in the cab of a locomotive or motor car. The cars are provided with side-opening doors. Means, arranged to be operated by [illegible] the movements of one or all of the [illegible] circuit when one or more of the doors are opened, and break it only when all of the doors are closed.

787,608. Printing Telegraph. John C. Barclay, New York, N. Y. Application filed July 9, 1904.

Constantly moving power mechanism [illegible] the printing mechanism. Selecting devices [illegible] tion of the printing mechanism and [illegible] electrically controlled sunflower, a separate relay, selecting circuits, primary and secondary selecting relays and restoring means. Other means connect and disconnect operatively the power member and the printing mechanism, the means being arranged to be operated simultaneously with the operation of the printing mechanism by the selecting mechanism.

787,610. Telephone Transmitter. Henry P. Clausen, Chicago, Ill., assignor to the American Electric Telephone Company. Application filed August 10, 1901.

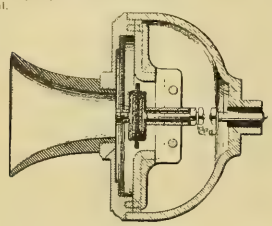
A springy or resilient sheet-metal box serves as yielding connection between the telephone diaphragm and its backing. Front and back electrodes and granular carbon are inclosed by the box, with suitable insulation for insulating the box from the back electrode, the front electrode being electrically connected with the box. A suitable transmitter body structure is provided with electrical connection between it and the resilient box, the transmitter or body structure thereby serving as one terminal of the electrical circuit. A terminal is electrically connected with the back electrode and insulated from the transmitter or body structure. (See cut on next page).

787,652. Electrical Stop-motion Mechanism for Textile Machinery. Joseph B. Whitney, New York, N. Y. Application filed June 30, 1903.

Stop-motion mechanism for textile machinery comprises pivoted detectors or fallers, each of the detectors being adapted to coact with wires as a circuit closer, and means for maintaining the wires under tension.

787,658. Induction Coil. John A. Baker, Seguin, Texas. Application filed June 13, 1904.

A primary winding is composed of a broad strip of metal disposed with its plane parallel with the axis of the core and having a secondary winding upon each side. The number of secondary windings exceeds the primary windings by one, and they occupy the extremes of the coil.



NO. 787,610.—TELEPHONE TRANSMITTER.

787,684. Trolley. Louis Leuenberger, Van Ness, N. Y. Application filed January 28, 1905.

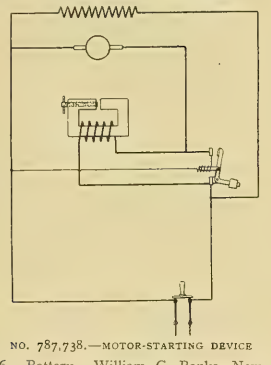
The trolley comprises a pivoted harp, a contact roller at the front portion, two hinge-mounted plates carried at the rear portion, rollers carried by the plates, a spring for pressing the plates and rollers into active position and a branched cord or flexible connection having one branch attached to the harp and the other branches attached respectively to the plates.

787,707. Electric Tool-driver. William F. Wagner, New York, N. Y., assignor to the American Inventions Company, New York, N. Y. Application filed December 7, 1904.

Electromagnetic coils operate the reciprocating driver of the tool, and means apply the force of the driver in one direction to a tool to move the tool longitudinally. Other means independent of the driver apply the force of the driver in the opposite direction to rotate the tool.

787,715. Battery. William C. Banks, New York, N. Y. Application filed October 20, 1904.

Combined with a jar are a standard supporting the remaining parts and having a tube portion supported above the bottom, a zinc supported on the standard, a basket substantially concentric with the tube located above the zinc, and terminals and insulators.



NO. 787,738.—MOTOR-STARTING DEVICE

787,716. Battery. William C. Banks, New York, N. Y. Application filed October 22, 1904.

An insulating support is provided for the positive element, and an insulating tube extends upward from the support to a point above the intended solution line. A positive element rests on the support. A depolarizer basket is insulated from the positive element and provided with a terminal, and a connection leads from the positive element to and through the insulating tube.

787,722. Motor-controlling and Regulating Device. Otto C. Britsch, New York, N. Y., assignor to David Wald, New York, N. Y. Application filed August 31, 1903.

Means coacting with the motor drive a mechanism embodying circuit wires. A plunger device moves in a vessel filled with electric conducting fluid and is brought into action by the operation of the manually operated mechanism for closing the electric circuit with its initial movement. The plunger device as it is progressively moved lessens or cuts out the resistance for gradually increasing the electric current and augmenting the speed and power of the motor.

787,738. Motor-starting Device. Arthur C. Eastwood, Cleveland, Ohio. Application filed September 9, 1904.

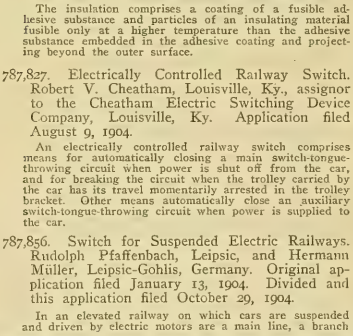
A body of inductive starting resistance is supplied to the motor in addition to the motor windings. Means dependent for their action on the counter electromotive force of the motor automatically cut the starting resistance out of circuit when the counter electromotive force rises to a predetermined point. (See cut.)

787,780. Wireless Telegraphic System. Walter W. Massie, Providence, R. I. Application filed November 1, 1904.

A space-telegraphic system, involving a sending and at least two receiving circuits, contains means common to the several circuits for closing them in sequence, the means having a movable member provided with circuit-closing means. A circuit-controlling member is arranged for operation by the movable member during a portion only of its movement. (See cut.)

787,802. Combination Gas and Electric Fixture. Charles S. Steinberg, New York, N. Y. Application filed May 4, 1903.

In a combined fixture in which the gas pipe is housed in a casing is a canopy clamped adjustably to the casing. A tube extends alongside of the gaspipe and has a bent end extended to one side of the casing and into the chamber of the canopy, the tube carrying the electric wires.



NO. 787,780.—SPACE-TELEGRAPH SYSTEM.

787,810. Trolley-pole Catcher. John H. Walker, Lexington, Ky. Application filed June 6, 1904.

On the trolley base is mounted a rack in a horizontal plane and extending backward from the foot of the pole. A brace from the trolley pole extends down to the rack, whose teeth are on the underside, and is supplied with a catch to engage the teeth. As the trolley pole is depressed the foot of the brace slides back on the rack and the catch, engaging the teeth, prevents the pole from flying up again. (See cut.)

787,820. Insulation for Electric Conductors. Lawrence E. Barringer, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 30, 1905.

The insulation comprises a coating of a fusible adhesive substance and particles of an insulating material fusible only at a higher temperature than the adhesive substance embedded in the adhesive coating and projecting beyond the outer surface.

787,827. Electrically Controlled Railway Switch. Robert V. Cheatham, Louisville, Ky., assignor to the Cheatham Electric Switching Device Company, Louisville, Ky. Application filed August 9, 1904.

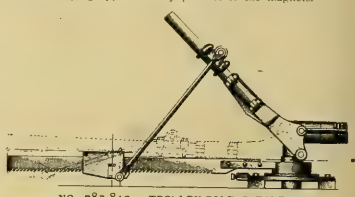
An electrically controlled railway switch comprises means for automatically closing a main switch-tongue-throwing circuit when power is shut off from the car, and for breaking the circuit when the trolley carried by the car has its travel momentarily arrested in the trolley bracket. Other means automatically close an auxiliary switch-tongue-throwing circuit when power is supplied to the car.

787,856. Switch for Suspended Electric Railways. Rudolph Pfaffenbach, Leipsic, and Hermann Müller, Leipsic-Gohlis, Germany. Original application filed January 13, 1904. Divided and this application filed October 29, 1904.

In an elevated railway on which cars are suspended and driven by electric motors are a main line, a branch connection having a switch rail, an electrical conductor along the main line and the branch connection and means for electrically insulating the portion of the conductor situated along the switch rail and the adjoining portion of the branch connection from the remainder of the conductor by the switch rail being opened. A device is supplied for reconnecting the insulated portion with the source of electricity by the closure of the switch rail.

787,879. Telephone Call or Ringer. Charles E. Egan, Durham, N. C. Application filed August 13, 1902.

Combined with the magnets of a telephone call bell are a supporting member for the magnets, an arm connected to the member and a condenser formed independently of the magnets and supported by the arm, the condenser lying approximately parallel to the magnets.



NO. 787,810.—TROLLEY-POLE CATCHER.

787,880. System of Electrical Distribution. Justus B. Entz, Philadelphia, Pa., assignor to the Electric Storage Battery Company, Philadelphia, Pa. Application filed April 23, 1904.

The invention embodies a working circuit, a battery provided with a booster and its circuit connection, an alternating generator feeding the working circuit and provided with a commutator, a prime mover for driving the generator and connections between the commutator and battery, whereby the frequency of the current generated and of the superimposed battery current is the same.

## EXPIRING PATENTS.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on April 24, 1905:

381,531. Telephone Transmitter. W. H. Collins, Chicago, Ill.
381,542. Solution for Voltaic Batteries. C. E. Egan, Columbus, Ohio.
381,555. Electric Railway. R. M. Hunter, Philadelphia, Pa.
381,556. Electric Railway. R. M. Hunter, Philadelphia, Pa.
381,568. Steam Dynamo-electric Machine. R. H. Mather, Windsor, Conn.
381,576. Electric Signaling Apparatus. M. W. Parrish, Detroit, Mich.
381,585. Trap for Electric-railway Conduits. W. M. Schlesinger, Philadelphia, Pa.
381,614. Electric-light Carbon. T. L. Clingman, Asheville, N. C.
381,650. Electric Motor for Railways. S. H. Short, Denver, Colo.
381,693. Electric Alarm for Ships' Compasses. A. Gross, Newcastle, New South Wales.
381,700. Armature for Dynamos. J. F. Kelly, New York, N. Y.
381,725. Electric-Door Opener. J. Schneider, New York, N. Y.
381,736. Electric Indicator. E. Weston, Newark, N. Y.
381,738. Telegraphic Signaling Apparatus. J. R. Willis, Portsmouth, County of Hants, England.
381,764. Telegraphy. P. B. Delane, New York, N. Y.
381,765. Electric Bell. C. F. De Redon, New York, N. Y.
381,768. Regulation of Electric Motors. S. D. Field, Yonkers, N. Y.
381,772. Electric Annunciator. J. Geary, Philadelphia, Pa.
381,780. Electrical Measurement Apparatus. H. V. Hayes, Cambridge, Mass.
381,789. Dynamo-electric Machine and Motor. M. Immisch, London, County of Middlesex, England.
381,794. Transformation and Distribution of Electric Energy. R. Kennedy, Glasgow, County of Lanark, Scotland.
381,817. Electric Heating System. E. E. Ries, Baltimore, Md.
381,818. Method of Electrochemical Heating. E. E. Ries, Baltimore, Md.
381,819. Heating Railway Cars by Electrochemical Means. E. E. Ries, Baltimore, Md.
381,823. Electrical Bell or Mechanical Striker. J. H. Brickford, Salem, Mass.
381,839. Dynamo Telegraphy. F. W. Jones, New York, N. Y.
381,852. Electric Fire and Burglar Alarm. A. Schuman, Springfield, Ill.
381,856. Electrical Apparatus. C. C. Sibley, New York, N. Y.
381,862. Suspended Cable and Electric Railroad. G. R. Taylor, Louisville, Ky.
381,866. Electrical Method of Automatically Controlling the Supply of Water or Gas. L. Weil, New York, N. Y.

## SPECIAL MENTION.

Mathias Klein & Sons, 81 West Van Buren Street, Chicago, make a specialty of supplying construction tools of all kinds for electrical workers. This firm was established in 1857 and is, therefore, one of the oldest in the business.

Electric buses, carrying 12 to 30 passengers, are manufactured extensively by the Commercial Automobile Company of Chicago. They are handsome in appearance and the company recommends them especially for hotel service, since they are "ready at any moment" and "run all day and all night."

Lindsley Bros. Company, Chicago, announces that it is unusually well equipped to fill orders for 35 to 40-foot Idaho cedar poles at practically the same cost as Michigan poles. The company will be pleased to hear from those in the market for poles of the sizes mentioned as well as for other lengths.

An encouraging spring demand for the well-known Star Soldering Stick is reported by its manufacturers, E. R. Crolius & Son, 6419 Peoria Street, Chicago. This soldering stick has been before the electrical trade for a number of years and has met with favor with a large number of customers, to which additions are constantly being made.

For best results with automatic-drilling and turning machines the Plume & Atwood Manufacturing Company of New York and Chicago desires to recommend its Snow Brand free-drilling brass rod. This, it maintains, turns clean and true, saving drills and taps, and is made in all sizes from one-eighth to two inches, in round, square and hexagonal shapes.

The Brown Corliss Engine Company of Corliss, Wis., has just secured an order from the National Tube Company to furnish its McKeesport plant with two 38 by 70 by 60-inch tandem compound rolling-mill engines for special heavy work. Important shipments have also been made recently to the Illinois Steel Company for the Joliet plant and to the Jones & McLaughlin Steel Company of Pittsburg. Among the large engines now under construction by the Brown Corliss company is a 26,000,000-gallon pumping engine for the city of Milwaukee.

The Burger gas engine, manufactured by the Woolley Foundry and Machine Works of Anderson, Ind., is being pushed energetically by its maker. The tandem styles are built in a straight line, eliminating many undesirable features. The feature of greatest importance, however, is the adoption of the automatic cut-off valve and inertia governor, which secure close regulation and economy of fuel consumption.

Nearly everyone knows that the Pennsylvania Line is the short and direct route from Chicago to Pittsburg, Baltimore, Washington, Philadelphia, New York and the East, but not everyone knows that it is also the short and direct route from Chicago to Indianapolis, Louisville, Columbus and Cincinnati. This will be readily seen by consulting the map. Agents of connecting lines will sell through tickets and give further information, or C. L. Kimball, assistant general passenger agent, No. 2 Sherman Street, Chicago, will communicate by letter with those interested.

# WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXVI. CHICAGO, MAY 6, 1905

## New Equipment of the Postal Telegraph-cable Company in Chicago.

Looking forward 25 years, the Postal Telegraph-Cable Company, on Easter morning, moved its Chicago main offices and the headquarters of its entire western division from the location which it has occupied in the Stock Exchange Building for the last 10 years into the Rialto Building, and that well-known structure, made two stories taller and renovated from top to bottom, is now known as the Postal Telegraph Building.

The main operating room, occupying the tenth and eleventh stories of the building, is lighted by 110 windows—practically light on all four sides. The room is 170 feet long by 67 feet wide, with a 24-foot ceiling. It furnishes seating capacity for 472 operators, and contains devices new to the telegraph world. Fig. 1 is from a photograph taken on a Sunday morning when the lines were not busy and a large part of the regular force of operators was not present. The switchboard, of the latest pattern, is composed of 11 sections, each section accommodating 50 wires, making a total of 550 main-line wires. The room presents a brilliant appearance at night, being lighted by 60 six-cluster electroliers, with latest improved reflectors, and also 35 side gas-light brackets.

The lighting of the room is one of the most important features, much time and thought having been devoted to the subject. Owing to the hundreds of typewriters in use (all messages being handled direct from the wire on typewriters, no pencil, pen or ink being used in this modern telegraph office) it is essential that the lighting arrangement should be so perfect that no flashes shall be thrown on the typewriter keys, as the striking of the wrong key by an operator might cause an error that would result in great loss or inconvenience to patrons.

Each of the 118 quartette tables is provided with four cabinets, for the care of typewriters, and each table is equipped with the newest and best machinery and apparatus known to the art. A special feature of the table equipment is the new resonators, containing the sounders for the use of operators receiving on the typewriters.

Fifty duplexes and 60 quadruplexes are provided to take care of the through traffic and the leased wires of the company, while 100 single Morse sets are allotted to the traffic on way and city wires. There are 15 sets of single-wire repeaters, 10 sets of direct-point duplex repeaters, used on through wires, and every table is connected up independently, and so arranged that it can be worked in any and every combination that the division chief in charge desires.

In the basement a terminal pin-jack arrangement, the first of its kind in the history of the telegraph, has been installed. It facilitates the testing of cables, to locate trouble, and, by a system of cords, any one cable can be cross-connected without a moment's delay. By means of the pin-jacks, grounds or other faults may be tested out at this point instead of at the operating switchboard or the regu-

[illegible] to the wire chief.

In addition to the basement terminal, there is a [illegible]

FIG. 1. NEW EQUIPMENT OF THE POSTAL TELEGRAPH-CABLE COMPANY IN CHICAGO.—THE OPERATING ROOM.

similar capacity, the switchboard being connected to both cross-connecting frames with 25-conductor and 50-conductor cables, and it is possible, with this improved system of transfer and the connecting frame, to change the location of sets, loops or wires, without breaking a single connection.

Pneumatic tubes, known as the transfer-tube system, in the main operating room, consist of 20 terminals, and are used for distributing messages to different parts of the operating room, to the general offices, the bookkeeping, delivery, receiving, file and other departments in the building and also to both floors of the Board of Trade Building, the office of the Associated Press and to outside branch offices.

Compressed air is used in the operation of this system, for which an air compressor with a capacity of 1,000 cubic feet of free air a minute has been installed. The compressed air is stored in three large tanks arranged for 12, five and 2½ pounds pressure to supply the requirements of the various tubes.

The tubes are fitted with electrically operated mechanism, which is very ingenious. The receiving

end of each tube is equipped with a clapper-like arrangement which closes the end of the tube. It it fitted with an armature so arranged that when the cover is closed it is attracted by an electro-magnet which holds the armature up and the cover in place. When a carrier, which is a small shell about six inches long, is inserted in the tube the cover is closed by hand, the elctromagnet holding it in place. At the same time the insertion of the carrier releases the air valve, which lets the air in behind the carrier. The carrier is then driven through the tube till it gets to its destination. Just before leaving the tube, however, it trips a small trigger, and in so doing, for a moment, opens the circuit of the electromagnet at the entering end. This allows the armature to drop and the cover opens, at the same time automatically shutting off the air. The tube is then ready for another carrier. This system gives the company continuous service 24 hours a day at a minimum cost, there being no power consumed except when tube is put in service.

The main terminal of the messenger call-box system is located in the business office on the ground floor. This equipment is of the latest and improved type, and is installed in accordance with the Postal company's new system.

Fig. 2 is a view of the operating switchboard on the operating floor. Not quite all of the board is shown in the picture, there being nine sections in the front and one at right angles at each end. The function of the switchboard is to connect for operation the different classes of service coming into the building. There are seven distinct classes of service which are supplied by the company, as follows: Local short city wires, 40 volts; longer city wires, 85 volts; short single wires connecting nearby cities, 130 volts; long single wires, 180 volts; duplex circuits, 250 volts, and quadruplex circuits, 350 volts.

By means of the switchboard, messages coming in over long-distance wires may be transferred to the local lines and taken at the stations of these lines direct. Also any local wires may be connected together, local and short main lines, etc.

Back of the switchboard is the terminal rack, and beyond this no high-tension current is passed. Three hundred and fifty volts, as used in the quadruplex circuits, would be dangerous to carry to the board or anywhere about the operating room. The higher pressure ends at the terminal board, and by means of internal resistance coils, is reduced to lower voltage. There must, in telegraph work, however, always be a meeting point for the high and low-pressure current, where the question of insulation is one of much importance where pressures as high as 350 volts are used.

In the basement of the building are located the dynamos, motor-generators, switchboard and air compressors. The dynamo switchboard, 25 feet long by eight feet high, is constructed of Maine slate. The switches are mounted direct. The bus bars are of bare copper.

The plant consists of 25 motor-generators, arranged for day and night service, and while the Chicago Edison Company furnishes the power, and also provides an emergency lead, the Postal company will also install engines and dynamos of sufficient capacity to take care of its service in the event of interruption to the Edison service. This emergency provision is to insure continuous service at all times. Fig. 3 is a picture of the switchboard and motor-generators.

The reason so many motor-generators are required is to supply the seven different voltages already alluded to. These sets are installed, according to their voltages, either in pairs or in groups of three. In the single-line circuits for the city service and short main lines, two generators are used in each case, either being able to perform the work. In the case of the duplex circuits, three generators are used, one for the positive side, one for the negative side and one which is interchangeable and can be used either positive or negative, thus acting as a spare to take the place of either machine in case of emergency. For the quadruple circuits six sets are in use.

It is interesting to note, in connection with the power plant of this telegraph office, that, if the old method of using batteries were employed, 60,000 cells would now be necessary to carry on the traffic, without allowing for any future extension.

Especial attention has been given to the comfort and convenience of employes. There is a circulating library, reading room, smoking room, locker and rest rooms for both men and women, and an up-to-date restaurant, open day and night. For the messenger boys, quarters are fitted up in the basement, containing the latest improved toilet, washrooms, bathrooms, shower baths and reading room, playroom and gymnasium, and, later on, it is the intention to provide evening classes for the boys, and lectures by electrical experts and well-known educators for the benefit of the older heads.

The moving of this large plant from the Stock Exchange Building to the new Postal Telegraph Building was effected without the least interruption to business, and was accomplished without any breaking of the circuits. Indeed, the fact that the office was being moved was unknown to any outside office having wire connection with Chicago. It was begun at three o'clock Easter morning (April 23d) and completed by 7 a. m., and on Monday morning the hundreds of operators, clerks and messengers took their respective places in the new building, and business was handled without hitch or delay in spite of the fact that that day, on account of the May wheat excitement on the Board of Trade and the financial difficultites of the Milwaukee bank, brought the company the largest business of any Monday in its history.

The work of arrangement, wiring and fitting up of the offices was begun nearly a year ago under the supervision of E. J. Nally, general superintendent; T. W. Carroll, electrical engineer; C. L. Bennett, his assistant in charge, and F. W. Conger, superintendent, besides a staff of expert engineers and electricians.

Mr. Carroll had full charge of the wiring arrangement of the operating room, terminal rooms, power plant, cable and pneumatic-tube systems, and to him is due the credit for the highly satisfactory manner in which the equipment was installed and the successful way in which the gigantic task of the removal was accomplished.

FIG. 2. VIEW OF A PORTION OF THE OPERATING SWITCHBOARD OF THE POSTAL TELEGRAPH-CABLE COMPANY.

## Electrical Exports for March.

Electrical exports from the United States for the month of March reached a total value of $1,126,201, compared with $930,297 for the corresponding month last year. This increase of $195,904 is made up from increases in both classes of electrical goods exported—electrical machinery and electrical appliances, the latter including telegraph and telephone instruments. The figures in detail, showing the electrical exports for the two months are as follows: Electrical appliances—March, 1904, $334,224; March, 1905, $505,705. Electrical machinery—March, 1904, $596,073; March, 1905, $620,496.

From the following figures, which show the value of the electrical machinery imported by the principal buyers from the United States during March, 1905, it will be seen that Japan is at the head of the list with $143,076 representing its purchases. In March, 1904, however, Japan's imports of electrical machinery from the United States amounted to $201,617, which was one of the highest figures in its record year of 1904. Following are the names of the principal buyers of electrical machinery from United States in March, 1905:

Japan, $143,076; British North America, $105,227; United Kingdom, $93,112; Mexico, $69,472; Philippine Islands, $56,799; France, $39,729; British Australasia, $26,591; Germany, $15,724; British East Indies, $11,088; British Africa, $7,321; Argentina, $5,536; Brazil, $4,411; Hongkong, $2,805; Cuba, $2,648; Chinese Empire, $2,078.

## Metering Discussed by the Institute.

The April meeting of the American Institute of Electrical Engineers was held in Carnegie Hall in New York on April 28th. President J. W. Lieb, Jr., presided and Secretary Pope announced that at the meeting of the board of directors held that afternoon 76 associate members were elected. The secretary also announced the death of Harry C. Smith and Charles E. Stephens. The latter was in the employment of the British Columbia Electric Railway Company at Victoria, B. C.

Four papers came up for discussion during the evening. They were: "Some Notes on Polyphase Metering," by Prof. J. D. Nies of Lewis Institute, Chicago, which was read by F. W. Roller; "Notes on the Use of Instruments on Switchboards" by F. P. Cox of the General Electric Company, Lynn, Mass.; "The Oscillograph and Its Uses," by Lewis T. Robinson of the General Electric Company, Schenectady, N. Y., and "Maintenance of Meters" by W. J. Mowbray of the Brooklyn Edison Company. The papers were well discussed, among those taking part being President Lieb, Caryl D. Haskins of Schenectady, N. Y., Professor Edward B. Rosa of Washington, D. C., Clayton H. Sharp of New York, F. C. Pratt, A. R. Everest of West Lynn, Mass. and A. H. Ackerman of New York.

It was pointed out during the evening that one of the most important questions in connection with electricity supply is that of metering. As President Lieb said, it is evident that a meter tested under laboratory conditions, with ideal surroundings, without vibration, stray fields, etc., will be more accurate than where the test is performed in a dark cellar and in various inaccessible places where the current varies and where conditions are generally unfavorable. The paper by Professor Nies upon this subject was one previously presented in Chicago, and it was well received. Speaking of some tests of meters that have been going on in the state of Massachusetts during the last several years, President Lieb said that it is surprising to most people to find that the average error of all the electric meters tested in 1904 was only 1.08 per cent. from unity at full load, and less than one per cent. at one-fifth load—50 per cent. better than results shown by gas meters.

Mr. Pratt in discussing polyphase metering said that in his opinion, which was contrary to the idea brought out in the paper of Professor Nies, it is just as easy to calibrate a polyphase meter as two single-phase meters. The two elements can be thrown in series just as easily as can two or three single-phase meters.

## Utilization of Blast-furnace Gases in Connection with Electric Production of Steel.

The production of electrical energy by means of gas engines operated from blast furnace gases opens up many possibilities in electrometallurgy generally, and in the manufacture of steel electrically in particular, since by utilizing the gases given off from the blast furnaces in producing pig iron cheap power is obtainable. It is generally admitted that steel electrically obtained possesses superior qualities to those of good open-hearth steel—almost as good, in fact, as crucible steel. For the manufacture of ferro metals or metals extensively used in the production of carbon steel there is found in the utilization of blast-furnace gases a new and profitable industry. In a paper read before the American Electrochemical Society at the convention of last week, held in Boston, Mr. Auguste J. Rossi gave some valuable figures relative to the production of power from such gases. He says:

"As utilized now in blast furnaces to heat the blast and generate steam under boilers, fully one-half of the total amount of gases (52 to 62 per cent.) per ton of iron is wasted. Calculations made by different metallurgists show that this waste, for a production of 20,000,000 tons of pig iron in a year amounts, according to the weight of gases assumed by the writers in different conditions, to not less than 1,000,000 to 1,200,000 horsepower per hour by the most conservative estimate, and may reach as high as 2,000,000 horsepower per hour.

"These gases have, indeed, a heat value per horsepower which is now admitted to be not far from 1,280 thermal units, so that for a production of some 10,000 units of gases per ton of iron, a rather small figure, as we will see, we could count on 12,800,000 thermal units, of which half at least, 52 per cent., or 700,000 thermal units, would be available for creating power. As the duty of a gas engine is now readily guaranteed by builders to be one effective horsepower per 10,000 thermal units on the gases (efficiency, 25 per cent.; one horsepower-hour = 2,545 thermal units), this gives us a surplus of 700 horsepower per ton-hour, which, for 2,240 ton-hours, gives 1,568,000 horsepower-hours. For a consumption of coke of 2,240 pounds per ton of iron, which is now about a normal average, it is considered that 14,000,000 thermal units can be assumed as the heat value of the gases. If we take only 52 per cent. of this as available surplus, as some conservative estimates do, we come to 728,000 thermal units, corresponding to 728 horsepower per ton-hour (1,630,700 horsepower-hour for 2,240 tons).

"Even if we assume only 9,000,000 thermal units as that of the gases, as it has been done by some writer for an exceptionally low consumption of coke, we come still, counting on a surplus of 52 per cent. only, to 468 horsepower-hours available per ton, or for 2,240 tons per hour, to 1,048,320 horsepower-hours. This figure we consider as much too low, as we will see, even for a consumption of coke of only 1,700 pounds per ton of iron (1,726 pounds have been recently secured in a memorable run of Mr. Gailey under special conditions). Hence, as we have said before, 1,000,000 horsepower-hours as a surplus may be considered as a minimum estimate. The quantity of fuel burnt in a given time in a blast furnace has certainly a direct influence on the total amount of gases, but it would be a mistake to conclude a priori, that a smaller amount of gases per ton of iron necessarily gives a smaller amount of power. As it is, with blast at 704° C. gases escaping at 250° C., with a consumption of coke of 2,000 pounds per ton of iron, as at the Clarence works, England, the weight of gases per ton of metal is given by Jonathan Bell at 109.17 gross hundredweight. This at 112 pounds per hundredweight gives 3,350 pounds of gases per ton in round numbers. With such ores as were used in the Pittsburg Works (Edgar Thomson) with blast at 593° C. and gases at 171° C. this amount is given per ton of iron is given by L. Bell as 100.10 hundredweight, or 11,200 pounds, for a consumption of coke of 1,881 pounds per ton of iron.

## Recent Improvements in Mercury-vapor Transformers.

The transformation of direct current into multiphase alternating current may be accomplished by means of a mercury-vapor device, as has often been demonstrated. As a transformer, the mercury-vapor lamp presents great possibilities, and not only the inventor, Mr. Peter Cooper Hewitt, but many others as well, are turning their attention toward this department of its usefulness. Two patents have recently been granted on "Means for Transforming Direct Current"—one to Mr. Charles P. Steinmetz and the other to Mr. Osias O. Kruh, both of Schenectady, N. Y., which are here briefly described.

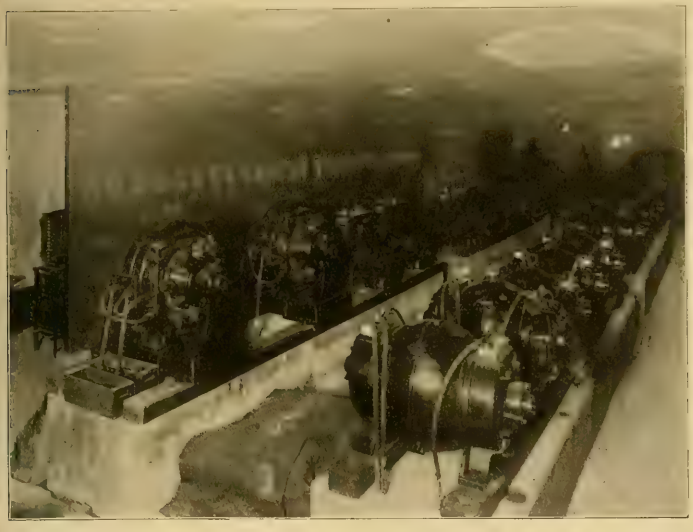


FIG. 3. MOTOR-GENERATORS AND SWITCHBOARD OF POSTAL TELEGRAPH-CABLE COMPANY IN CHICAGO.

As to the construction and mode of operation of Mr. Steinmetz's invention a better understanding may be had by reference to Fig. 1, which illustrates one of the numerous embodiments which the invention may assume in practice.

In the diagram a source of direct current is indicated conventionally at (1). From this source is derived a direct current, which is to be transformed into multiphase alternating current. The vapor conductor, through the operation of which the transformation is largely effected, consists of a highly exhausted receptacle (2) of glass or other suitable material, provided with pockets for holding bodies of mercury (3) to (7), inclusive, constituting electrodes. In place of mercury any other suitable material may be employed. The electrode (7) is located centrally with respect to the other four electrodes and constitutes the cathode or negative electrode. It is connected through a leading-in conductor with the negative lead (8) extending from the source. The other electrodes operate intermittently as anodes and are connected, respectively, with the terminals of two primary windings of two transformers, the corresponding secondaries of which are indicated at (11) and (12). The diametrically situated anodes are connected to the terminals of one primary and the other anodes to the terminals of the other primary. The middle points of the two primaries are joined by a conductor (13), and from this conductor connection is made through a lead with the positive terminal of the direct-current source.

In order to start up the apparatus the receptacle

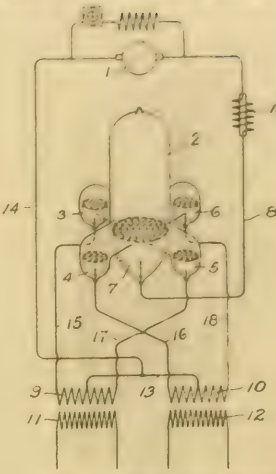



FIG. 1. STEINMETZ'S MERCURY-VAPOR TRANSFORMER.

to flow by reason of the conducting path formed by the arc which follows the break in the mercury path. Suppose the arc to be formed between the anode (4) and the cathode (7). As soon as this arc is formed it jumps to one of the adjacent anodes (3) and (5). It then jumps to the next anode beyond, and continues thus to move rapidly around the cathode (7) in the center. The direction in which the arc starts to move around the center is apparently largely a matter of chance. After the arc is started, however, it continues its rotation in the same direction and with a rapidity which depends to a considerable extent upon the size of the positive electrodes or anodes and their distances from the cathode. The shifting of the arc from one anode to an adjacent anode seems to be due to the fact that as soon as the arc starts from one anode the heat thus generated produces an increasing resistance between the anode and the cathode until a point is reached where less resistance to current flow exists between an adjacent anode and the cathode. The arc then shifts to this adjacent anode and repeating the operation continues to shift from anode to anode in regular progression around the cathode. Suppose, for the sake of illustration, that the arc shifts in succession from anode (3) to anode (4), then to anode (5) and anode (6), and so around the circuit indefinitely. A pulsation of current is thus produced first in the lead (15), then in the lead (16), then in the lead (17), then in the lead (18), and so on. In producing these current pulsations current flows from the main (14) always in the same direction to the junction with the conductor (13), whence it passes in the direction of the arrows through the middle points of the primaries (9) and (10). When the arc is passing from the anode (3) to the cathode, current is therefore flowing from the middle of the primary (9) to the lead (15). When the arc shifts to the anode (4), current flows from the middle of the primary (10) to the main (16). When the arc again shifts to the anode (5) the current flows from the middle of the primary (9) to the main (17). In the same way when the arc shifts to the anode, then current flows from the middle point of the primary (10) to the lead (18). As the arc continues to shift from anode to anode the operations mentioned are repeated.

It will be observed that in each primary current first flows through one half of the winding so as to produce a magnetizing force in one direction, and then through the other half of the winding so as to produce a magnetizing force in the opposite direction. An alternating magnetomotive force is thus produced by each primary winding, which thereby generates in the corresponding secondary an alternating electromotive force. By reason, therefore, of the shifting of the arcs in the vapor

conductor a multiphase alternating current may be derived from the secondaries (11) and (12).

In order to render the flow of power in the direct-current circuit more steady and thus to fill up as much as possible the gaps or intervals during which no current, or at least a small current, is flowing in either of the primaries (9) and (10), there is connected in series with the direct-current source an energy-storing device, such as an inductance coil (19). This coil stores energy while the current is flowing directly from the source and discharges the energy in the form of current

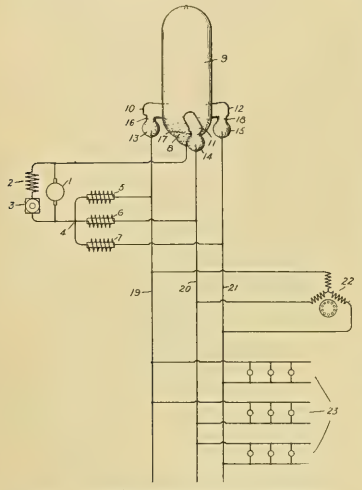


FIG. 2. KRUH'S MERCURY-VAPOR TRANSFORMER.

at such times as the current from the source tends to cease flowing or to fall in value. By the use of this energy-storing and restoring device the alternating magnetizations produced in the primaries approximate closely the effect of an ordinary alternating current.

Fig. 2 represents the transformer devised by Mr. Kruh. The direct current which is to be transformed into alternating current is derived from a suitable source—such, for example, as a direct-current generator, the armature of which is indicated at (1) and the field winding at (2). One lead from the generator is connected to the junction between three reactance coils (5), (6) and (7), while the other lead is connected to the central mercury electrode constituting the cathode of a mercury-vapor apparatus. This apparatus consists of an envelope (9) of glass or other suitable material, provided with a number of pockets for containing bodies of mercury constituting electrodes. One of these pockets, which is located centrally with respect to the others, contains the cathode. The other pockets consitute enlargements of depending portions of equally spaced downwardly bent tubes (10), (11) and (12), communicating with the main envelope (9), as shown. These enlargements contain bodies of mercury constituting electrodes co-operating with the cathode and are connected with the main tubes (10), (11) and (12) through necks or constricted portions. The circuits of the inductance coils extend, respectively, to the electrodes. As shown in the diagram, a translating device may be connected in circuit with leads (19), (20) and (21), extending from the inductance coils and their co-operating electrodes. These translating devices may be of any character desired—such, for example, as an induction motor, banks of lamps, etc., and are supplied by multiphase current fed to the mains (19), (20) and (21).

In starting up the apparatus the receptacle is tipped so as to cause mercury to flow between the central electrode and some one of the surrounding electrodes, and a regular rotation of impulses is set up, as in Mr. Steinmitz's apparatus. The rapidity of progression is rendered high by reason of the reduced exposed area of the electrodes (13), (14) and (15). The arcs receive current from the source (1) through the medium of the inductance coils (5), (6) and (7), and are so connected to the source as to cause the direction of flow of current to be from the source through the inductance coils to the electrodes. These electrodes are thus positive and the central electrode negative. It will be observed that when current flows to one of the electrodes—as, for example, electrode (14)—several paths are open—one through inductance coil (6) directly to the electrode and the others through the inductance coils (5) and (7) to the translating devices, through which the current passes and returns along the main (20) to the electrode (14). As the arc shifts to the next electrode, as (15), a similar flow of current takes place. It will thus be seen that alternating impulses of current flow in the mains (19), (20) and (21). Each current impulse traverses one of the inductance coils and stores a portion of its energy therein. In restoring the energy the inductance coils have the effect of securing a symmetrical multiphase-current flow in the mains.

## Dynamo Tenders' Handbook in Japanese.

Creditable to the author and pleasing to the publisher is the fact that the "New Dynamo Tenders' Handbook" and the "Incandescent Wiring Handbook," written by Mr. F. B. Badt and published by the Electrician Publishing Company of Chicago, have been translated into the Japanese language and published in book form. The translation was made some years ago by Tadajiro Kamiyama, member of the Engineers' Society of Japan, and Kinji Uchimura, engineer of the Onomichi Electric Light Company.

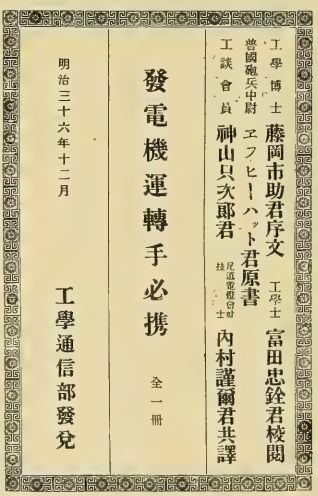
A copy of the Japanese Dynamo Tenders' Handbook was recently sent to Mr. Badt, and it has an unusual interest to Occidental eyes, as may be judged by the accompanying reproductions of two pages of the book, the size of which, in the original, is 5½ by 8½ inches.

Fig. 1 shows the title page of the book (which is also the last page), a rather literal retranslation of which, made by the Japanese consul in Chicago, is as follows:

Preface by Ichisuke Tujioka,
Kogakuhakase.
Revised and corrected by Tadanori
Tomita, Kogakushi.
Original work by F. B. Badt, Artillery
Lieutenant of Prussian Army.
Translated into Japanese by Tadajiro Kamiyama,
member of Engineers' Society, and Kinji
Uchimura, engineer of Onomichi
Electric Light Company.
ELECTRICAL ENGINEERS' GUIDE.
Meiji Thirty-sixth year, Twelfth month.
Published by Engineering Correspondence
Department, Engineers' Society.

A typical page of the Japanese translation is shown by Fig. 2. As near as can be ascertained, the matter shown on this page is the last part of page 33 and the first of page 34 of the original work. The drawing to the right shows a left-hand series dynamo and the one to the left a right-hand shunt dynamo. All the cuts in the original Dynamo Tenders' Handbook have been reproduced in the Japanese translation.

A copy of the Japanese translation of the Incandescent Wiring Handbook has not been received yet, but no doubt is similar to the present publication.


發電機運轉手必携

全一冊

工學博士 藤岡市助君序文 工學士 富田忠鉉君校閲

普國砲兵中尉 エフヒーハット君原書

工談會員 神山只次郎君 兄遠藤宮尾君 内村謹爾君共譯

明治三十六年十二月

工學通信部發兌

Fig. 1. Title Page.

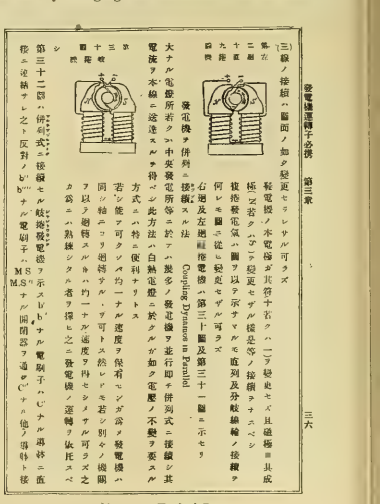

發電機運轉手必携 第三章 三六

Fig. 2. A Typical Page.

DYNAMO TENDERS' HANDBOOK IN JAPANESE.

## The Mercury Arc.[1]

By E. Weintraub, Ph. D.

This paper contains results of an investigation on the properties and nature of the conductivity of metallic vapors carried out in the research laboratory of the General Electric Company. The investigation was started with the practical purpose in view of using the arc discharge in metallic vapors, and especially mercury vapors, as a source of light. The subject is of special interest to the electrochemist, whose science can be in the main properly defined as the science of conductivity of a particular kind of matter, namely, of solutions and molten salts. The ionic theory of conductivity that had its birth in electrochemistry found afterwards fruitful applications in the theories of conductivity in gases. Any increase of our knowledge in this last-named branch is in its turn apt to react on the general structure of that theory, and eventually influence the electrochemical ideas themselves.

*The Role of the Cathode in the Starting Process.*—The distinctive feature of the conductivity of gases and metallic vapors, in contradistinction to that of metals and electrolytes, consists in that under ordinary conditions, in absence of exterior ionizing agents, the current itself has to create the material which is to carry it from one electrode to the other. As this material does not exist at the beginning, some special means must be used to start the discharge, and thus we meet in gases and vapors with the problem of starting a problem unknown in the realm of conduction through metals and electrolytes.

The new way of starting an arc discharge in mercury vapor that I want to expound here was the outcome of the theoretical conceptions on the mechanism of the arc and the function of the ionization at the cathode surface that I formed in the course of these investigations. According to these conceptions an arc discharge in metallic vapors is a discharge deriving its carriers, at least in the immediate neighborhood of the cathode, from the material of that cathode. The application of a moderate electromotive force is of itself insufficient to start the process by which these carriers are formed out of the material of the cathode. The new fact discovered was that this formation of carriers (the "ionization" process) is started and the arc discharge made possible if a spark or a small arc is produced at the surface of the cathode. The following experiment will serve to illustrate this statement:

The tube is represented in Fig. 1. (K) is a cup filled with mercury. (A) and (B) are electrodes of graphite, iron or mercury. In the figure they are shown as mercury cups. The tube is exhausted on the Sprengel pump to the highest possible vacuum, and by some means, such as heating from outside, or by the arc itself, the gases are driven off from the walls of the tube and the anode material. Two different sources of direct current are used—one applied to (K) and (B), the other to (K) and (A), in such a way that (K) is the negative pole of both. If, now, the little arc (BK) is started by bringing the electrodes into contact and separating them, the other arc (KA) starts instantaneously. If the connections are changed in such a way that (K) is the common positive pole of the two sources, the arc (BK) does not cause the starting of the arc (AK). The fundamental importance of the cathode in the process of starting

1. Abstract of a paper read at the general meeting of the American Electrochemical Society, Boston, Mass., April 25, 1905.

an arc is illustrated by the experiment in a simple and striking way. We can depict in the tube of Fig. 1 with the use of two different sources and use the same source with different resistance in the two branches. In Fig. 2 (B) is the cathode, (D) and (A) are both connected to the positive pole; ($r_1$) is a large resistance; (r) is a small resistance used for the purpose of regulating the current in the main arc (BD). By suitably holding the tube the arc (BA) can, whereupon the arc (BD) starts of itself. The switch (S) in the side branch arc (BA) can then be opened and the auxiliary arc discontinued.

For the practical use of this starting method the operations of separating the electrode (B) and (A) and discontinuing the auxiliary arc the moment the main arc is started must be performed automatically by the current itself. One of the arrangements that I have devised is represented in Fig. 3. (KL) is an iron plunger, (S) a solenoid and (O) a magnetic cut out. The solenoid (S), in pulling up the plunger (KL), produces the auxiliary arc. The current in the main arc flows through the magnetic cut-out and automatically opens the circuit of the auxiliary arc.

It is interesting to remark that the old method of starting an arc by contact is based also on excitation of the cathode; only, instead of having one arc instantaneously formed by another, we have a continuous growth, a short arc producing a longer one.

*Influence of the Conditions Prevailing in the Space Between the Electrodes on the Starting Process.*—The space separating the electrodes has an important influence on the velocity with which the starting takes place, but this influence is mainly of a negative character. The space must present as little hindrance as possible to the flow of ions starting from the cathode surface. Accordingly, the degree of vacuum must be the highest obtainable, and the

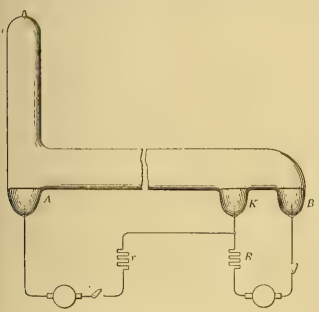


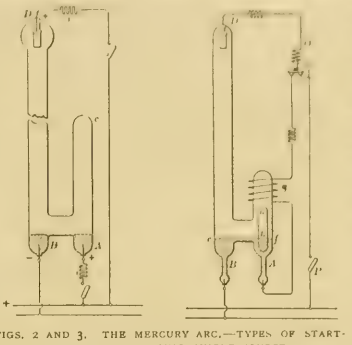

FIG. 1. APPARATUS FOR STARTING MERCURY-VAPOR ARC.

more careful the exhaustion the more instantaneous is the starting. If foreign gases, or inert ordinary mercury vapor, are present, the starting is slow. The ionized vapor is seen to rise from the surface of the cathode and slowly move along the tube, impeded in its use not only by the gases present in the tube, but also by the mercury vapor which volatilizes from the heated surface of the mercury cathode. When the vapor reaches the anode the arc will eventually start, but if the pressure of the foreign gases is high enough the arc does not establish itself at all.

*Function of the Anode in the Starting Process.*—In contradistinction to the cathode the anode plays no role whatever in the starting process. It receives the carriers of the current without any previous excitation.

*The Influence on Stability of the Arc Conditions at the Cathode Surface.*—In the study of the conditions of the stability of the mercury arc one meets with a phenomenon which is being observed in all arcs, i. e., the existence at each impressed voltage of a lower limit of current, below which the arc is not stable and extinguishes. The experiments performed on the mercury arc led me to the conclusion that the physical cause of it is in the conditions prevailing at the very surface of the cathode. Under ordinary circumstances there is a bright spot on the surface of the mercury cathode, which spot is continually wandering about on that surface. The wandering of this spot has not found as yet any very satisfactory explanation. This spot is, according to the conceptions expounded here, the place where the production of ions takes place, and the continuous motion of that spot means a disturbance of the ionization process and a danger to the existence of the arc. The wandering of the spot can be avoided in two different ways—either by making the surface of the cathode small, of the same magnitude as that of the spot, or by having a wire of iron or platinum project above the surface of the mercury.

The conductivity of the arc depends on the relative amounts of ionized and inert mercury vapor. If a sufficient condensing space is provided so that the pressure of the ordinary mercury vapor volatilized from the cathode is kept down to a certain




FIGS. 2 AND 3. THE MERCURY ARC.—TYPES OF STARTING APPARATUS USING SINGLE SOURCE

change of polarity the ionization process at the cathode dies out and moderate electromotive forces are insufficient to start that process by themselves on the surface of the other electrode when the latter becomes of negative sign. It is therefore obvious that if an alternating electromotive force of moderate value is to maintain an arc in metallic vapors, one metallic electrode must permanently keep its negative sign, notwithstanding the perpetual change of polarity. This, if realized, would mean a unidirectional flow of current in the arc, and consequently rectification of the alternating current.

If, referring to Fig. 1, the electrodes (K) and (B) are connected to a source of direct current, (K) being the cathode, and a source of alternating electromotive force of a few hundred volts is applied to (K) and (A), that half of the alternating current which has the direction (AK) (K cathode) passes, since the ionization process at the surface (K) is kept up by the direct-current arc; the opposite half wave is completely suppressed. The arrangements by means of which both halves of the current wave are made to pass in the arc and are superposed in the same wire are mainly applications of electrical principles to the given case. Of all the devices used by me I mention but two. In both of them the tube contains three electrodes, one of mercury, the others of graphite, iron or mercury. The one electrode of mercury serves as the cathode, the two others, which we will suppose

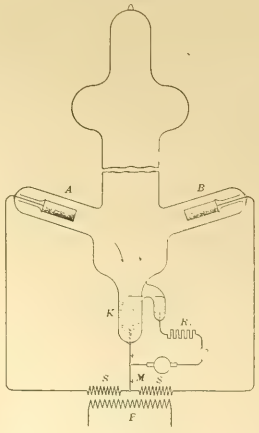



FIG. 4. THE MERCURY ARC. -STARTING APPARATUS USING TRANSFORMER.

to be made of graphite, serve as anodes of the rectified arcs. In the first arrangement, represented in Fig. 4, a transformer is used, the ends of the secondary of which are connected to the two graphite anodes. A wire taken out from the middle of the secondary is connected to the cathode. One half wave takes them in the arc in the direction (AK), the other in the direction (BK), and both are superposed in the same direction in the neutral

connected to respectively the negati

solid piece and wherever that spot strikes the

cathode spot leaves fine lines and grooves burned, so to say, into the material. The loss of weight of these solid cathodes is usually very small. The largest part of it is, however, due to the mechanical disintegration of the material which accompanies the electrical one, which circumstance deprives the results of theoretical significance. We can, therefore, conclude from these experiments that a transfer of matter either does not take place at all, or is so small as to be of the order of mag-

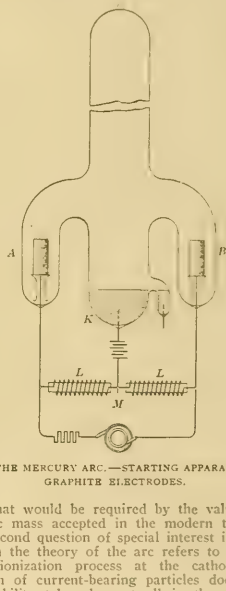



FIG. 5. THE MERCURY ARC.—STARTING APPARATUS USING GRAPHITE ELECTRODES.

nitude that would be required by the value of the electronic mass accepted in the modern theories.

The second question of special interest in connection with the theory of the arc refers to the cause of the ionization process at the cathode. The formation of current-bearing particles does not in all probability take place at all in the arc itself. The potential drop in the arc and that at the cathode surface (about five volts) are so small that productions of ions by collision seems to be excluded. As the anode plays no appreciable role during the starting and the running of the arc, we are led to the conclusion that in an arc through metallic vapors in an exhausted space the cathode is the only place where the current-bearing material is formed.

## Copper Market.

Though few deals of magnitude in the copper trade have been reported recently, the general belief is that the strength of the market in this commodity will continue unabated. The movement of copper into consumption and on foreign contract continues to be large. Prices have been fairly steady for several weeks, being, for the latter part of April 15 to 15¼ cents a pound for electrolytic wire bars and also 15 to 15¼ cents for Lake. It is believed that in the face of an export trade amounting to 20,000 tons a month no considerable accumulation of copper is possible. There has been some apprehension in London trade circles lest copper prices ease off in the event of peace between Russia and Japan, but prominent authorities believe otherwise, for, with the cessation of war, it is pointed out that a large demand may be expected to replace used-up war material.

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## DATES AHEAD.

Association of Railway Telegraph Superintendents (annual meeting), Read Hotel, Chattanooga, Tenn., May 17th and 18th.

National Electric Light Association (annual convention), Denver, June 6th, 7th and 8th, and Colorado Springs, June 9th, 10th and 11th.

American Institute of Electrical Engineers (annual convention), Battery Park Hotel, Asheville, N. C., June 19th to 23d.

National-Interstate Telephone Association (first convention of consolidated telephone associations), Chicago, June 21st, 22d and 23d.

National Electrical Contractors' Association (fifth annual convention) and Electrical Exhibition, Mechanics Hall, Boston, Mass., July 15th to 22d.

International Association of Municipal Electricians (annual convention), Erie, Pa., August 29th, 30th and 31st.

CHICAGO, taken in the aggregate, has miserable street lighting. Mile after mile of streets are lighted by gas lamps, and these not even good of their kind. It is therefore ridiculous to talk of selling the surplus current of the municipal street-lighting stations to commercial users. There is no surplus, but instead a great, yawning deficit. Let the streets be lighted properly before the city administration looks around for a market for the product of its arc-lighting stations. All taxpayers share in the expense of the municipal plants, but only a minority have the benefit of electric street lights in their own neighborhoods. If from one modern plant current were sold for commercial use, this injustice would be still further accentuated.

JUDGE ARTMAN'S decision in the Clinton Circuit Court, holding that under existing laws of Indiana the people are not authorized to vote a tax in aid of the construction of electric interurban railways, and that county commissioners cannot legally order such elections, has provoked much discussion in that state. Friends of the interurbans had thought that the statute of 1879, authorizing subsidy elections to vote aid in the construction of railroads, makes no distinction among railroads as to the kind of motive power used. They assert that it was the intent of the Legislature to encourage the development of transportation facilities of the state by authorizing the people to vote aid for the construction of railroads without reference to motive power. "The laws of Indiana certainly give the people the right to vote aid to a railroad, subject to the constitutional debt limitation, without reference to the motive power," says a lawyer who has investigated the question. In support of this view is cited a recent decision of the Kentucky Court of Appeals, in which it is held that "where an electric railroad has been incorporated under the railroad law of the state, it becomes a railroad. Whether a railway is a street railway or a trunk railway does not depend on the motive power employed by it." Judge Grosscup of Chicago, in a recent decision, said: "The fact that a railroad company's trains are to be operated by electricity instead of steam does not affect its place in the laws of the state as a railroad company."

A member of the Indiana Legislature said that a bill was introduced in the last Legislature to prohibit the voting of subsidies to electric lines, but it was killed on the argument advanced that it would be a flagrant case of discriminating or class legislation, and, therefore, invalid. What effect Judge Artman's decision will have at the seven or eight subsidy elections to be held in Indiana during May remains to be seen. It is understood that another case will be brought in another circuit to enjoin the placing of a tax on the "duplicate" for collection, and thus raise the question at stake before another judge. Interurban men are advised that the Supreme Court may not sustain Judge Artman's decision, but they regard the contention as unfortunate at this time, and may defer the building of some lines for a year or more.

THE General Electric Company occupies such an important place in the electrical industry that its annual reports are always awaited with interest and read with attention. That for the year ended January 31, 1905, is just out, and is given, nearly in full, elsewhere in this issue of the Western Electrician. It will be noted that the sales of the company were less in 1904 than in 1903. This is in agreement with the general situation as given in the "Statistics of Electrical Manufactures" published in the New Years number of the Western Electrician of January 7, 1905. It is gratifying to us (while wishing that business had been better) to note the verification of the Western Electrician's annual estimates, made four months ago, by the official report of this great electrical company. This is especially the case, as an esteemed New York contemporary, less well informed, published a little table in its corresponding New Years issue purporting to show that the value of electrical apparatus produced in the United States in 1904 was over 10 per cent. greater than in 1903. However, our contemporary doubted its own figures, as well it might, and gave opportunity for those who questioned its table to find confirmation in its editorial comment.

Many interesting facts are contained in this valuable report. For instance, 289 steam turbines had been sold up to February 1st last, generating from 450,000 to 500,000 kilowatts. These new prime movers have been exported to many foreign lands, including Canada, Europe, South America, Japan, New Zealand and Mexico. In another place General Griffin says that "it will not be many years before all suburban trains in the vicinity of our large cities will be operated by electric power." Mr. Rice reports that "we have now on order apparatus for nine [power-transmission] installations employing currents of 60,000 volts or over and transmitting electricity from 47 to 100 miles." Again, the high-speed electric centrifugal pump "promises to replace the steam pump for supplying water to cities." Unofficial tests of the first New York Central electric locomotive showed a speed of 75 miles an hour. The official tests indicated a speed of 52 miles an hour with a 550-ton train and 69½ miles an hour with a 265-ton train, and were satisfactory in all respects. Of the new alternating-current railway motor Mr. Rice says: "This novel form of motor is under certain conditions cheaper and more economical than our standard direct-current motor, and the field of electric traction will be extended by its use."

Facts such as these show that electrical advancement is as fascinating in 1905 as it ever was, and perhaps not less important.

HOW TO IMPROVE the terminal facilities of the steam railroads, especially in the large cities, is a problem that has been before railroad officials for several years. How to meet the constantly increasing interurban electric-railway competition to the branch lines of the steam roads is a question of as much importance. As a number of the large roads of the country have decided to substitute electricity for steam on the terminals and suburban lines, the former problem may be considered solved in favor of the electric locomotive, although the method of applying electricity to get the greatest economy and efficiency has not been determined by some of the roads contemplating a change. The Illinois Central in Chicago, for instance, has decided to equip its terminals with electricity, but on account of the recent developments in the use of alternating-current motors for railway work further practical results will be awaited, in all probability, according to an officer of the company, so that relief from smoke and cinders may not be looked for within a year or two.

Electricity for branch-line service, however, is considered impracticable by many engineers and officials of the steam roads. These gentlemen object to the first cost of installing power houses and transmission lines, and assert also that the proportional cost of operating trains where the service is infrequent compared with suburban traffic would be too high.

The steam roads admit that something must be done on their branch lines to meet competition from electric roads. More frequent service must be given, and to do this a self-contained motor car is considered as the most favorable. Central and western roads are experimenting with gasoline motor cars with some success. Mr. G. H. Groce, superintendent of telegraphs of the Illinois Central, has recently been west to investigate gasoline motor cars operated by the Union Pacific on branch lines. A car of 40 tons weight operated by a 100-horse-power marine-type gasoline engine impressed Mr. Groce as being practicable. On a long run, 23 miles an hour on a slight grade was maintained without difficulty. His company will proceed at once to build a similar car on a larger scale and will give gasoline engines a thorough test. Mr. Groce does not believe that gasoline motor cars will supersede steam for terminal service in Chicago, but on account of their greater economy has much faith in them for branch-line operation.

We do not think it probable that the gasoline cars will furnish serious competition for electric traction. But they may bridge the gap between the steam railroad and the electric railway in places where the conditions are favorable. Passengers are not likely to take any too kindly to the gasoline cars. If experience with the automobile is any precedent, they will easily get out of order, while the disagreeable odor and the remote possibility of explosion are also objections. But the subject is one that will demand and receive further study.

# AMERICAN ELECTROCHEMICAL SOCIETY.

The seventh general meeting of the American Electrochemical Society, which was held last week in Boston and Cambridge, Mass., was pronounced by retiring President Henry S. Carhart one of the most enjoyable and successful in the history of the organization when he brought the session to a close with a brief speech in acknowledgment of courtesies received from the Massachusetts Institute of Technology, Harvard University and various industrial interests which contributed to the entertainment of the members during their stay in the city.

The convention began Tuesday, April 25th, with a morning session in the lecture hall of the Lowell Building at the Institute of Technology. There was no formality about the opening proceedings, President Carhart expediting matters in most commendable fashion by immediately announcing the first paper on the programme. This feature, namely, the facility of the presiding officer in directing the presentation of the papers and the transaction of business coming before the convention, was one of the most gratifying elements in the success of the daily assemblages of the members. No time was wasted, yet ample time was given, it was apparent, for all the questions necessary for the understanding of each subject, as presented by those who had assignments upon the programme.

About 30 papers were submitted. Some of them were necessarily read by title, the available time being insufficient for the full reading of all of them. Very few papers were discussed, in the broader significance of the term, although questions were asked at the close of some of the numbers and brief supplementary remarks were made by other members in some instances relative to experiments conducted by them along the lines of those exemplified by the authors of the papers.

Conspicuous among the subjects were: "The Aluminum Electrolytic Condenser," by C. Irving Zimmerman; "Reversible and Irreversible Electrolytic Polarization," by Prof. W. S. Franklin and L. A. Freudenberger, and "The Edison Storage Battery," by Dr. M. DeKalb Thompson, on the opening day; "Electrolytic Precipitation of Chromium," by Prof. H. R. Carveth; "Electrodeposition of Metals on Aluminum," by A. Lodyguine; "On the Utilization of Blast Furnace Gases in Connection with Electric Smelting," by A. J. Rossi, and "Conduction in Electrolytes," by Dr. J. W. Richards, on the second day; and "Colloids," by Dr. W. R. Whitney; the "Mercury Arc," by Dr. E. Weintraub; "Electric Arcs," by Dr. W. R. Whitney; "An Electrolytic Switch," by W. S. Horry; "Silicon," by F. J. Tone; and "The Microstructure of Silicon and Silicon Alloys," by A. B. Albro, on the third day. An interesting situation developed in connection with Mr. Horry's paper when it was suggested that a fellow member, Herbert H. Dow, had taken out patents covering the principles illustrated in the apparatus shown by Mr. Horry. Mr. Dow, being present, was called upon to verify the statement, and said that he believed his patents did cover the specifications practically as they are set forth by Mr. Horry.

The president passed the comment at this juncture that the association could not anticipate the action of the courts in such a case, but concerns itself simply with the scientific conclusions rather than the legal ones. Mr. Rossi's address on the second day was discussed by several of the speakers and really evoked more controversy than any other submitted. Mr. Dow took exceptions to Mr. Rossi's estimate of the importance of the saving economy possible by the processes that were referred to by him. He believed that coal was too cheap to make it worth while to incur the expense involved in utilizing the so-called waste gases on a large scale. Dr. Richards, on the other hand, sustained the view taken in the paper and predicted the speedy arrival of the time when the larger producers, who are working always toward greater economy in operation and further prevention of waste, will take account of the possibilities suggested by Mr. Rossi's paper. Remarks supplementary to Mr. Tone's paper on "Silicon" were made by Elihu Thomson and others.

[Some of the papers, in full or in abstract, are published elsewhere in this issue, or will be published in future issues, of the Western Electrician.]

### President Carhart's Address on the Theory of Electrolysis.

The presidential address, delivered Tuesday evening in the lecture hall of the Lowell Building, was on the subject of "Revisions of the Theory of Electrolysis."

"No subject in the whole domain of theoretical electricity," said President Carhart, "possesses more interest to the electrochemist than the theory of the decomposition of aqueous solutions of salts and acids through the agency of an electric current. For more than a hundred years scientific attention has been converged on it, for it has presented problems both of unusual interest and unusual difficulty."

The speaker traced the history of the subject comprehensively from the earliest record, dating back of the invention of Volta's dry pile and crown of cups, and told how the decomposition of water by electricity [illegible] and Deiman, in 1789. [illegible] water in a narrow glass tube between gold wires whose ends were [illegible] apart.

"Volt's disclosure of his invention was made in a letter to Sir Joseph Banks, president of the Royal Society of London, dated March 20, 1800.

"Although they expected decomposition of water, observers and experimenters of the time were not prepared for the astonishing fact that, while hydrogen appeared at the exposed end of one of the wires the oxygen appeared only at the end of the other, nearly two inches distant. This new phenomenon was to its discoverers inexplicable. They made the very relevant and acute remark that this new phenomenon 'appears to show, perhaps, a general law of the action of electricity in chemical processes.'

"The explanation of this remarkable fact has ever since engaged the attention and best endeavors of science. It has perhaps only within our day been happily solved."

Cruikshank, Davy and Grotthus and their work were discussed in sequence.

"From the time of Grotthus there was a long pause of 50 years in the theory of electrolysis," said the speaker, "for no important step was taken until Clausius in 1857 published his profound modification of the Grotthus theory.

"The ideas of Clausius are so fundamental in the modern theory of electrolysis that I have thought it best to translate them freely rather than to paraphrase them. Clausius belongs to our own day. The gray hair and benign expression of this beautiful old man made a lasting impression on me as I saw him at the International Electrical Congress in Paris in 1881.

"The first attempt to answer the question as to the manner in which the facts of electrical conductivity are reconciled with those of general chemistry was contained in the theory of Grotthus; the second attempt was made by Clausius in 1857, and 30 years later a further answer was made in the work of Arrhenius.

"The transition from the incidental and almost infinitesimal dissociation assumed by Clausius to the ideal infinite dilution and complete dissociation taught by the 'Leipsic School' marks the essential revision of the theory of electrolysis made in recent years.

"The theory of ionization has now passed beyond the bounds of electrolytic solutions. As Van't Hoff imported the gas law into solutions to explain osmotic pressure, so others, like J. J. Thomson, have seized on electric convection by ions to explain electrical discharges through gases. It is now conceded that the only tenable explanation of electric currents through gases is that of convection by ions. The ionization of gases is brought about by ultra-violet light, by Roentgen rays, and by the radiations from radio-active substances. The electric charge conveyed by ions in gases appears to be identical with the charge conveyed by ions in an electrolyte in aqueous solution, but the masses conveying negative charges are only about one-thousandth part of the hydrogen ion.

"The passage of electricity through a gas, as well as through an electrolyte, is accompanied by chemical changes; and chemical decomposition, says J. J. Thomson, is not to be considered an accidental attendant on the electrical discharge, but an essential feature without which it could not occur.

"In reviewing the changes that have occurred in the theory of electrolysis, I would not be understood to imply that we now have the ultimate truth. Many cogent objections have been urged against the theory of dissociation in its present form. Theories should be regarded as helps or scaffolds only; they are necessary for the construction of the edifice of truth, and they finally disappear like the staging. We should use them as temporary expedients, not retaining them till the whole edifice is completed, but only until a grand arch is finished, some minaret or tower emerges against a clear sky, or light streams through some noble window.

"The physicist or chemist who is more intent to ascertain the truth than to preserve its consistency, holds to a theory no longer than he finds it able to furnish support. Faraday, the prince of research, said that experimental work is a great disturber of preconceived theories.

"Just now the dissociation theory is in a state of siege, with many valiant defenders. The objection is urged that there are many cases of electrolytes in solution in which the osmotic pressure does not exceed that required by the gas law. Hence there can be no dissociation. Also, that the simplest cases of electrolysis are those of a molten salt, such as silver electrodes in molten silver chloride. In these cases there is no complication with a solvent and no dissociation by solution. In what way, then, is that migratory freedom of the electrically charged part-molecules, which is assumed in the theory of dissociation, secured in a molten salt? Dr. Kahlenberg has shown that 'a normal solution of trichloracetic acid in allyl mustard oil is a poorer conductor of electricity than [illegible] ductivity.

[illegible] point in the general ionic theory is the migratory [illegible]

[illegible] and not infrequent refrain of the later recessional. [illegible] we are destined to struggle forever with the unsolved problems of the here and the hereafter.

"It is often darkest just before the dawn. Sometimes, too, we emerge into the light with a suddenness that blinds before the eye adjusts itself to the new illumination. One dreary day in April I took the train in Switzerland over the St. Gotthard route. We entered the north end of the tunnel at Goeschenen with a clouded sky and snowflakes swirling through the air. Ten minutes passed in the darkness, a thousand feet below the village of Andermatt—fifteen, seventeen—and then the train ran out on the Italian side of the great divide at Airola into a burst of sunshine and clear sky and white-capped Alpine peaks and tempered winds and the pale green of olive groves. So sudden was the transformation that an involuntary exclamation of surprise ran through the train.

"The experiences of the last 20 years warn us that we must be prepared for similar surprises in the illumination that physical science is shedding on the world of nature. We need not prophesy; we need only work and wait."

### Amendments to Constitution and Other Business.

The session in the lecture hall of the Pierce Building at Harvard University on Wednesday was devoted in part to business attendant upon the annual meeting of the society. Amendments to the constitution, previously proposed, introduced mainly for the purpose of obviating the necessity for consuming much time at the annual meetings in the routine of electing officers, counting ballots, etc., were adopted. The changes made were as follows:

Article IV. was amended as follows:

Section 2: Words "annual meeting" to be stricken out, and "16th day of March" substituted.

Section 3: Words "annual meeting" to be stricken out, and "by the 16th of March" substituted.

Article VI.—Substitute the following for the present articles:

Election of Officers.—The secretary shall send nominating blanks to all members not later than the 1st of January. Nominations, not necessarily upon these forms, will be received by the secretary not later than the 1st of February. He shall mail to every member, before February 16, a printed list of all candidates thus nominated, who have received more than five per cent. of the number of valid nominating ballots cast. The voting need not be restricted to the names on this list. The board of directors may endorse those whom they wish to recommend, and, if so, the published list shall state it. The voting shall be by secret letter ballot; the voter shall sign his name on an outside envelope, and the ballot shall be enclosed in an inner sealed and unmarked envelope. Ballots must reach the secretary before the 16th day of March. The results of the elections shall be announced at the annual meeting.

2. At the directors' meeting, to be held in February or March, the board of directors shall appoint three tellers, who shall not be members of the board of directors, and three alternates. Should this directors' meeting not be held, the president shall appoint these tellers, who shall be notified by the secretary.

3. The tellers shall meet as soon after the 15th day of March as possible. The secretary shall deliver to the tellers all ballots received by him, shall mark the outside envelopes received from members not entitled to vote. The tellers shall open only the envelopes not thus marked, and shall proceed in secret to count the valid ballots. All ballots and unopened envelopes shall be returned to the secretary, who shall preserve them for one month. At the end of one month the secretary shall return to the senders all rejected envelopes, and shall open all unidentified envelopes. Cumulative votes shall count as one vote. The tellers shall prepare and sign a report of the results, which shall be sealed and shall remain in the possession of the chairman of the tellers, who shall hand this report to the presiding officer at the ensuing annual meeting. The presiding officer shall then cause this report to be read, and shall declare duly elected the eligible persons receiving the greatest number of votes for the respective offices.

Article VIII.—Meetings. Section 1 was changed to read:

1. The annual meeting shall be held during the last week of March or in April. Business affecting the organization of the society shall be transacted only at the annual meetings. Proxy or mail votes shall be received.

Secretary S. S. Sadtler submitted his annual report at this meeting also. It covers the period from April 7, 1904, to April 25, 1905, and shows a net gain of 28 in the membership, the total number a year ago being given as 561; applications passed upon since the last annual meeting, 60; resignations during the year, 28; deaths, four.

"It will be noticed," the secretary adds, "that during the year, as might have been expected, the number of applications has fallen off. It would have been practically impossible to have kept up the same rate of accessions as had taken place during the first and second years of the existence of the society. It is a fact, however, that the members coming in at this time are more closely identified with electrochemical interests than many who

had joined at first, and the growth, although small, is a healthy one.

"The chief element which will contribute to strengthening the position of the American Electrochemical Society in the future will be the character of the papers, presented at its meetings, and subsequent publication thereof. It is, therefore, hoped that the members will be loyal to the society in contributing the results of their researches and industrial accomplishments, believing it will be to our mutual advantage.

"It has been noticed recently by the secretary that the transactions have been in active demand by libraries, which shows that our publication is accepted on its merits."

The committees on publication and on papers also reported. The latter committee states that 44 papers have been printed in the transactions in 1904, as compared with 45 in 1903 and 42 in 1902.

The report of the financial condition of the society showed the substantial bank balance of $3,617.67.

SOCIAL FEATURES.

Incidental to the convention were the afternoon and evening programmes, when receptions, visits to points of interest and noted industrial plants, and other informal gatherings heightened the pleasures of the annual gathering. On Tuesday most of the members and their guests, including the ladies of the party, lunched at the Technology Club, by invitation of President H. S. Pritchett of the Institute of Technology. Tuesday afternoon the members had a special trip to the General Electric works at Lynn. Tuesday evening, after the presidential address by Dr. Carhart, there was a smoker at the Hotel Lenox for the members. Wednesday noon at the Harvard Union there was a luncheon, on invitation of President Charles W. Eliot of Harvard University, who has recently returned from Europe, and in his address to the visitors, welcoming them to Harvard, took occasion to contrast the status of the scientific schools connected with American universities with that of the scientific schools abroad, laying special emphasis upon the efforts that are made here to elevate the standard of the technical graduates to the level of the medical, legal and divinity professions. A visit to the various university buildings and a trip to the New England Gas and Coke Works at Everett were scheduled for Wednesday afternoon. Thursday noon there was another luncheon at the Technology Club, followed by an inspection of the Technology buildings. A trip to Wellesley College was also one of the events for the ladies of the party.

The banquet at the Hotel Lenox on Wednesday evening was an exceedingly enjoyable social affair, with about 40 participants. The speechmaking was quite informal, remarks being made by President Carhart, Dr. Joseph W. Richards, Dr. William H. Walker, Carl Hering and Dr. Wiley of Washington. Prof. A. E Kennelly was toastmaster.

NEW OFFICERS AND ATTENDANCE.

When the members assembled in the lecture hall for the final session on Thursday morning, the result of the election was announced as follows:

President—Wilder D. Bancroft, Ithaca. N. Y.

Vice-presidents—E. F. Roeber, New York; Carl Hering, Philadelphia; Louis Kahlenberg, Madison, Wis.

Managers—Charles A. Doremus, New York; C. P. Townsend, Washington, D. C.; W. R. Whitney, Schenectady, N. Y.

Secretary—S. S Sadtler, Philadelphia.

Treasurer—Pedro G. Salom, Philadelphia.

Among those registered for the session were:

Henry S. Carhart, Ann Arbor, Mich.; Dr. Joseph W. Richards, Bethlehem, Pa.; S. S. Sadtler, Philadelphia; H. P. Talbot, Boston (M. I. T.); W. H. Walker, Boston (M. I. T.); A. C. Melcher, Newton Center, Mass. (M. I. T.); M. deKay Thompson, Jr., Boston (M. I. T.); Carl Hering, Philadelphia; N. L. Amster, Boston; C. Irving Zimmerman, Pittsburg; Frank D. Easterbrooks, Germantown, Pa.; Philip B. Sadtler, Germantown, Pa.; H. E. Heath, Lynn, Mass.; F. Austin Lidburg, Niagara Falls; A. B. Albro, New York; Frederick P. Sedgwick, New York; E. F. Roeber, New York; W. S. Franklin, Bethlehem, Pa.; W. H. Kimball, Portland, Me.; W. R. Whitney, Schenectady, N. Y.; William Hand Browne, Jr., New York; F. E. Schmitt, New York; Charles Field III., Chestnut Hill; Yogoro Kato, Kyoto, Japan (M. I. T.); Olive M. Wallace, Cambridge, Mass; A. von Isakovics, Monticello, N. Y.; Auguste J. Rossi, New York; F. J. Tone, Niagara Falls; Clinton P. Townsend, Washington; Mrs. Joseph W. Richards, Bethlehem, Pa.; Ray Hill White, Boston; E. J. Hutchinson, Cincinnati; Edward R. Taylor, Penn Yan, N. Y.; Mrs. Taylor; R. Fleming, Lynn; A. H. Gill, Boston (M. I. T.); A. Lodyguine, New York; S. E. Whiting, Cambridge, Mass.; A. E. Kennelly, Cambridge; H. M. Goodwin, Boston; W. O. Snelling, Washington; Mrs. Martha L. Griffin, Mechanicville, N. Y.; Geneva B. Davidson, Melrose, Mass.; William Smith Horry, Niagara Falls, N. Y.; Edmund S. Smith, Niagara Falls, N. Y.; Henry S. Blackmore, Mount Vernon, N. Y.; Mrs. Blackmore, Mount Vernon, N. Y.; H. R. Carveth, Niagara Falls, N. Y.; Gust. Drobegg, New York, N. Y.; Edward F. Kern, Troy, N. Y.; C. C. Speiden, New York; T. J. Clexton, Boston; Max A. Claflin, Boston; H. W. Wiley, Washington; W. McA. Johnson, Washington; E. A. Sperry, Cleveland; H. T. Matthew, New York; G. W. Coggeshall, Boston; M. L. Griffin, Mechanicsville; Hubert Buckley, Niagara Falls; Charles A. Kraus, Boston (M. I. T.); Elihu Thomson, Swampscott; Henry Noel Potter, New York; A. W. Smith, Cleveland; H. H. Dow, Midland, Mich.

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Louis Hessig, J. H. Hessig and H. H. Hessig have incorporated the Klamath Telephone and Telegraph Company, with principal place of business at Klamath Falls, Wash. The capital stock is $15,000.

## Gas and Electric-light Bills Before Illinois Legislature.

Gas and electric-lighting interests in Illinois have their attention still fixed on Springfield. Two new bills, one to give Chicago power to sell electricity for light, heat and power purposes, and one aiming to give all cities and villages in the state the power to regulate the price to be charged by private corporations for gas and electricity, have been reported out by committees and have created much interesting discussion on their way to passage or defeat. At this writing one of the bills has passed the House and the other advanced to third readings, and it is urged by their supporters that they be passed by the Senate before the adjournment scheduled for May 6th.

The bill giving villages and cities the power to regulate gas and electric-light rates carried with it from the committee an amendment which, it seems, was intended to delay legislation with the hope of adjournment, as both sides are opposed to the provisions of the amendment, which reads:

Provided that such rates shall be fixed after a full and fair investigation, at which the company shall be represented by its proper representatives. The rates fixed shall be for a period not exceeding three years, such rates to be fair and reasonable, allowing, first, for the cost of conducting the business in a first-class manner, and, second, a fair profit above such cost.

The amendment was just what the companies did not want, because it permitted rates to be changed every other day if the City Council should see fit. It was not what the cities wanted, because it required an investigation with such formality that a commission might as well have been appointed.

The bill to allow Chicago to sell its surplus electricity was delayed several times because of objections from members asserting that it was a straight municipal-ownership bill in disguise. An amendment to the bill to make it apply to the state at large, instead of to Chicago alone, was offered, but, after an hour's debate, was defeated, and later reconsidered. An amendment was proposed by some of the republicans opposed to municipal ownership. This was to provide that there should be no sale of surplus electricity until the streets of the city have been lighted. The amendment will take the life out of the bill effectually, as it will be recognized as impossible to light all the streets of Chicago with the present financial resources of the city. A compromise was reached whereby the amendment will provide that there shall be no sale of "surplus" while there are any demands for an extension of street lighting.

During last week Mayor Dunne and others of Chicago, together with representatives of other cities, met the representatives of gas and electric companies in the Hall of Representatives where a hearing was conducted. The private companies were represented principally by Attorneys Meagher and Beale, representing the People's Gas Light and Coke Company, the Ogden Company and the Chicago Edison Company. In the course of his argument, Mr. Beale, counsel for Chicago Edison Company said: "I admit the right of the state to regulate such companies as that I represent. I may differ with others as to the manner in which such regulation shall be undertaken. For several years such bills as these we are now considering have been before the Legislature. They never have been pressed and we never thought it necessary to come down here. It is probable that nothing more would have come of these bills if it had not been for an unfortunate happening last week. At that time a newspaper in Chicago undertook to do something which might be called stirring up the animals. Thereupon there ensued an outcry on the part of certain elements in Chicago. This did not come from the people. I look around me in vain for an uprising of the people. I see certain men who represent nothing but themselves. I see no representation of the tax-paying people. Mr. Fisher [of the Municipal Votrs' League] represents a certain something, and I give him credit for sincerity in what he says. I will not assail Mr. Fisher, although I may assail his views. Mr. Fisher unfortunately does not know what he is talking about. It happens that I do. I do not hold, with Mayor Dunne, that commissions are failures. I don't believe that corruption or anything else makes the work of the interstate commerce commission unsatisfactory or the work of the railroad and warehouse commission ineffective.

"For the purpose of regulating such companies as that which I represent I should suggest a commission, in which the company would have representation, a commission of three, one of which would be appointed by the mayor, another by the company, and a third by the other two."

"If you want an illustration of the monumental folly of municipal ownership look at the water works of Chicago. You doubtless have read something of this attempt at municipal ownership in one of the Chicago papers. Pick up your Chicago paper tomorrow morning and see what the Health Department says about this water. Nobody reads it, but there it is. Suspicious, bad, fair, etc. What city would stand for such conditions, if a private concern had the plant?"

Mr. Beale closed by saying: "I have admitted that such companies as we represent need control. I represent only the Chicago Edison Company, and have no interest in the two gas companies except such as is aroused by the fact that we are attacked together in this bill. I may say for the gas companies that gas cannot be sold in Chicago for 75 cents, but these companies have their own representatives to state their case. Admitting that control of natural monopolies is necessary it yet remains to determine the method of control, and hasty legislation is not calculated to determine it. Here we are in the closing days of the Legislature trying to settle this proposition by snap judgment. We, the representatives of these corporations, ask that you use deliberation. It is not a subject which you can settle in a few days' consideration, and we ask that you give it the attention it needs."

Several other men spoke, after which adjournment was taken. It is asserted that legislation of some sort will be enacted this week, otherwise, it is declared by some that a special session of the Legislature is taken from the report.

## Annual Report of the General Electric Company.

Last week the General Electric Company issued its thirteenth annual report, covering its business for the year ended January 31, 1905. As usual, the report consists of the president's summary and more detailed reports regarding sales, manufacturing and engineering and finances. What follows is taken from the report.

PRESIDENT C. A. COFFIN TO THE STOCKHOLDERS.

The profits of your company for the past year (including $281,927.34 from securities sold, and $465,716.73 from royalties, dividends, sundry profits, etc.), after deducting all general and miscellaneous expenses and allowances for depreciation and losses, and writing off $593,624.08 from patent account, and $1,778,491.87 from factory plants and machinery, were ..... $6,719,545.78

Less net debit to profit and loss in revaluing the assets of the Stanley Electric Manufacturing Company and other acquired interests..... 759,654.05

| | |
|---|---|
| | $5,959,891.73 |
| Paid in dividends during the year..... | 3,684,384.00 |
| Surplus for the year..... | $2,275,507.73 |
| Amount of surplus at the end of last fiscal year was..... | 7,293,688.75 |
| Total surplus January 31, 1905..... | $9,569,196.48 |

The sales billed by your company to its customers for the last year were about $2,500,000 less than for the previous year, showing a shrinkage in business done of about six per cent.

It will be observed that the amount written off factory plants is substantially 60 per cent. of the cash expended thereon during the year. It is expected that expenditures of this nature will be smaller during the current year than in either of the two previous years.

SALES (VICE-PRESIDENT EUGENE GRIFFIN).

Sales and Orders.—The total sales (amount billed to customers) during the year were $39,231,328; the total orders received were $35,094,807. A comparison with the five previous years is as follows:

| Year Ending Jan. 31. | Amount Billed. | Orders Received. |
|---|---|---|
| 1900 | $22,379,463 | $26,323,626 |
| 1901 | 28,783,275 | 27,669,541 |
| 1902 | 32,318,036 | 34,350,840 |
| 1903 | 36,685,508 | 39,944,454 |
| 1904 | 41,699,617 | 39,060,938 |
| 1905 | 39,231,328 | 35,094,807 |

Contracts.—Among the important contracts are contracts with the New York Central railroad for 30 90-ton electric locomotives, for 40,000-kilowatt capacity steam turbines, for entire switchboard plants for the Mount Morris and Yonkers power stations, contracts with the Public Service Corporation of New Jersey for steam turbines and rotary converters, with complements of transformers, switchboard apparatus, etc.; contracts with Interborough Rapid Transit Company of New York city, for additional control equipments and motors for operation of the subway trains; contracts for car equipments with the New York City Railway Company, the Philadelphia Rapid Transit Company, the Chicago Union Traction Company, the Boston and Northern Street Railway Company, the Old Colony Street Railway Company, the United Railroads of San Francisco and other traction and street-railway companies; contracts for generators to develop waterpowers in 10 of the United States and in Mexico and other foreign countries; contracts for 154 steam turbines with 86 corporations and individuals.

Curtis Steam Turbines.—On February 1, 1905, we had sold a total of 289 Curtis turbines capable of generating in daily operation from 450,000 to 500,000 kilowatts. Ninety per cent. of all turbines installed and in actual operation November 1, 1904 (three months prior to the close of the fiscal year), have been accepted by the customers and payments made.

We have sold a large number of these turbines to various customers in Canada, Europe, South Amer-

[illegible], Japan, New Zealand, Mexico and other parts of the world.

Sprague General Electric Control [illegible] in this business [illegible] as follows:

Total number of cars equipped [illegible]
Total number of cars equipped [illegible]

Steam Railroad Work.—The first high-speed passenger locomotive for the New York Central railroad has been thoroughly tested with [illegible] results. The electrical work of the New York Central railroad has excited much interest among the officials of other railroads, and from the numerous inquiries and requests for plans and estimates which we receive it is evident that we are entering upon a most interesting phase of electrical development in connection with steam railroads and that it will not be many years before all suburban trains in the vicinity of our large cities will be operated by electric power.

Current Orders.—During the year we received about 187,350 separate orders (not including contracts), an average of 624 per working day. The average orders per day indicate the growth of the business as follows: Year ended January 31, 1900, 473; 1901, 500; 1902, 533; 1903, 541; 1904, 570; 1905, 624.

Organization.—While our total business was less in 1904 than in 1903 in money value, the number of contracts and orders was greater, resulting in more work for the organization. Where a customer placed one large order in 1903, he placed several small orders in 1904; where a customer promptly decided on his requirements in 1903, he asked for and considered many alternate propositions in 1904. More work for the same volume of business was required of our salesmen, engineers, manufacturers and managers in 1904 than in 1903. The selling organization has cheerfully and efficiently met this extra demand with but little increase in numbers and has continued to render the most zealous and loyal service.

Manufacturing and Engineering (Vice-President E. W. Rice, Jr.).

Manufacturing.—About $2,000,000, exclusive of the cost of patterns, special tools, etc., has been expended during the year for real estate, erection of new factories, extensions to existing buildings and for additional machinery.

The following table shows approximately the floor space and the number of employes during the past five years:

| | Floor Space. | Employes. |
|---|---|---|
| 1901 | 2,300,000 | 12,000 |
| 1902 | 2,500,000 | 15,000 |
| 1903 | 3,000,000 | 18,000 |
| 1904 | 3,700,000 | 17,000 |
| 1905 | 4,100,000 | 18,000 |

The lands of all three plants now amount to about 425 acres. The total book value of the land and buildings of the Schenectady, Lynn and Harrison factory plants is $4,593,812.88, or about $1.12 per square foot of manufacturing floor space.

Schenectady Works.—The machine shop of 237,000 square feet, for the manufacture of steam turbines, mentioned in the last report, has been completed and partially occupied.

A few minor additions and extensions have been made in different parts of the plant.

Lynn Works.—The machine shop and power house of 137,000 square feet floor space, referred to in the last report, is substantially completed and is now occupied. A number of minor additions to the plant have been made during the year, amounting in all to approximately 5,000 square feet.

Harrison Works.—Only a few minor additions, aggregating 1,100 square feet, have been made during the year.

Engineering.—Engineering effort has, as in the past, been largely devoted to the extension, improvement and cheapening of our established lines of apparatus.

The commercial success of long-distance transmission systems is generally recognized and the number of such undertakings has increased. We have now on order apparatus for nine installations employing currents at 60,000 volts or over and transmitting electricity from 47 to 100 miles. One of the recent and interesting installations is that of the Mexican Light and Power Company, Mex[illegible] supplied this company with 31 transformers of [illegible]

[illegible] motors. One interesting instance is that of the high-speed electric motor centrifugal pump, which promises to replace the steam pump for supplying water to cities. This electric pump occupies about [illegible] efficient than the present steam pump.

Our line of steam-turbine generators has been extended and improved and a large number of important installations were made during the year. The New York Central railroad [illegible] 5,000-kilowatt turbo-gnerators for supplying the electric energy for that portion of its road between Croton and the Grand Central Station, which it is proposed to electrify. The vertical type which we developed for large units, largely because of its economy of space, has been uniformly successful and reliable. The few difficulties which we naturally encountered on account of the newness of the art have been gradually overcome. Because of its high speed and rotary motion the steam turbine is peculiarly adapted to the operation of electric generators. The combined turbo-generator has such manifold advantages in economy, reliability, simplicity and low cost that it is certain to replace all other forms of steam engines in generating electricity.

The first of the locomotives built for the New York Central railroad was subjected to its initial tests on the Central tracks west of Schenectady on October 27, 1904. The locomotive was tested in daily operation under all conditions for several months. It attained a speed of 52 miles an hour with a 550-ton train and 69½ miles per hour with a 265-ton train. These are official figures with a four-mile track. After the track was extended to six miles, unofficial tests showed a speed of 75 miles per hour.

The tests were satisfactory in all respects.

Our new alternating-current railway motor has been successfully employed on two tramways and a number of additional orders have been received. This novel form of motor is under certain conditions cheaper and more economical than our standard direct-current motor, and the field of electric traction will be extended by its use.

We have succeeded in still further improving the design and reducing the cost of our standard switchboard devices, and as heretofore have obtained the bulk of orders in this important line.

Our inventors have been actively at work for several years to discover more efficient and better methods of electric illumination than the present carbon arc and incandescent lamp. As a result, this last year we have introduced the "magnetite" arc lamp, which gives a light equal to the present carbon arc with about one-half the consumption of energy and have also made important improvements in the economy of the incandescent lamp.

Our engineers have been successful in the improvement of the different lines of our small articles of manufacture, such as meters, instruments, switches, controllers, etc.

Letters patent covering new and important designs have, as usual, been applied for.

It is a great pleasure to heartily commend the work of our engineers and factory managers.

Financial Report.

The financial report of Treasurer H. W. Darling is summarized in the consolidated balance sheet and consolidated profit-and-loss account herewith presented in facsimile. During the year there was expended in acquiring sundry patents and in patent litigation $593,624.08. This amount has been charged to profit and loss, leaving the company's patents, franchises and good-will standing at $2,000,000, the same as at January 31, 1904.

The total book cost of the factory plants is over $21,000,000, but over $13,500,000 has been written off for depreciation, leaving the total book value on January 31, 1905, $7,500,000.

The total par value of all stocks and bonds [illegible] way companies owned or controlled by the General company, and which will be liquidated as the securities of these companies are sold.

The company has no note payable.

The total debentures outstanding at the date of the balance sheet amounted to $2,[illegible].

At the same date the total capital stock outstanding was $48,247,943.33.

During the year the entire floating indebtedness of the Stanley Electric Manufacturing Company has been paid off.

**Consolidated Balance Sheet of January 31, 1905**

| Assets | | |
|---|---|---|
| Cash | | $6,829,118 89 |
| Stocks and Bonds | $14,[illegible] 10 | |
| Real Estate (other than factory plants) | [illegible] | |
| Notes and Accounts Receivable | [illegible] | |
| Work in Progress | [illegible] | |
| | [illegible] 33 | |
| Merchandise Inventories | | |
| At Factories $10,330,737 40 | | |
| At General and Local Offices 1,214,181 76 | | |
| Consignments 143,[illegible] 41 | | |
| | 11,[illegible] 64 | |
| | | 45,605,220 43 |
| Factory Plants | 7,500,000 00 | |
| Patents, Franchises and Goodwill | 2,000,000 00 | |
| | | 9,500,000 00 |
| | | $61,634,345 32 |

| Liabilities | | |
|---|---|---|
| [illegible] Debentures | [illegible] | |
| [illegible] | [illegible] | |
| [illegible] Interest [illegible] | [illegible] | |
| Accounts Payable | [illegible] | |
| [illegible] Dividend | [illegible] | |
| | | $3,479,205 31 |
| Deferred Liability on Account of [illegible] Patent [illegible] February 1, 1906 | | 342,000 00 |
| Capital Stock (see page [illegible]) | | 48,247,943 33 |
| Surplus | | 9,569,196 48 |
| | | $61,634,345 32 |

E. & O. E. HENRY W. DARLING, *Treasurer*
EDWARD CLARK, *General Auditor*

**Consolidated Profit and Loss Account of January 31, 1905**

| Expenses | | Earnings | |
|---|---|---|---|
| Cost of Sales | $33,524,131 84 | Sales | $39,231,430 23 |
| Interest on Debentures | 79,672 14 | [illegible] | 810,[illegible] 21 |
| Profit for the current year | 6,719,849 78 | [illegible] | 281,927 24 |
| | $40,323,353 78 | | $40,323,353 78 |
| [illegible] Stanley Electric Manufacturing Company and other acquired interests | 759,[illegible] | Surplus brought over from last year | 7,293,[illegible] |
| Dividends paid [illegible] | 3,684,584 00 | Profit for the year ending January 31, 1905 | 6,719,849 78 |
| Surplus at January 31, 1905, carried forward to next year | 9,569,196 48 | | |
| | $14,013,234 93 | | $14,013,234 93 |

E. & O. E. HENRY W. DARLING, *Treasurer*
EDWARD CLARK, *General Auditor*

ANNUAL REPORT OF THE GENERAL ELECTRIC COMPANY.

## Result of Public Lighting Inquiry in New York.

The legislative committee charged with the investigation of the cost of lighting in New York city has reported several recommendations and has prepared bills designed to carry its recommendations into effect. It suggests that the maximum price of gas should be reduced to 75 cents a thousand cubic feet, and the maximum price of electrical energy from 15 to 10 cents a kilowatt hour. It is proposed to establish a public service commission of three members to have complete control of electric-light and gas companies, and all new franchises. Meters are to be inspected by the city officials.

The report recommends that it be illegal for one public-service corporation to hold the stock of another corporation in the same line of business. The city may use any surplus waterpower for generating current, but may not acquire waterpower for the express purpose of electrical generation. The committee also recommends that the city of New York shall be assisted in building its proposed municipal electric-light plant.

Besides the above recommendations the committee's report makes others along the line of giving the proposed new state public-service commission authority to fix the standard of light to be furnished and to make rules regulating the pressure of air through the gas pipes.

## New Members of the Institute.

Among the associates elected to membership in the American Institute of Electrical Engineers on April 28th, were the following named:

Harry L. Bachman, [illegible], Taft & Co., Columbus, O.; Edward H. Banes, Central Union Telephone Company, Indianapolis; Magnus Beckman, [illegible], Sweden; L. P. Coulter, Cutler-Hammer Manufacturing Company, Milwaukee; Isidor Deutsch, Electric Controller and Supply Company, Cleveland, O.; Ernst Watson Farley, [illegible] Power Company, Niagara Falls, N. Y.; Russell [illegible] Feicht, Westinghouse Electric and Manufacturing Company, Pittsburg, Pa.; Louis Friedmann, General Incandescent Arc Light Company, Chicago, Ill.; William R. Garton, W. R. Garton Company, Chicago, Ill.; George Gibbs, Westinghouse, Church, Kerr & Co., New York city; Henry Charles Harris, Ohio Inspection Bureau, Columbus, O.; Frank Fairchild Kinney, Chicago Edison Company, Chicago, Ill.; Nathan [illegible], Fort Wayne Electric Works, St. Louis, Mo.; Norman Malcolm, with L. W. Stanton, Chicago; Coleman Evan Nutter, Atchison, Topeka anl Santa Fe Railway, Topeka, Kan.; Hiroyoshi Oshima, Osaka Electric Light Company, Osaka, Japan; Thomas [illegible] Perkins, Westinghouse Electric and Manufacturing Company, Pittsburg, Pa.; Harry Curtis Rice, Stanley Electric Manufacturing Company, Pittsfield, Mass.; Wray Thompson Thorn, Northwestern Elevated railway, Chicago, Ill.; Theodore Varney, Westinghouse Electric and Manufacturing Company, Pittsburg, Pa.; Frank Wenner, Iowa State College, Ames, Ia.; Arthur Symes Wheeler, University of California, Berkeley, Cal.; Brent Wiley, Wellman-Seaver-Morgan Company, Cleveland, O.; Joseph Lester Woodbridge, Electric Storage Battery Company, Philadelphia, Pa.

## Tesla's Method of Transmitting Electrical Energy Through Space.

Nikola Tesla of New York city, who, as is well known, has done much work of an original nature in the direction of the transmission of electrical energy through space, has recently been granted a patent (No. 787,412, April 18, 1905) upon such a method for the propagation of energy. The title of the patent is "Art of Transmitting Electrical Energy Through the Natural Mediums." Application for it was made May 16, 1900, and renewed June 17, 1902.

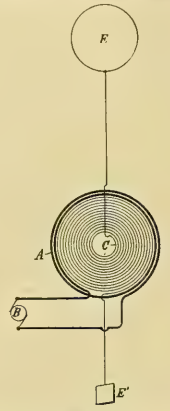
A fact now of common knowledge is that when electrical waves or oscillations are impressed upon such a conducting path as a metallic wire, reflection takes place, under certain conditions, from the ends of the wire, and in consequence of the interference of the impressed and reflected oscillations the phenomenon of "stationary waves" with maxima and minima in definite fixed positions is produced. The existence of these waves indicates that some of the outgoing waves have reached the boundaries of the conducting path and have been reflected therefrom. Mr. Tesla has been led to believe from his observations that notwithstanding its vast dimensions the terrestrial globe may in a large part or as a whole behave toward disturbances impressed upon it in the same manner as a conductor of limited size.

In the course of certain investigations which he carried on for the purpose of studying the effects of lightning discharges upon the electrical condition of the earth it was observed that sensitive receiving instruments arranged so as to be capable of responding to electrical disturbances created by the discharges at times failed to respond when they should have done so, and upon inquiring into the causes of this unexpected behavior it was discovered to be due to the character of the electrical waves which were produced in the earth by the lightning discharges, and which had nodal regions following at definite distances the shifting source of the disturbances. From data obtained in a large number of observations of the maxima and minima of these waves their length has been found to vary approximately from 25 to 75 kilometers, and these results and certain theoretical deductions led Mr. Tesla to the conclusion that waves of this kind may be propagated in all directions over the globe and that they may be of still more widely differing lengths, the extreme limits being imposed by the physical dimensions and properties of the earth.

Recognizing in the existence of these waves an unmistakable evidence that the disturbances created had been conducted from their origin to the most remote portions of the globe and had been thence reflected, the idea was conceived of producing such waves in the earth by artificial means with the object of utilizing them for many useful purposes for which they are or might be found applicable. This problem was rendered extremely difficult, owing to the immense dimensions of the planet, and consequently enormous movement of electricity or rate at which electrical energy had to be delivered in order to approximate, even in a remote degree, movements or rates which are manifestly attained in the displays of electrical forces in nature and which seemed at first unrealizable by any human agencies. But by gradual and continuous improvements of a generator of electrical oscillations, for which Mr. Tesla had previously obtained a patent, he finally succeeded in reaching electrical movements or rates of delivery of electrical energy which he believed not only approximated, but, as shown in many comparative tests and measurements, actually surpassed those of lightning discharges, and by means of this apparatus he found it possible to reproduce, whenever desired, phenomena in the earth the same as or similar to those due to such discharges.

In the figure, (A) designates a primary coil forming part of a transformer and consisting generally of a few turns of a stout cable of inappreciable resistance, the ends of which are connected to the terminals of a source of powerful electrical oscillations, diagrammatically represented by (B). This source is usually a condenser charged to a high potential and discharged in rapid succession through the primary. But when it is desired to produce stationary waves of great lengths an alternating dynamo of suitable construction may be used to energize the primary. A spirally wound secondary coil (C) within the primary has the end nearer to the latter connected to the ground (E') and the other end to an elevated terminal (E). The physical constants of coil (C), determining its period of vibration, are so chosen and adjusted that the secondary system (E' C E) is in the closest possible resonance with the oscillations impressed upon it by the primary. It is, moreover, of the greatest importance in order to still further enhance the rise of pressure and to increase the electrical movement in the secondary system that its resistance be as small as practicable and its self-induction as large as possible under the conditions imposed. The ground should be made with great care, with the object of reducing its resistance. Instead of being directly grounded, as indicated, the coil (C) may be joined in series or otherwise to the primary (A), in which case the latter will be connected to the plate (E'). The total length of the conductor from the ground-plate (E') to the elevated terminal (E) should be equal to one-quarter of the wave length of the electrical disturbance in the system (E' C E), or else equal to that length multiplied by an odd number. This relation being observed, the terminal (E) will be made to coincide with the points of maximum pressure in the secondary or excited circuit, and the greatest flow of electricity will take place.

In order to magnify the electrical movement in the secondary as much as possible, it is essential that its inductive connection with the primary (A) should not be very intimate, as in ordinary transformers, but loose, so as to permit free oscillation—that is to say, their mutual induction should be small. The spiral form of coil (C) secures this advantage, while the turns near the primary (A) are subjected to a strong inductive action and develop a high initial electromotive force. These adjustments and relations being carefully completed and other constructive features indicated rigorously observed, the electrical movement produced in the secondary system by the inductive action of the primary (A), will be enormously magnified, the increase being directly proportionate to the inductance and frequency and inversely to the resistance of the secondary system. It is practicable to produce in this manner an electrical movement thousands of times greater than the initial—that is, the one impressed upon the secondary by the primary (A), and the inventor claims to have thus reached activities or rates of flow of electrical energy in the system (E' C E) measured by many tens of thousands of horsepower. Such immense movements of electricity give rise to a variety of novel and striking phenomena, among which are those already described. The powerful electrical oscillations in the system (E' C E) being communicated to the ground cause corresponding vibrations to be propagated to distant parts of the globe, whence they are reflected, and by interference with the outgoing vibrations produce stationary waves, the crests and hollows of which lie in parallel circles relatively to which the ground-plate (E') may be considered to be the pole. Stated otherwise, the terrestrial conductor is thrown into resonance with the oscillations impressed upon it just like a wire. More than this, the movement of electricity through it follows certain laws with nearly mathematical precision. It will be, however, sufficient to state that the planet behaves like a perfectly smooth or polished conductor of inappreciable resistance with capacity and self-induction uniformly distributed along the axis of symmetry of wave propagation and transmitting slow electrical oscillations without sensible distortion and attenuation.




TESLA'S METHOD OF TRANSMITTING ELECTRICAL ENERGY THROUGH SPACE.

Besides the above, three requirements seem to be essential to the establishment of the resonating condition.

First—The earth's diameter passing through the pole should be an odd multiple of the quarter-wave length—that is, of the ratio between the velocity of light and four times the frequency of the currents.

Second—It is necessary to employ oscillations in which the rate of radiation of energy into space in the form of hertzian or electromagnetic waves is very small. To give an idea it may be said that the frequency should be smaller than 20,000 per second, though shorter waves might be practicable. The lowest frequency would appear to be six per second, in which case there will be but one node, at or near the ground-plate, and, paradoxical as it may seem, the effect will increase with the distance and will be greatest in a region diametrically opposite the transmitter. With oscillations still slower the earth, strictly speaking, will not resonate, but simply act as a capacity, and the variation of potential will be more or less uniform over its entire surface.

Third—The most essential requirement is, however, that irrespective of frequency the wave or wave train should continue for a certain interval of time, which estimated to be not less than one-twelth or probably 0.08484 of a second and which is taken in passing to and returning from the region diametrically opposite the pole over the earth's surface with a mean velocity of about 471,240 kilometers per second.

The presence of the stationary waves may be detected in many ways. For instance, a circuit may be connected directly or inductively to the ground and to an elevated terminal and tuned to respond more effectively to the oscillations. Another way is to connect a tuned circuit to the ground at two points lying more or less in a meridian passing through the pole (E'), or, generally stated, to any two points of a different potential.

## Permanent-magnet-suspension Measuring Instruments.

For the measurement of the amperage and voltage of direct-current circuits, instruments of the well-known permanent-magnet, moving-coil type are of the utmost value. It has been the practice to support the moving system of such instruments when applied to switchboard and similar work, upon hardened steel pivots in jeweled bearings, and to conduct the current into and out of the moving coil by means of spiral springs.

But such construction, according to the Simplex Company, is open to several objections, which it enumerates as follows:

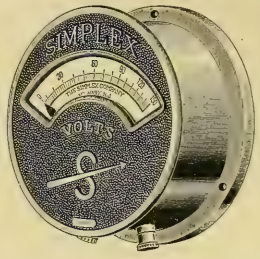
First—Changes of temperature are liable to condense the moisture of the air enclosed in the instrument case, upon the steel pivots, causing them to rust, destroying their fine needle points and smooth surfaces, and thereby creating friction in the bearings with the result that the proper operation of the instrument is interfered with.

Second—The fragile nature of both the bearing points and the jewels renders them liable to fracture under sudden jar or long-continued vibration.

Third—Some play or movement in the direction of the axis of the pivots must be allowed for to prevent binding in the jewels, and where the magnetic-gap clearances are small the side thrust of the moving system frequently binds the latter against the adjacent pole-pieces.

This company, which has its office at 60 Nassau Street, Newark, N. J., has brought out a permanent magnet-suspension instrument which is entirely free from such objections. It supplies them in a number of different cases, of which the accompanying picture illustrates one of the most common switchboard types.

The instrument involves a horseshoe permanent magnet having four flat soft-iron pole-pieces and a flat disk soft-iron core. The moving system consists of a flat rectangular coil wound on a damping frame, supported above and below by straight band-conducting filaments, which are attached through a yielding support to insulated bridge-pieces. The pole-pieces, core, bridge-pieces and scale are all supported by a one-piece structure, rendering their mutual alignment permanent. The pole-pieces fit tightly into recessed slots in the magnet ends and perfect magnetic contact results. The magnet is secured in place by cotter pins tightly driven into the pole-pieces.




PERMANENT-MAGNET-SUSPENSION INSTRUMENT.

Filaments, which serve the triple purpose of supports, electrical conductors and retarding springs, are made from a highly resilient bronze alloy of good conductivity, low-temperature coefficient and high-tensile strength. They are non-oxidizable and so proportioned that they radiate easily the heat generated in them at maximum reading.

The yielding support is an important feature of the device, as it protects the moving system from damage by jar or continued vibration and corrects for the change in the length of the filament due to change in temperature or angular movement of the moving coil. The pull upon the filament is so regulated that the latter is kept perfectly taut, and the moving system being balanced, the instrument may be operated in any position. The flat moving coil with its particular arrangement of magnetic air-gaps has its entire coil surface active, thus allowing a lighter coil than would otherwise be necessary.

Before aging, the magnet is assembled with its

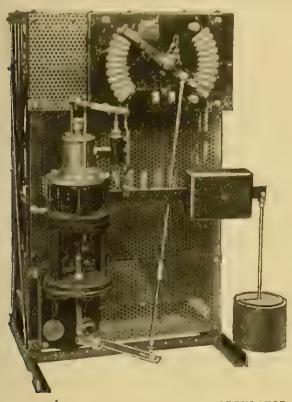
pole pieces and core and the latter is not again removed, the front arrangement of the parts being such that the moving coil may be assembled readily or removed without disturbing any of the other parts. Zeroing and tautening adjustments for the filaments are provided for.

The magnet is made up of a very high grade of Swedish magnet steel notable for its strength and permanence and is treated thoroughly and aged by special processes.

In operation the instrument behaves exactly like a pivot and jewel-supported moving-coil instrument, except that there is an absence of appreciable friction. It may be subjected to unusually severe jars or vibration without damage and will operate perfectly under all atmospheric conditions.

## Cutler-Hammer Automatic Speed Regulator.

The Cutler Hammer Manufacturing Company, Milwaukee, has developed an automatic speed adjuster which has some interesting features, and which has solved, satisfactorily, it is said, certain problems of motor control. The accompanying illustration shows a type of the regulator applicable to a variety of sizes whereby the speed of the motor is automatically adjusted to suit the requirements at any given time, and where the speed of



CUTLER-HAMMER AUTOMATIC SPEED REGULATOR.

the motor is varied as these conditions of demand vary.

The regulator finds an application in connection with mechanical stokers for induced-draft or forced-draft systems in boiler plants, and in pumping plants where it is desired that the motor operate continuously and supply water continuously at certain pressures, the volume of water furnished varying with the demand.

For boiler plants, the controller is arranged to vary the speed of the motor which drives the draft fan, and the control is taken from the boiler pressure directly. The regulator proper, shown in the cut as mounted at the lower left-hand corner of the resistance frame, consists of a pressure regulator controlled directly by the steam pressure, and a hydraulic cylinder controlled through the pressure regulator, whose piston in turn is mechanically connected to the rheostat lever. The steam pressure is admitted directly below the diaphragm of the pressure regulator, and the pressure of the steam on the diaphragm is balanced by the weights on the lever. The lever will therefore rise and fall slightly with the rise and fall of steam pressure in the boilers.

The operation of the hydraulic cylinder is controlled by a pilot valve, and the operation of the pilot valve is controlled in turn by a floating lever between the crosshead on the hydraulic-cylinder piston rod and the link from the regulator lever. The operation of the cylinder is so arranged that the piston will be forced downward when the regulator lever rises, and the relative motion of the piston rod and the link from the regulator-weight lever is such that proper operation of the pilot-valve stem is obtained. When the pressure rises, slightly opening the pilot valve, water is admitted to the hydraulic cylinder, forcing its piston downward, and thereby causing the pilot valve to close a corresponding amount. Any slight rise or fall of the pressure causes a corresponding fall and rise of the hydraulic cylinder and a corresponding operation of the rheostat lever. The parts are so proportioned that, with a certain variation in pressure, the rheostat lever will travel from one end of its contact to the other, and for smaller variations, a proportional smaller travel will be obtained. The result is that, as the pressure rises and falls, the rheostat lever follows the change exactly and changes the speed of the motor inversely to correct the changes in pressure. As the pressure rises, the motor is slowed down, decreasing the draft, and conversely, if the pressure falls, the motor is accelerated, increasing the draft. In boiler operation this [illegible] a given normal pressure, absolutely automatically, and the speed of the motor [illegible] of demand on the boiler, [illegible] set by the regulator, to give a draft suiting the demands upon the boiler.

The speed of the motor may be controlled [illegible] several ways, either by resistance in the armature only, by resistance in the shunt-field circuit only, or by a combination of these two. These methods only have been cited as being the simplest and the methods most generally used, but, of course, by suitable arrangements any method of speed control may be adopted. For very large motors, speed control is obtained by means of solenoid switches, and the rheostat lever shown on the drawing is therefore used only to control the windings of the several solenoid switches, since it would be impracticable to handle heavy currents when the motion of the rheostat lever must necessarily be very slow and at times very small.

In connection with pumping plants, conditions are sometimes obtained where it is desired that the motor be kept running continuously, and that it shall run at speeds corresponding to the demand upon the system. Where a small amount of water is being used it is desired that the motor be run at a slow speed, and as the demand increases, by opening up more outlets, it is necessary that the motor speed be increased to maintain a constant pressure at the source of demand. The regulator in question, in connection with a motor-driven pump, performs its functions very satisfactorily, adjusting the speed of the motor to suit the demand upon the system automatically, and maintaining the motor speed constant at a given point as long as the demand remains constant.

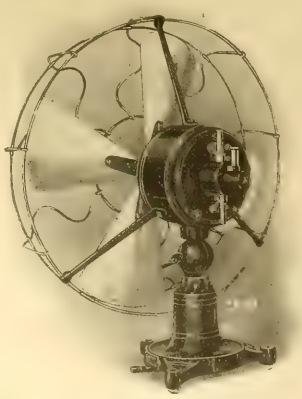
For small equipments it is usual to install, in connection with a regulator of the character described above, a standard automatic-release type of starter. An automatic starter is also advisable, since the regulator is permanently shut down, and apparatus of this character is necessary in starting the motor up after it has been shut down.

## New Robbins & Myers Fan.

The accompanying cut illustrates a new and improved type of universal desk or bracket fan that was put on the market this season by the Robbins & Myers Company of Springfield, O. Its manufacturer designates it the "standard direct-current Universal fan." The most important and valuable feature of this fan and one that will be appreciated by contractors and jobbers supplying fans in large numbers and for a variety of services is that no tools are needed for changing the fans from desk to bracket use or for changing the direction of the air current.

The long experience of the Robbins & Myers Company in fan building has put that concern in a position to eliminate, practically, every weakness in fan design, so that the fan which is now being introduced may be expected to give years of service without repairs.

Structurally considered, the fan is a fine exam-



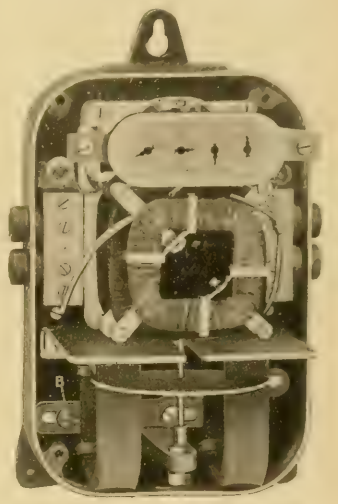
NEW ROBBINS & MYERS FAN.

ple of modern factory methods of rapid duplication; the various parts are all made to jigs and gauges and therefore interchangeable. This fan combines in a single neat and ornamental structure the desirable features of both the desk and bracket fan. It will be noted that it may be mounted on either the desk or the wall, and it will run equally well in any position. A turn of the thumbscrew at the side is all that is necessary to make the adjustment. Once mounted the direction of the air current may be changed as desired into either a vertical or horizontal plane and then fixed in that position by means of the thumbscrew.

[illegible] speed regulator, which, in the 12-inch fan gives [illegible] revolutions per minute.

## Westinghouse Direct-current Integrating Wattmeter.

[illegible] Electric and Manufacturing Company has developed a direct-current integrating wattmeter which contains many of the special features found in the alternating-current type and is constructed with the same regard to long-continued accuracy, strength, durability and convenience in installation which is attributable to the company's apparatus in general. In appearance the new instrument resembles the Westinghouse alternating-current integrating wattmeters. The case is finished in black enamel, with letters in low relief. The terminals enter at the sides, passing through the case, the line wires being connected on the right-hand side of the meter and the load wires on the left, the



WESTINGHOUSE DIRECT-CURRENT INTEGRATING WATTMETER.

upper wire line being the positive. To make connections it is only necessary to bare the ends of the wires, to insert them in the bushings at the sides of the case and to tighten the binding screws. The bushings form a close junction with the terminal blocks and make the case as insect and moisture proof at this point as at all others.

By removing the cover, as shown in the illustration, all parts of the mechanism are exposed. The adjustments, which are wholly mechanical and do not depend upon variable resistance or similar arrangements, can then be easily made. To compensate for friction the shunt coil shown at (A) is moved in or out, this coil being held in position by two screws which clamp against brackets as shown.

The speed of the disk is controlled by two permanent magnets so mounted as to secure perfect alignment. Moving the magnets in from the edge of the disk increases the speed, and moving them out toward the edge decreases the speed at any given load. Releasing the adjusting screws, one of which is shown at (B), permits the magnets to be moved as required.

The lower bearing of the shaft is of the cup-and-ball type, the same as that used in the company's integrating wattmeters for alternating current, which has thoroughly demonstrated its value in reducing wear and friction. The shaft terminates in a removable sleeve with a slightly cupped sapphire jewel, which rests upon a hardened steel ball one-sixteenth inch in diameter. This ball is supported by a second jewel, similarly cupped, which is set in the end of the adjusting screw which forms the lower half of the bearing. The lower jewel is spring-mounted, a construction which effectually protects it against sudden jar. The steel balls and jewels undergo a special polishing process and are rigidly inspected before using.

The very slight friction of a bearing of this form insures the meter remaining in calibration at light loads longer than is possible with a bearing of any other type, and this feature, combined with the reduced weight of the moving element,

affords a long period of active service for this meter.

The commutator is an important part of all direct-current wattmeters and requires the use of non-oxidizing metal and a diameter small enough to minimize friction. Especial attention has been given to this feature and it has been fully developed in every respect, the diameter being only five-sixty-fourths of an inch, which insures a reduction of friction to a minimum.

A perfect commutator is ineffective, however, without suitable brushes, so this feature has been made a subject of special study. Perfect contact with the least amount of friction must be maintained and the material must be such that oxidization will not take place. The brushes in this meter are composed of a number of strands of wire of non-oxidizing material. This subdivision of the brush gives an excellent contact, as each strand is thereby made a separate brush and the series of strands conform exactly to the surface of the commutator with less total tension, insuring ideal working conditions.

## Special Train Service to the Denver-Colorado Springs National Electric Light Convention in June.

This year's National Electric Light convention at Denver and Colorado Springs bids fair to be one of unusual interest and attractiveness. The city of Denver is an ideal one for summer conventions, but with Colorado Springs to co-operate in the matter of the amusement features this locality becomes doubly attractive for what promises to be a surprisingly large and enthusiastic gathering of electrical people from all over the United States.

As is now generally understood by almost everyone interested in this convention, through the indefatigable efforts of its advertising committee, the Denver-Colorado Springs convention will be held on the dates from June 6th to June 11th, inclusive, the first three days in Denver and the remaining three in Colorado Springs.

All information relative to the plans of Master of Transportation George F. Porter handling the eastern section of the United States and Assistant Master of Transportation Frank L. Perry attending to the western section of the country on matters of a railroad nature now becomes of much interest.

The Pennsylvania Railroad has been made the "official" railroad to be used as far as Chicago, while the C., B. and Q. railroad, better known as the "Burlington Route," has been likewise made "official" and been given the special train from Chicago to Denver to operate in conjunction with the Pennsylvania railroad special and haul the latter train coupled to its own from Chicago to Denver.

While up to the present time it is impossible to give an exact schedule of the leaving time of the rtains, generally speaking, it may be stated that it is more than probable that the Pennsylvania railroad special will leave Jersey City some time Saturday morning, June 3d, Philadelphia also the same morning, and proceed westward through Harrisburg, arriving at Fort Wayne, Ind., the morning of June 4th. The train will reach Chicago, say, on the same forenoon of Sunday, June 4th. Western passengers to the convention, therefore, should plan to be in Chicago Sunday morning, June 4th. The Burlington special, it is promised by the officials of the C., B. and Q., will be a train on which the service will be more elegant and elaborate than that of ordinary first-class trains; this train will be electrically lighted. In a word, the arrangements with the two railroad companies are for two thoroughly first-class trains to be combined into one at Chicago, and to include baggage car (accessible from the rest of the train in order that the sleepers may be relieved of all impediments.) There will also be a dining car—two dining cars if necessary—standard sleeping cars and a library car with observation compartment and platform. The main idea followed by Master of Transportation Porter was that every effort should be made to attain economy in time and an increase in comfort and pleasure wherever it was possible.

In addition to the strictly high-class train equipment and service that is promised, the Burlington keeps constantly in mind the pleasure of its passengers after they have reached the Rockies. At the Burlington information bureau, 1039 Seventeenth Street, Denver, a corps of well-informed employes will constantly be on hand ready to assist in every way the patrons of the route. Representatives of the Burlington route will meet this special on its arrival in the city and place their services at the command of the passengers for such a time as they may be required. It is more than likely, too, that a special representative of the Burlington route will accompany the train from Chicago to Denver.

The route of the Pennsylvania special will lie through New Jersey, Southern Pennsylvania, Central Ohio and Northern Indiana; the Burlington train will pass through Southern Iowa and Central Nebraska. It is believed that a more diversified and hence more interesting route could not have been planned. The return trip will be via this or other direct routes, as the special train is to be abandoned at Denver in order that its passengers may return at their own pleasure instead of on a set date.

While, it will be remembered, that for three days, viz., June 6th, 7th and 8th, business, science and hard work in Denver will be foremost in the minds of the attendants of this convention, still there will be ample opportunity to "do" Denver "on the side," so to speak.

A word about Denver: Its streets are broad and level and with large observation street cars and commodious automobiles, within an hour's time a sightseer may view the city at a dozen different angles, always with the magnificent Rocky Mountains in full view. Denver's arrangements, too, for the entertainment of this convention are thorough and generous; it is not to be outdone by Colorado Springs. Denver is a city experienced in entertainment, and this quality, backed by its typical western energy, as was shown in the city's successful efforts to participate in the convention, is a sufficient guaranty of what the convention people may expect.

The special train will be abandoned at Denver, but the tickets will be good for a continuation of the journey to Colorado Springs and Pueblo and the visitors may proceed to the Springs whenever they may elect. As Friday, Saturday and Sunday, June 9th, 10th and 11th, are the days constituting the period of the convention's festivity, it is putting it mildly to prophesy a thoroughly good time during the last three days of the convention.

With reference to the entertainment features, it should be stated that Manitou is but six miles from Colorado Springs, with electric street-car service every 15 minutes, and the journey requires less than 45 minutes.

Ute Pass begins almost in the heart of Manitou: it contains the Grand Caverns, Cascade Canon and Green Mountain Falls.

The Cog Road to the summit of Pike's Peak begins where the Colorado Springs cars are halted in Manitou, and the round trip to the Observation Tower on the Peak requires hardly more than three hours, and includes ample time for use of the great telescope.

Stratton Park and Cheyenne Canons are only 4½ miles southwest of Colorado Springs. Carriages and electric cars, the latter running with a 15-minute headway, cover this attraction in a 20-minute ride.

North Cheyenne Canon contains the Cascades and wonderful rock formations.

South Cheyenne contains the famous Seven Falls near the grave selected for herself by Helen Hunt Jackson.

The Garden of the Gods is five miles northwest of Colorado Springs and is reached by two carriage routes.

Monument Park, containing grotesque natural statuary, is 10 miles north of Colorado Springs, and Crystal Park, four miles south of Manitou.

The above are only a few of many points of interest so conveniently near Colorado Springs that the three days' stay will permit the visitors to see the greater number of, if not all, the natural attractions.

It should be stated, too, that Cripple Creek, at an altitude 3,500 feet higher, may be reached by a railway journey of only 2½ hours. The Royal Gorge is just out of Canon City and twice penetrated in a journey of less than a day; Pueblo is less than 40 miles distant, with a frequent train service. The Georgetown Loop may be circled in a day via Denver. Glenwood Springs is but a trifle more than 200 miles distant and Salt Lake City even is less than 600 miles.

Summarizing, the Rocky Mountains and all their grandest features are clustered so closely about the places of meeting that the sight-seer may literally revel in many attractions.

In view of the above enumerated attractions and the magnificent scientific features of the Denver convention, and judging from the remarkable universal sentiment in favor of the Denver-Colorado Springs trip, the officers of the association feel most enthusiastic over the prospects for a magnificent united convention train pulling out from Chicago, Sunday, June 4th.

Prospective visitors to the convention are to be urged for their own comfort early to make known their railroad requirements. All those proposing to join the Burlington train, which will run from Chicago to Denver, should make their reservations or inquiries of F. E. Bell, city passenger agent, C., B. and Q. railroad—Chicago office, northeast corner of Adams and Clark Streets—who, to facilitate matters, will act for Assistant Master of Transportation Frank L. Perry of the Western Electrician.

The cost of round-trip tickets and of sleeping-car berths from Chicago to Denver will be as follows: Round-trip fare, Chicago to Denver, via the Burlington route, $30.00; lower berth one way, $6; upper berth, $6; drawing rooms, $21.

The meals will be a la carte. An important point that will particularly interest the ladies is that the baggage car on the combination special will be accessible at any time, trunks may be packed with the knowledge that they can be reached while the train is in motion if desired. Each ticket entitles the holder to carry 150 pounds of baggage.

## Interurban Roads Plan Interchangeable Mileage Books.

Representatives of a number of electric railways doing business in Northern Illinois and Wisconsin met at Rockford, Ill., on April 10th and formed the Interurban Electric Railway Association. The object of the new organization will be the placing of an interchangeable mileage book into use and securing co-operation among the interurban lines. The companies which joined the association at the meeting are: Aurora, Elgin and Chicago Railway Company; Chicago and Joliet Electric Railway Company; Chicago and Milwaukee Electric Railroad Company; DeKalb-Sycamore Electric Company; Elgin, Aurora and Southern Traction Company; Joliet, Plainfield and Aurora Railroad Company; Rockford and Interurban Railway Company; Rockford, Beloit and Janesville Railroad Company, and Waukegan, Fox Lake and Western Railway Company. Since then the Fox River Interurban Railway Company, which runs into Green Bay, Wis., has joined.

Officials of these roads have felt the need of some arrangement to avoid the frequent purchase of tickets by persons making long trips, including travel over several roads, and also for the convenience of traveling men who jump from town to town. It is planned to divide each line into five-cent-fare zones. Books containing $6 worth of five-cent coupons will be sold for $5. Larger books, which will probably be issued later, will be sold, according to the present plan, at a reduction of 16 2-3 per cent. from the face value. The coupons collected will be turned in to an accounting department maintained jointly by the roads in the organization, which will make returns to the various companies according to the coupons sent in.

Edwin C. Faber, general manager of the Aurora-Elgin-Chicago third-rail line, was elected temporary president. He will complete the arrangements and draw up a contract which will be considered by the association at a meeting to be held soon.

Those who were present at the Rockford meeting were H. H. Clough, T. M. Ellis, Fred L. Lucas, A. L. Drum, John T. Huntington, F. E. Fisher, W. H. Zimmerman, J. R. Blackhall, Edwin C. Faber, George W. Knox and John I. Beggs.

At the monthly meeting of the Ohio Interurban Railway Association in Springfield, O., on Thursday of last week, the subject of interchangeable mileage was again taken up. President E. C. Spring gave a report of the results of a trip made through Northern Ohio and Michigan. He said that nearly all the roads are in favor of such an arrangement. The rates vary on different roads and some kind of a uniform system will have to be arrived at if it is to take in Michigan and Indiana as well as Ohio. It is believed that a rate of two cents a mile will have to be made. Mr. Spring said that within two weeks four more roads will have joined the 21 now in the association.

W. I. Slichter of the General Electric Company spoke on "The Single-phase Electric Railway." E. C. Meade of the Westinghouse Company, who was to have spoken on the topic, became ill and could not be present. C. A. Alderman of Springfield discussed the subject with Mr. Slichter.

The May meeting will be held in Cleveland on the 25th of the month.

## Space-telegraph Demonstration in Brazil.

Over a year ago the Brazilian government made arrangements with a German concern to install a space-telegraph system to communicate between Rio Janeiro and nearby points, the experiment, if successful to be followed by a contract for a large number of outfits to operate along the coast. Last year the American De Forest Wireless Telegraph Company determined to enter the contest, and an expedition was sent out in December from New York in charge of two young operators, one of whom was Harry Athearn, who was operator for the London Times "wireless" in the China Sea a year ago. The apparatus consisted of two complete wireless outfits of one-kilowatt capacity. The Americans set up their stations, one at Rio Janeiro and the other at Grand Island, 72 miles south, 40 miles of this being over mountains. The masts were the same as used by the German experimenters, and were only 130 feet high. The Grand Island station is 500 feet above the sea and the Rio Janeiro station 300 feet.

Between these two stations the De Forest system is now said to operate successfully although the static influences in this neighborhood are excessive.

Mr. Athearn describes the country as being particularly difficult for the operation of space-telegraph apparatus owing to the mountains. Even on the coast it is difficult to find a straight stretch of water.

The Seattle Electric Company has secured a franchise for the extension of its electric railway to Fort Lawton, Wash.

## International Railway Congress.

As the Western Electrician goes to press the International Railway Congress at Washington, D. C., has commenced its seventh session, May 3d being the opening day. The closing session will be held on May 13th. The New Willard Hotel has been chosen as the headquarters of the congress, and one of the most enthusiastic and valuable meetings in the history of the organization is anticipated.

In the words of the first article of its constitution, the International Railway Congress, "is a permanent association established to promote the progress and development of railways." Although primarily devoted to the interests of steam railroads, there is much on the programme which is of interest to the electrical engineer, in view of the closer relationship which is constantly manifesting itself between steam and electric railways.

The committee which has had charge of the arrangements for this meeting, the president of which is Mr. Stuyvesant Fish, president of the Illinois Central railroad, has done its work well. Besides the president of the association, Mr. Arthur Dubois, who is honorary director of the Belgian state railways, Mr. Fish has had associated with him Mr. Theodore Voorhees, vice-president of the Reading railway, and Mr. Theodore N. Ely, chief of motive power for the Pennsylvania railroad.

The proceedings of the congress will be divided up under five heads or sections, as follows: Section 1, ways and means; section 2, motive power and rolling stock; section 3, operation; section 4, general, and section 5, light railways.

The official language of the congress is French, but the constitution allows that the proceedings be carried on in the language of the country in which the congress is held. The present session is the first ever held in this country and the second in an English-speaking country. The first session of the congress was held in Brussels, Belgium, in 1885, the second in Milan, Italy, in 1887, the third in Paris, France, in 1889, the fourth in St. Petersburg, Russia, in 1892, the fifth in London, England, in 1895 and the sixth in Paris in 1900.

Extensive exhibits are a prominent feature in connection with the session in Washington. For this purpose the American Railway Appliance Exhibition has secured a plot of ground known locally as Monument Park, a five-minute walk from the New Willard.

President Roosevelt, in recognition of the importance of the congress, has designated Vice-president Fairbanks to receive the delegates at the White House and make the opening address.

The subjects of papers which are of particular interest to electrical men were printed in the Western Electrician of March 18th. A report of the opening of the congress will be given next week.

## Combined Soldering Iron and Blow Torch.

The Emmelmann Bros. Manufacturing Company, Indianapolis, Ind., is introducing the patent Combination Automatic Gasoline Soldering Iron and Blow Torch, illustrated by the accompanying cut, which is one-third the actual size of the tool. In the operation of this device the cap at (A) is removed and gasoline poured into the magazine until it is within one-half inch of being full; then the cap is screwed on firmly. The alcohol lamp, which accompanies each tool, is lighted and the iron is heated at (B) for at least three minutes in a slanting position with the head down, keeping the valve (C) closed to generate a hot gas pres-

COMBINED SOLDERING IRON AND BLOW TORCH.

sure. After heating (B) the stated time, the valve is gently opened and lighted by passing the tool over the flame at (F). The tool should continue to be heated at (B) for three minutes more. The operator can regulate the blast to suit the work to be done by means of valve (C). If the work is being done outside in a heavy wind, or the tool is used as a blow torch, the shutter at (B) should be closed. Any shape copper point can be used. By removing the copper point, shown at (E), the tool can be used as a blow torch. Should the tool not work readily the steel head shown at (F) can be unscrewed and the small hole in the center of plug cleaned with a fine wire. The hole, however, should not be enlarged.

The manufacturer asserts that this is the only successful combination soldering iron and blow torch that requires no pump nor platinum coils or other similar appliances. When properly started it is said that every particle of gasoline is consumed in a hot gas form without any danger of explosion and the magazine can be refilled without generating. The cost to keep the tool in constant operation is said to be only about five cents a day. The tool is furnished with two drop-forge coppers, one for regular work and one for heavy work. The head is a high-grade steel casting. The cylinder is made of 16-gauge drawn-brass tubing.

## Electric-light Rates in Chicago.

The municipal [illegible] Mayor Dunne at the [illegible] result of the recent city [illegible] municipal gas plant, [illegible] municipal electric-light plant [illegible] with municipalization of [illegible] everything else in the distance. [illegible] municipal electrical plant in Chicago [illegible] clusively for street lighting, but the mayor is advocating the passage of a law that [illegible] to supply current commercially to private consumers. At this juncture the Chicago Daily Tribune publishes an editorial [illegible] ing from an influential and disinterested source, is worthy of attention. The editorial is entitled 'Gas and Electric Light,' and the writer [illegible] the gas companies must make up their minds to accept 75-cent gas (the price now is [illegible] thousand). He continues:

"With respect to electric light, the Tribune is unable definitely to express an opinion. It does not know at present whether the charges to small consumers are reasonable or unreasonable, but those to large consumers are reasonable. They are made by contract and are below the published rates. Some of them are extremely low, and after careful examination experts have frequently decided that the largest consumer can get light and power from the electric-light company cheaper than he can make them himself. A dozen of the largest consumers in Chicago, including Marshall Field & Co., the Northwestern road, some of the hotels, and the Tribune itself will testify to this fact. They have tried both systems and have abandoned individual plants for the central plant, because those allowances for depreciation which are so much spoken of now in connection with municipal ownership devour the profits of almost any small electric-light plant. Probably 100 property owners in Chicago will testify to this.

"Whether the city can economically run a plant in the outskirts and supply private consumers we are not able to say. Undoubtedly the accounts of the city as far as electric lighting is concerned have not been squarely kept. No allowance has been made for depreciation, the nonpayment of taxes, free water, and other items such as would be entered on the books of a private company.

"It may or may not be that the small consumer is charged too much at present by the electric-light company. That is a matter for investigation and determination. But we do not believe that the field of activity of the city in respect to public utilities should be extended too rapidly. We do not believe it should engage in the electric-light or gas business until it shall learn properly to administer the water business and the traction business which it is just about to undertake."

## Reorganization of National Electric Company.

Owing to the recent defalcation of F. G. Bigelow, president of the First National Bank of Milwaukee, who was also chairman of the board of directors of the National Electric Company of the same city, that company has taken prompt steps toward reorganization, as is explained by the following open letter from John I. Beggs, the new president:

Milwaukee, Wis., April 27, 1905.—At a special meeting of the board of directors of the National Electric Company, held this forenoon, the resignations of S. W. Watkins as director and president, F. G. Bigelow as director and chairman of the board, F. C. Randall as director, vice-president and general manager, and Gordon Bigelow as director were presented and accepted.

The vacancies were filled by the election of John I. Beggs, Charles F. Pfister, Frederick Vogel, Jr., and J. H. Van Dyke, Jr., as directors. John I. Beggs was then elected president of the company, and J. H. Van Dyke, Jr., vice-president.

The resignations of A. N. McGeoch and B. T. Becker were likewise presented, but were not acted upon by the board.

The business of the National Electric Company will be actively continued, and all contracts now on the books of the company promptly completed. The indebtedness of the company is now being ascertained by the new management, and as soon as it is fully known a meeting of the creditors will be called to consider the best course to be pursued for the protection of all creditors and for the future welfare and progress of the company.

The National Electric Company is one of the important and promising manufacturing industries of Milwaukee, employing a large force of skilled mechanics, and the new management will make every effort to preserve and increase the business of the company, believing as they do that it can be made one of the most profitable manufacturing enterprises in the city of Milwaukee. JOHN I. BEGGS.

Mr. Beggs, who ranks among the leading electrical men of the country, is a director of the First National Bank of Milwaukee and subscribed $300,000 toward its funds at the time of the disclosure of the embezzlement. He is a man of large resources and great business capacity, and, as president of the National Electric Company, should add distinctly to its strength.

## Change of Address.

The New York office of the Western Electrician is now at 150 Nassau Street (American Tract Society Building), and persons having business to transact with it are requested to note the change of address. The new telephone number is 4147 John.

## An "Aluminum" Outing.

[illegible] E. H. Noyes, Chicago manager of the Pittsburg [illegible] City railway.

[illegible] the party had made away with a fine lunch, and [illegible] was met by President [illegible] car Louisiana, in which it was taken over the Joliet, Plainfield and Aurora [illegible] latter city it was planned to transfer to a special car offered by J. R. Blackhall, general manager of the Chicago and Joliet electric railway in which to make the run to Chicago, but as rain had begun to fall the Louisiana completed the trip to the city limits, where it was met by a special car sent by General Manager [illegible] of the Chicago City railway, who, however, was not with the party.

Mr. Noyes and his guests arrived [illegible] p. m., and all were greatly pleased with the ride. A feature of the trip was the fact that the current which operated the cars over the entire run was conducted over aluminum transmission wires. As aluminum and aluminum products are the specialty of the Pittsburg Reduction Company, Mr. Noyes planned the trip for the double purpose of entertaining the electric-railway men and also demonstrating the extensive use of aluminum as an electrical conductor in railway service.

## Chicago Street-railway Situation.

The first business meeting of the Chicago City Council since the inauguration of the new administration was held this week, but nothing new in relation to plans for bettering the city's street-railway system has yet developed. It is interesting to note that when an order requiring the Chicago Union Traction Company to remove all dead tracks on Michigan Avenue was before the council, the six Republican members of the local transportation committee (which has 13 members) were among the few to vote against it.

Judge Grosscup has announced that he will decide the case involving the life of the Chicago Passenger Railway Company on May 8th. Mayor Dunne is anxious for this decision, as it involves the Adams Street line on which he intends to experiment with municipal ownership.

Mayor Dunne has received the report from John J. Cummings, who had been asked to investigate the tangible value of the Chicago street-railway properties. Speaking of the report the mayor said: "The whole city for $50,000,000 can be gridironed with tracks, including not only the Union Traction and its consolidated lines and the Chicago City Railway Company, but also all street-railway lines within the city limits, with the most modern appliances, the best tracks, the most comfortable cars, and all other mechanical improvements."

## Bids Received for Space-telegraph Outfits.

The Navy Department has received the following bids for furnishing and installing complete space-telegraph outfits at the places named: Cape Henlopen, Del.—American De Forest Wireless Telegraph Company, $5,472; International Telegraph Construction Company, $3,350; Massie Wireless Telegraph Company, $2,650 and $2,850; National Electric Signaling Company, $10,000; Ostheimer Bros., $5,525 and $9,225. Beaufort, N. C.—De Forest, $7,480; International, $3,575; Marconi, $10,600; Massie, $3,150 and 3,350; National, $12,500; Ostheimer Bros., $5,675 and $9,375. Charleston, S. C.—navy yard, De Forest, $5,472; International, $3,575; Marconi, $10,600; Massie, $3,160 and $3,360; National, $12,500; Ostheimer Bros., $5,675 and $9,375. St. Augustine, Fla.—De Forest, $5,472; International, $3,600; Marconi, $10,600; Massie, $3,180 and $3,380; National, $12,500; Ostheimer Bros., $5,675 and $9,375. Jupiter Inlet, Fla.—De Forest, $5,472; International, $3,650; Marconi, $10,600; Massie, $3,200 and $3,400; National, $12,500; Ostheimer Bros., $5,675 and $9,375. New Orleans naval station—De Forest, $5,472; International, $3,200; Massie, $3,250 and $3,450; National, $12,500; Ostheimer Bros., $4,875 and $8,575.

A space-telegraph system invented by the Rev. Father Joseph Murgas, of Wilkesbarre, Pa., was tested there recently with success, the newspapers say. In the system each letter of the alphabet, as well as code words, is expressed by a single musical note.

## Brush on the Arc Light.

Charles F. Brush, the inventor of the open-coil dynamo and the commercial series arc lamp, has an interesting article, with portrait and pictures, in the May Century. The following extracts will be of interest:

"Carbon being the most refractory substance known, the temperature of the crater is the highest yet produced artificially, and ranks next to that of the sun. It is fortunate that nature has provided us with such a substance as carbon, combining, as it does, the highest resistance to heat with the necessary electrical conductivity. Without carbon, or an equivalent—and none is known—we could have no arc light."

"The first dynamo and lamp actually sold by the Telegraph Supply Company were shipped to Dr. Longworth of Cincinnati about January, 1878. I went down to Cincinnati to show the doctor how to run his machine, and one evening while I was there he exhibited the light from the balcony of the building in which he lived, on one of the principal streets. It was a 4,000-candle light, and of course attracted a large crowd, every man of which was ready and willing and eager to tell his neighbors all about it. I mingled in the throng for a time to hear the comments. One man who had collected a considerable audience, called attention to the solenoid at the top of the lamp and said, 'That is the can that holds the oil,' and, referring to the side rod, said, 'That is the tube which conducts the oil from the can to the burner.' He said nothing at all about electricity—a little oversight, apparently unnoticed by his hearers, and they went away happy in their newly acquired knowledge of the electric light."

"To decrease their electrical resistance and retard the burning of the carbons, we electroplated them with copper, which is still customary. This little scheme of covering the carbons with just enough but not too much, copper was the only easy invention that it was my privilege to make; and it paid well, considering its seeming simplicity. It yielded, if I remember correctly, something like $150,000 in cash royalties before serious competition set in."

"The use of enclosed arcs has become large enough to stop the growth of carbon manufacture, notwithstanding the steady and large increase in the number of arc lamps in use. The General Electric Company alone sold about 85,000 enclosed-arc lamps in 1903—far more than of the open-arc variety."

## The Institute Convention.

Thus far arrangements have been made for the presentation of 15 papers at the annual meeting of the Institute which is to be held in Asheville, N. C., on June 19th to 23rd. The list as now prepared is as follows:

"Appalachian Water Powers," by F. A. C. Perrine, New York; "Three-phase Traction," by F. N. Waterman, New York; "Limits of Injurious Sparking in Direct-current Commutation," by Thorburn Reid, New York; "Study in the Design of Induction Motors," by C. A. Adams, Harvard University, Cambridge, Mass.; "Choice of Motors in Steam and Electric Practice," by Wm. McClellan, University of Pennsylvania, Philadelphia, Pa.; "High-potential Oscillations of High Power in Large Power-distribution Systems," by Chas. P. Steinmetz, Schenectady, N. Y.; "Theoretical and Experimental Investigations on the Disruptive Strength of Air at Very High Voltages," by Chas. P. Steinmetz; "Heavy Electric Freight Traction," by C. de Muralt, New York; "A New Instrument for Measuring Alternating Currents," by E. F. Northrup, Philadelphia, Pa.; "Motor-generators and Rotary Converters," by W. L. Waters, Milwaukee, Wis.; "Frame Reactance," by Sebastian Sonstius; "Electrical Features of Block Signaling," by L. H. Thullen, Pittsburg, Pa.; "The Plant of the Ontario Power Company," by P. N. Nunn, Niagara Falls, N. Y.; "The Standardization of Fuses," by H. O. Lacount; "A New Induction Generator," by William Stanley, Great Barrington, Mass.

Papers have also been promised by M. H. Gerry, Jr., John W. Howell, Percy H. Thomas, and Dugald C. Jackson.

The total membership of the Institute is now approximately 3,400, apportioned as follows: Honorary members, 2; members, 484; associates, 2,938. There are also about 600 students.

## New England Cotton Manufacturers' Association.

At the annual meeting of the New England Cotton Manufacturers' Association, held in Boston on April 26th and 27th, several papers of electrical interest were read. Among them were these: "Electrical Measurement of Power Required in Manufacturing Heavy Cotton Goods," by Louis I. Guion of Columbia, S. C.; "Static Electricity Neutralized," by Philip Dana of Westbrook, Maine, an "Progress in the Development of the Electric Drive," by Sidney B. Paine of Boston.

## How the Theory of Probability May Be Applied to Telephone Traffic.

Calls from subscribers constitute, of course, the load on a telephone exchange. It is highly important to anticipate the periods when this load will approach the maximum and when it will recede, in order to provide the apparatus and operators to handle it efficiently and yet with economy. It is known, for instance, that a much larger number of operators will be needed at 4:30 p. m. than at 4:30 a. m., and from years of experience load curves are plotted which may be taken, for each exchange (for, of course, exchanges in business, residential and rural districts have differing characteristics), as indicating the probable demand with reasonable certainty. Nevertheless, in the matter of calls and in many other features of telephone work—and, indeed, in electric-light and power work also—the element of chance does enter into the calculation. Recently, advanced telephone engineers have been making studies to see whether the mathematical theory of probability could not be used, in a practical way, to help indicate, after the known business and social factors had been considered, what—to take one instance—the probable number of calls on a given exchange will be in a certain future interval of time.

Malcolm C. Rorty, formerly of the home office of the American Telephone and Telegraph Company in Boston, but now superintendent of traffic of the Central District and Printing Telegraph Company of Pittsburg, is one of the engineering investigators to whom reference has been made. He read a valuable paper on "Applications of the Theory of Probability to Telephone Traffic" before the Chicago branch of the American Institute of Electrical Engineers on April 25th and brought out the possibilities of the theory of probability in telephone work in a way that greatly interested the telephone men present. Mr. Rorty gave the basic formula used in all work on probability, but said that the summation was not easily calculated for specific cases. He displayed three curve-sheets of probability that he had worked out. The first showed the relation between the total number of calls during any interval of time and the number of calls during a particular one-half of the same interval. In the second diagram the relation was between any interval and a particular tenth of that interval, while the third showed the relation between the given interval and one-sixtieth of that interval. On each sheet were several curves giving various refinements of probability, as one chance in 100, one in 1,000, one in 10,000 and one in 100,000.

After displaying and explaining these curve-sheets, the speaker went on to say that the practical application of the mathematical curves of probability will frequently kill a false system in its inception, thus avoiding much experimental work. For instance, call-distributing systems are being considered by both Independent and Bell engineers. In this investigation probability curves will be found useful. Again, they are available in calculating team work among operators. With five operators as the unit of team work, the ordinary multiple board is shown to have 79 per cent. of its theoretical maximum efficiency with 4½-second service. Then, too, the curves are of use in determining trunk loads. The manager can select the number of trunks that are indicated for various probabilities of being "stuck" or overwhelmed by rush of business. Thus, if he is willing to take one chance in a 100 of being "stuck" in a certain interval of time, he can use the number of trunks indicated on the curve-sheet. But if he prefer to take only one chance in 100,000 he will put in the larger number of trunks found by referring to the curve-sheet. Further, the curves may be used in determining the proportion of the month's business that will occur during the maximum day of the month.

In concluding, Mr. Rorty took pains to say that the theory of probability is useful only in making experimental data more widely valuable.

In opening the discussion, Kempster B. Miller, who presided, said that the author of the paper had made a valuable and even remarkable contribution to telephone literature. He called on S. J. Larned, general superintendent of the Chicago Telephone Company. Mr. Larned was rather skeptical of the value of the probability curves. He said that some of the factors in telephone traffic are determined not by chance but by causes which can be foreseen, like the opening of banking hours and the like. On the other hand, such a calamity as the Iroquois Theater fire caused all the subscribers, apparently, to want to talk at once, and could not be provided for by any law or theory.

Mr. Rorty explained that all known social and business factors were first taken into account before the curves of probability were applied.

A. P. Allen of Indianapolis, superintendent of traffic for the Central Union Telephone Company, said that at first sight the mathematical theory of probability is very puzzling. However, as the telephone service expands and ramifies, such theoretical studies have more and more value. Very few telephone problems can be solved by plain arithmetic. The curves had interested him greatly. One application would be in connection with service tests and service-test reports.

Angus S. Hibbard, vice-president and general manager of the Chicago Telephone Company, was the next speaker. He said, in effect, that the study of probability was an important one, because if all subscribers called up a telephone exchange at once, nobody would get anybody. That, of course, was unlikely to happen; but it is interesting to compare the data on the curves with the actual results in practice. The breaking-down point is a possibility in any business, the telephone included. The probability depends on the work to be done and how it is provided for. "We must," said Mr. Hibbard, "bend all our efforts to distribute the probability of simultaneous calls. We do not arrange all bankers, all brokers, all jobbing houses on one exchange; but quite the reverse. The constant study is to level up the load. In Yards Exchange it is a serious problem how to distribute the lines to avoid the tremendous rushes at that point." Mr. Hibbard mentioned the Iroquois Theater fire as a time when a phenomenal demand was thrown on the telephone service. In Central Exchange they were almost overwhelmed. This exchange is within a block of the theater, and a terrific rush of calls was thrown on it for two hours. Later, almost unexpected, came an evening rush from the outskirts of the city. Then the strain was transferred to the exchanges in the residence districts, and some were fairly breaking down. The speaker then went on to say that in everyday telephone practice one call breeds another, just as in face-to-face conversation one remark calls out another. The rise and fall of topics of conversation is really the thing governing the telephone men in providing facilities. In Chicago the high-water mark, so to speak, comes on Saturday morning, and the busiest minute of the week is at 10 minutes past 10 on that morning, while the hour from 9:45 to 10:45 is the busiest hour. The busiest days in the year, telephonically, are the day before Thanksgiving and the 24th of December. The loading of trunk lines is a very intricate problem; the moving of families and large business establishments affects it materially, and in this matter the telephone company is at the mercy of the public.

F. J. Dommerque of the Kellogg Switchboard and Supply Company dwelt on the difference in length of calls as affecting the curves of probability. He spoke briefly of the mathematical aspects of the question, but while he had been greatly interested in the paper, which he considered of much value, he had not given attention to the theory of probability for many years and was hardly prepared to go into the details of such an abstruse subject without preparation.

J. G. Wray, superintendent of maintenance of the Chicago Telephone Company, mentioned some practical problems to which the theory might be applied. He was followed by Frank R. McBerty, telephone engineer for the Western Electric Company, who spoke appreciatively of the curves presented. He said: "We must know our facts before we try to reason from them. The curves have an application. We'll get the facts; we'll apply the laws, and we'll be better off."

## EXTENSIONS AND IMPROVEMENTS.

The Southwestern Telephone Company has purchased property in Fort Worth, Tex., and will erect a new telephone exchange.

The Napa Telephone Company of Napa, Cal., intends to expend about $10,000 in the improvement of its lines, switchboards, etc., at Napa.

Charles E. Hotle is seeking to arrange for a rural telephone line to connect Sebastopol with Green Valley, Cal., and the country lying north and west of the latter town.

It is reported that the Peoples Telephone Company of Fall River, Shasta County, Cal., will extend its line from Fall River Mills through Burney Valley to Montgomery Creek, down Oak Run to Millville and then to Redding by way of Palo Cedro.

## NEW COMPANIES.

Articles of incorporation of the Orange Home Telephone and Telegraph Company at Santa Ana, and for a similar organization at Anaheim, Cal., have been filed. The capital stock is $100,000, of which $10,000 has been subscribed. W. L. Porterfield, L. K. Parks, E. F. Dotson, W. M. Niebel and S. A. Sanderson are the directors.

The following telephone companies have been incorporated recently: Midway Mutual Telephone Company, Cozad, Neb.; Coldwater Telephone Company, Coldwater, Kan.; Magnet Independent Telephone Company, A. J. Williams, Magnet, Neb.; Frontier Telephone Company, Frank E. Bell, Hubbell, Neb.; Reading Independent Telephone Company, Reading, Kan.; Union Mutual Telephone Company, D. Lyman, Union, Kan.

The franchises and holdings of the Gila Valley (New Mexico) Telephone Company have been purchased by the Sunset Telephone, Telegraph and Electric Company of Phœnix, Ariz.

## Telephone News from the Northwest.

The property and franchises of the United States Telegraph and Telephone Company, with exchanges in 14 counties in Northwestern Iowa, have been sold by order of the Federal Court. The property was bid in by Thomas Cavander, of Webster City, for $55,000. Improvements costing $100,000 are now contemplated.

E. G. Scott of Drayton, N. D., has purchased a controlling interest in the Benson County Telephone Company. He will move to Minnewaukon and assume personal charge of the business.

The Interstate Telephone Company of Modale, Iowa, has been incorporated with a capital of $50,000. W. H. Smith is president.

W. A. Hopkins and associates have incorporated the Lamoni (Iowa) Telephone Company with a capital of $25,000.

The Rockwell (Iowa) Telephone Company proposes to construct about 75 miles of new line.

F. B. Michener and others have incorporated the North Belmont Telephone Company of Milo, Iowa.

The Iowa and Mutual telephone companies at Des Moines, Iowa, are competing for the privilege of installing their systems in the new courthouse. The supervisors have decided that only one system will be allowed.

The Mutual Telephone Company of Des Moines, Iowa, has moved into its new exchange building.

Instructions have been given the corporation attorney in St. Paul to prepare an ordinance looking to regulating telephone rates. It is understood that the Northwestern Telephone Exchange Company, which is the only company to be affected, will fight by litigation. The Twin City company has its rates fixed by franchise and cannot be regulated so long as it adheres to the franchise terms. The Northwestern franchise makes no mention of rates and the contention of the corporation attorney is that as a common carrier it is subject to regulation by power delegated from the state Legislature to the councils.

The Waseca (Minn.) Telephone Company is erecting a brick office building for its exchange.

The Glenville (Minn.) telephone system is being turned into a co-operative exchange.

The Walker Telephone Company of Walker, Minn., has been formed to install a local exchange.

E. A. Hughes of Bismarck, N. D., has let the contract to R. H. Hankinson of Hankinson, N D., to build a telephone line from Bismarck to Underwood, N. D.

The Rocky Mountain Bell Telephone Company expects to build long-distance lines east from Billings, Mont., ultimately reaching Williston, N. D., where connection would be made with the system of the Bell company through to the East.

The Farmers and Merchants' Telephone Company of Lena, Wis., has effected a combination with the Bell Telephone Company.

The La Crosse (Wis.) Interurban Telephone Company has bought the Star Telephone system, including over 200 miles of line through Vernon, Crawford and Richmond counties. R.

## Indiana Telephone Items.

The St. Wendel Telephone Company No. 2 has been incorporated and will operate a telephone system in Posey and Vanderburg Counties, with headquarters in St. Wendel. The St. Wendel Telephone Company No. 1 has been dissolved on account of a dispute between two members of the company. Wm. Reiman, J. F. Paul, J. P. Zeller and Anton Glaser are the directors.

The New Salem Telephone Company, incorporated with a capital stock of $5,000, will establish and operate a telephone plant in Rush, Fayette, Franklin and Decatur Counties. John O. Williams, H. O. Dogan, W. P. King and H. S. Barnes are the directors.

The Farmers Mutual Telephone Company of Whitley County (Columbia City) has increased its capital stock from $25,000 to $100,000.

The Meir Electric Company of Indianapolis has been incorporated to manufacture telephones and to construct, manufacture and repair electric machinery and apparatus. Frank L. Meirs is president.

The Indianapolis Telephone Company and the New Long-distance Telephone Company will give the annual dinner to the officers and managers of the Independent telephone companies and exchanges of the state at the German House, Indianapolis, on May 10th. The programme will include the names of a number of prominent Independent telephone men, among them being Breckinridge Jones of St. Louis, J. B. Hoge of Cleveland and Col. J. D. Powers of Louisville, Ky. Mayor Holtzman will deliver the address of welcome. The Independent companies now have in Indiana 368 exchanges, 1,560 toll offices, 30,000 miles of toll-line wires, and 166,255 telephone subscribers. Most of the speakers will be gentlemen who have been closely associated with President Sheerin of the Indianapolis Telephone Company and the New Long-distance Telephone Company in the active work of the National association. Much of the rapid growth and admirable facilities of the Independent system of Indiana is due to Mr. Sheerin's energy and capacity for selecting capable assistants and business associates who give their departments their best efforts. S.

## Independent Telephone Situation in Detroit.

The Co-operative Telephone Company, [illegible] which started a franchise [illegible] years ago and now has small exchanges in the city, has been reorganized. C. O. [illegible] Cowles as manager and take the place of [illegible] Fowler on the board of directors. Mr. Cowles has been elected vice-president of the company but retired from active management.

Following the reorganization of the Co-operative Telephone Company, amended articles of [illegible] were signed by the Peninsular Telephone Company, increasing its capital stock from $2,000,000 to $5,000,000. This company furnishes toll-line connections with Independent companies throughout the state to the Co-operative company and now covers the only two Independent lines running into Detroit. One line runs to Toledo through Wyandotte and Monroe and the other forms a circuit with three others to the central part of the state through Plymouth and Lansing. It is said that the Peninsular company will at once build new lines into Detroit, and that a large sum of money will be spent for this purpose in the next three months. One line is projected from Detroit through Ann Arbor to Jackson and the West, and another through Pontiac to Flint, where it will connect with the Saginaw line. The Peninsular company is organized by stockholders from Detroit and Independent lines throughout the state. In the state, outside of Detroit, there are said to be 70,000 Independent telephones in use, as against about 50,000 telephones owned by the Bell company, not including Detroit.

The co-operative company was organized under a special franchise in which it was granted the use of the city's conduits, poles, buildings and other property on a rental basis at the actual cost of maintenance. The company says that the city has been overcharging it for the use of conduits, poles, etc., and has begun suit against the Public Lighting Commission. C. O. Trask, the new manager of this company, built the Alma line, now known as the Union Telephone Company, one of the best systems in the state. For the last three years he has been building Independent lines in Missouri. At the time the Co-operative company secured its ordinance it was regarded in the light of a possible future municipal telephone plant and therefore secured the concessions granted by the ordinance. The rates which this company can charge are fixed by its ordinance at $48 for business and $24 for residence telephones. It is surmised that the activity developed by the Peninsular Telephone Company is the result of the recent agitation in the Independent telephone companies throughout the state; and the Independent systems may, through the Peninsular company, acquire a strong foothold in the city of Detroit.

## Reporting by Telephone.

In daily newspaper work, especially in the larger cities, the telephone is of the utmost value in news reporting. Newspaper men of today can hardly see how papers got along before the telephone came into general use. On some of the New York afternoon papers there are reporters of the regular staff who do not see the office for weeks, or even months, at a time. Their salaries are sent to them by messengers. They receive their assignments by telephone, and after getting their "stories" they telephone the facts to the office. If the story is a particular "rush" affair the reporter dictates into the receiver to the man in the office, who takes it off on a typewriter. Some of the papers have a rule that every reporter must call up the office once every half hour, whether there is any news to be given or not. Thus a city editor may keep constantly in touch with 15 or 20 men "on assignments" and is able to take a man from a comparatively unimportant assignment and send him to the scene of a "big story." The telephone is furthermore invaluable in a newspaper office in obtaining long-distance news in a hurry. It often beats the telegraph, as it did in many cases last November, when the long-distance telephone lines were used for sending news of the presidential election over the country.

## TELEPHONE MEN.

The New Ulm (Minn.) Rural Telephone Company has engaged Oscar Turnquist as manager of the new company.

E. M. Dahlby of North Branch, Minn., succeeds Charles Avery as manager of the Maple Leaf and Mutual telephone companies of North Branch.

A. E. Harris, manager of the Iron Range Telephone Company at Cass Lake, Minn., has been transferred to Bemidji, Minn., where he succeeds B. G. Fahnestock, who goes to the Twin Cities.

The Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., reports having recently closed contracts for switchboards for the following places: Louisville, Ky., New Berlin, N. Y., Kenmore, N. D., Candor, N. Y., Sidney, N. Y., Kemp, Ill., Pittsboro, N. C., West Brownsville, Pa., Camden, N. J., Newberg, Ore., Butte, Mont., Wayland, N. Y., Newport, Tenn., Sanford, N. C., and Altoona, Pa.

## GENERAL TELEPHONE NEWS.

[illegible]

county clerk.

[illegible]

sidered.

The management of the Rocky Mountain Bell Telephone Company has announced that work will be [illegible] telephone line between Billings and Lewiston, Mont. This move will inaugurate competition between the Bell company and the Billings Mutual Independent Company.

A false report has been circulated, to the effect that the Johnson County Telephone Company of Iowa City, Iowa, had gone into the hands of a receiver. To the contrary, Secretary A. T. Presson states that the company is solvent and in the most flourishing condition in its history. The company operates an independent system, giving local and long-distance service. H. L. North is president, and J. D. Gross vice-president.

Independent telephone managers of Southern California met recently at the office of the Home Telephone Company in Los Angeles to discuss the advisability of forming an association. About 25 representatives were present and all were in favor of organizing and becoming a part of the National association. Messrs. Frew, Higgins and Wells were appointed to arrange the preliminaries and call a meeting to form a permanent organization.

Further reduction in the price of service has been made by the New York Telephone Company. The rates to large users of the telephone have been reduced from 20 to 50 per cent. in the various branches, and further reductions are promised. The charges for circuits connecting stations off the premises to private branch exchanges, or for lines connecting one private exchange with another, formerly from $60 to $84 a mile, have been reduced to from $48 to $60.

The annual general meeting of the Association of Telephone Subscribers of Paris was held recently under the presidency of Marquis de Montebello, the founder and president of the association. It was announced that the number of members had increased during the year from 1,500 to 6,503, out of a total of 40,000 telephone subscribers. Mr. Montebello urged that the administration must be forced to adopt modern systems and regulations which have worked well in other countries.

It is stated that the telephone exchange which is to be opened at Hamburg in the course of the present year will be the largest in Germany. The exchange will be able to deal with 50,000 subscribers on the all-metallic system, although the existing connections only number 21,000. The telephone cables have all been laid underground, and on the starting of the exchange the present overhead wires connected with the old exchanges will be entirely removed from the roofs of the buildings throughout the city.

## New Electrical Engineering Society in England.

For some time past there has been a strong feeling on the part of electrical engineers in the British government telegraph and telephone service that the great developments in every branch of engineering, and the increasing responsibilities of their position, justified the formation of a new organization. Considerable attention was devoted to the subject, and, as a result, a conference was held on April 8th in London, for the purpose of arriving at a decision.

The importance of the occasion was fully emphasized by various speakers, and, after a long discussion, it was unanimously resolved to form a definite organization, having for its title "The Society of Postoffice Engineers." The following-named officers were then elected: President, D. H. Kennedy, A. M. I. E. E., London; vice-president, P. Jarvis, Sunderland; treasurer, J. M. Crawford, London, and secretary, J. W. Atkinson, 45 Arbuthnot Road, New Cross, London, S. E.

The preliminary arrangements will be completed in the course of the next few months, and it is anticipated that by the preparation of programmes of lectures and papers, and in other ways, the society will be of material assistance in promoting the interests of the members.

Bonds to the amount of $15,000 have been voted by the city of Winfield, Kan., with the proceeds of which it is intended to complete the municipal electric-light plant.

# CORRESPONDENCE.

## Great Britain.

London, April 19.—Municipal trading may be said without much exaggeration to have reached a somewhat acute stage in Great Britain, and this applies as much to the electrical industry as to any other branch. For a long time now small local authorities wishing to embark upon electric-supply schemes have experienced a difficulty in persuading the Local Government Board—the authority which sanctions the necessary money being borrowed—that small schemes of the character suggested are of any value to the ratepayers. Several eminent men have recently spoken against municipal extravagance generally, and even the London County Council has drawn the attention of the borough councils to the present state of things as being one needing the greatest consideration. One drawback to this matter is the tendency it has to throw discredit upon the electrical-engineering industry and at the same time to have a retarding influence upon its progress. Another example of the present attitude of small local authorities here has just occurred at Boston, quite a small town in Lincolnshire. The Local Government Board after having held an inquiry into a proposal to borrow money for a new electric-lighting scheme has written to the local authority to the effect that it is not satisfied that a scheme of the nature proposed would be financially successful, and suggests to the local council that a consulting engineer should be engaged to formulate a scheme on more businesslike lines. The communication from the Local Government Board concludes with the warning that the council would be well advised to reconsider the whole matter. The loan, accordingly, has not been sanctioned.

The inquiry into the fire at the Bank Exchange of the National Telephone Company, which was caused through a wire coming into contact with the live rail of the District Railway, is being continued and will no doubt be concluded within the next few days. The facts of the occurrence have already been given in these notes. The Telephone company now holds the engineers of the railway company responsible for the disaster. Apart from this the only point of interest in the proceedings has been a statement made by the inspector of overhead wires to the corporation of London, who has given the daily papers something to talk about in saying that had the accident occurred in the daytime when many subscribers were using their instruments there would have been great possibility of a great public danger, for, he reasoned, a person using a telephone in a damp place would have run the risk of receiving a 500-volt shock. As a matter of fact, however, he could give no reason beyond it being his opinion. He could cite no such instances. Today some expert evidence was to have been called, and the cost of this the city corporation has kindly offered to defray.

It is a pleasure to report that Lord Kelvin is so far recovered that no further bulletins are being issued. No details have been made public as to the exact nature and cause of the operation which his lordship has had to undergo, but the fact that he is now on the road to recovery will be received with gladness by all admirers of the great scientist.

Great anxiety has been incurred by the surface-railway companies in Great Britain, part of whose lines are worked electrically, owing to persons wilfully trespassing upon the track, with, in several cases, fatal results. In consequence, numerous Board of Trade inquiries have been held and a large number of recommendations made to prevent these accidents. All of these have been complied with by the railway companies, but still this foolhardy trespassing continues. With the hope of checking this once for all, notices have been posted by the Lancashire and Yorkshire Railway Company that persons crossing their electric lines at other than the appointed places will be prosecuted. Two boys have already been fined and the magistrates have intimated that all future cases will be severely dealt with.

While the question of a representative exhibition of electrical engineering goods in London is assuming material shape, it is a fact that during the last year or two local exhibitions by the dozen have been in progress throughout the countrty. In order to stimulate the interest in the local electric-supply undertakings, exhibitions under the auspices of the local companies or authority have been promoted in numerous towns, large and small, throughout the kingdom, and from reports to hand it would appear that the results have been by no means unsatisfactory. It certainly augurs well for the big show. G.

## New York.

New York, May 1.—The loop of the subway at the Battery was completed on Friday, and is now ready for the laying of the tracks. This loop will connect both with the Manhattan subway and with the East River tunnel work, which is progressing rapidly. Progress is also reported on the work of the subway in Brooklyn.

The state Senate has definitely taken from the pending Esopus water bill the provision urged by Mayor McClellan that that city may use surplus waterpower at Esopus for electrical purposes.

On Friday the rapid-transit commissioners heard of a proposal to lay a subway under Eighth Avenue from Sixty-second Street to Hudson Street, to connect with the Pennsylvania railroad depot. On the same day there was a public hearing for an application for the double-tracking of the Second Avenue elevated line, but the application was vigorously opposed.

George L. Rives, counsel of the Rapid Transit Commission, announces that the time is nearly ready when specific statements can be made concerning routes of future subways. After that, surveyors will be put to work, and bids will be advertised for in the fall.

The New York City Interborough Railway Company has increased its capital stock from $400,000 to $5,000,000. Cornelius Vanderbilt is one of the promoters of this concern.

David McClure, William G. Davies and George R. Read have been appointed by the Supreme Court to form a commission to report on the proposed extension of the New York and New Jersey Railroad Company.

The Brooklyn Rapid Transit Company has placed an order at Pittsburg for 2,700 new car-wheels, the contractors being the Schoen Steel Wheel Company. These wheels are said to be made by a new process which gives a much longer life.

Albany legislators are still busy with bills and amendments affecting the waterpower at Niagara Falls. The newest endeavor is to allow an electrical power company to have the same rights as a railroad to enter on, and condemn lands necessary for its purposes.

A report comes from Bath, N. Y., of some rapid telephone construction work on a five-mile line from Bath to Kniffin Hill, which was said to be completed in 3½ days. Twenty-four hours later six instruments were in operation on the new line. The work was supervised by Henry Niver.

W. V. D. Lawrence, A. W. Lawrence and J. J. Lannin have incorporated the Lawrence Park Heat, Light and Power Company of Yonkers, N. Y., with a capital of $50,000. D. W. W.

## Southeastern States.

Charlotte, N. C., April 29.—The Seaboard Air Line has about completed connections that afford an entrance to Union, S. C. The big waterpower on Broad River, nearby, to be completed possibly in 12 months, will be used to furnish power for the operation of the 12-mile connecting link of the road. An electric line already runs from Union to Buffalo, and big extensions are constantly talked of.

It is said that the Montgomery (Ala.) Traction Company has given a $2,000,000 mortgage to secure a loan from the Real Estate and Trust Company of Philadelphia, the money to be used in overhauling the electric system and adding thereto.

The town of Monroe, Ga., has voted a bond issue for a new electric-light plant.

At Oxford, N. C., the Oxford Water and Electric Company has been chartered, with $100,000 authorized capital, to furnish water, light and power. The incorporators are Harry L. Millner of Morganton, N. C., and Washington (D. C.) capitalists.

Northern and local capitalists who recently bought the Columbia (S. C.) street railway, have now negotiated for the purchase of the Columbia Water Power Company which supplies 9,000 horsepower to the street-car system and to manufacturing plants. A waterpower of 14,000 horsepower is also to be developed on the Saluda River near Columbia.

M. Mouzon of Georgetown, S. C., is interested in the promotion of a scheme to build an electric railway in that town.

In accordance with recent legislation the railroad commission of Tennessee has sent out to all electric railways in the state a schedule upon which they are required to list their property for taxation, from which the assessment will be made by the board. There are only nine corporations in the state operating electric railways at present.

The commissioners of public works of Orangeburg, S. C., have been instructed to secure information as to the best machinery for improving the lighting system, about $5,000 to be expended. L.

## Texas.

Austin, Texas, April 28.—The Hunter Electrical Supply Company of Dallas has obtained the contract for installing a new electric-light and power plant at McKinney. The plant will be in operation in about two months.

Progress is being made in the project of building an electric railway between Corsicana and Fairfield. J. V. Watkins of Corsicana is promoting the enterprise.

The Bryan-College Electric Right of Way Company has been organized for the purpose of building an interurban electric railway between Bryan and the town of College, where the state agricultural and mechanical college is situated. A. W. Wilkerson of Bryan is interested. The company also has a franchise to operate its cars over the streets of Bryan. F. N. Levens of Cleveland, Ohio, has been in Bryan with the view of financing the enterprise.

Edward J. O'Bierne, president of the Gainesville Electric Light and Power Company, has been granted a franchise to build and operate a system of electric railway in Gainesville.

Rapid progress has been made in the construction of the electric street-railway system in El Paso by Col. W. C. Greene. It is stated that the new electric-railway system will be built across the Rio Grande and a similar system established in the city of Juarez, Mexico; also a line to Fort Bliss.

The contract has been signed for the construction of an interurban electric railway between Hamilton and Dublin, Texas, a distance of about 35 miles. The New York Bond and Security Company is financing the enterprise. W. D. H.

## Mexico.

City of Mexico, April 27.—William A. Jones of the City of Mexico has made application to the government of the state of Jalisco for a concession to establish an electric power and transmission plant near Talpa..

The exclusive concession which the state government of Aguas Calientes has granted the Douglas company for the construction and operation of additional lines of electric street railway in the city of Aguas Calientes shall be in force for 30 years. The property of the company is exempted from all state taxation for that period. Five years are given it in which to complete the work of converting its lines from mule traction into electric transit.

An electric railway will be built to connect the Los Grados mine and the mill of the company, in the state of Guerrero. Ferdinand McCann of the City of Mexico can give information.

An electric power plant will be installed to transmit electricity to San Miguel de Allendo, and used for lighting and power purposes.

The Canadian syndicate which recently purchased from Mackin & Dillon the concession for an extensive system of electric street railway in Monterey, is at work constructing the new lines. This syndicate also owns a controlling interest in the two existing street-railway systems in Monterey and will convert them into electric traction as fast as possible. E. Keating is general manager, and the work of improvement is being carried on under his personal direction.

The Greene Consolidated Copper Company recently completed an important extension of its electric-tramway system at Cananea. The new line operates in the Veta Grande tunnel. The electric motor handles with ease nine cars containing about 60 tons of ore, and its operation dispenses with the services of 72 carmen.

It is stated that the preliminary arrangements for the installation of an independent electric-light and power plant in Nuevo Laredo have been completed. Octaviano Gonzalez is promoting the enterprise.

At the recent annual meeting of the stockholders of the San Ildefonso Hydraulic-Electric Company, held in the City of Mexico, a dividend of seven per cent. on the preferred shares of $2,250,000 and six per cent. on the ordinary shares of $1,000,000 was declared. H.

## Ohio.

Cleveland, April 29.—Gen. C. M. Spitzer of Toledo has disposed of his interests in the Jackson and Battle Creek Railway Company and retired as president, Myron W. Mills succeeding him. Mr. Mills, D. W. Mills, James R. Elliott and George G. Moore are the purchasers.

Fire destroyed the plant of the Solar Carbon Works at Ravenna a few days ago, with a loss of $45,000 and insurance of $36,000. The plant was owned by the National Carbon Company of Cleveland.

The Trolley Company of Canton has been incorporated with a capital stock of $50,000 to manufacture electric-railway supplies. J. S. Weckman, J. B. Steel and others are interested.

The superintendent of one of the branch hospitals at Cincinnati has reported to the board of public service that the municipal light plant in the building has not been used for the last six months because the cost of operating it was more than the lights cost from the electric company, not including the salary of the engineer.

Plans have been under way, it is said, to prevent the sale of the Central Market Street railway at Columbus, as well as the other two larger properties of the Appleyard system. The Columbus Railway and Light officials have not yet admitted that they are looking toward the purchase of the Central Market. It is said that one of the receivers, M. H. Wilson of Cleveland, has been in communication with a number of capitalists regarding the road, and that plans for re-organization are still in progress.

H. T. Yaryan, manager of the Toledo Lighting and Heating Company is reported to have denied the rumor that his company would extend its system to the business section of the city to compete with the Toledo Railways and Light Company. Irving B. Hiett has been elected president of the Toledo Lighting and Heating Company to succeed T. W. Childs, who resigned a short time ago.

The question of trolley competition has been revived in the Cincinnati, Hamilton and Dayton office and it is said the company has a car at its shops similar to a gasoline car used by the Chicago and Alton, which may be put in service between Cincinnati and Dayton, if it proves a success. These

cars may be used wherever trolley roads come in competition with the company's lines. The officials are awaiting the tests on the Chicago and Alton and the Southern Pacific.

The J. A. Stewart Electric Company of Cincinnati has been incorporated with a capital stock of $50,000, by John A. Stewart, G. W. Platt, Paul Stewart and others.

The Columbus Public Service Company has asked for bids on machinery to double the capacity of the plant on Mound Street, Columbus.

Articles of incorporation have been filed by the Urichsville and New Comerstown Railway Company which will build a line between the two cities indicated in the name. The office will be at Uhrichsville. T. D. Heals, C. S. Evans, J. M. Cooper and others are interested.

Judge Taylor of the United States District Court has denied the application of the Cleveland Electric Railway Company for a temporary injunction against the Forest City Railway Company and the city of Cleveland to prevent the former from operating a street-car line on Central Avenue. The court said that the franchise of the road had expired on March 22d of the present year. It is thought the company will take the case to the United States Court of Appeals.

An all-day test of the sprinkler system as protection against fire in street-car barns was made at the Miles Avenue barn of the Cleveland Electric Railway Company last week. The company has installed a system, which is virtually three systems, in that barn. One of them is against the ceiling, the other just low enough to throw the water into the transoms of the cars and another line is still lower and will hurl the water into the windows. All were tested separately and it was found that a hot fire could be confined to a single car with any of them. In the last test made of the low lines, a head opened and drowned out the blaze before it had hardly gotten started. A second attempt was made, oil being used to produce a hot blaze, but it was kept under control without the least difficulty. The lower lines are objectionable because they are more or less in the way, men sometimes strike their heads against them when working about the cars. The Cleveland Inspection Bureau conducted the test and there were many insurance men and inspectors present to witness it. O. M. C.

## Indiana.

Indianapolis, April 29.—A Philadelphia dispatch is authority for the report that a number of Cincinnati traction magnates with the Wiedner-Elkins syndicate, contemplate one of the greatest traction deals ever consummated in the Middle West. The plan includes the purchase of the Dayton, Springfield and Urban line, the Columbus, London and Springfield, the Dayton and Western, the Richmond Street and Interurban and the Indianapolis and Eastern lines. Over this system accommodation and limited trains will be run and sleeper and dining service will be installed. An express company will operate over the entire system and other innovations will be introduced to make it the most complete transportation system evolved since the inception of the electric railway. J. W. Chipman, general manager of the Indianapolis and Eastern, says that while such a merger may be effected sometime he has no knowledge of such a deal at present.

Subsidy elections in Rochester and Liberty townships, Fulton County, held on the 28th inst, voted $40,000 in aid of the Logansport and South Bend Traction Company. Richland township defeated the proposition.

The Ft. Wayne and Wabash Valley Traction Company will open Boyds Park June 1st. A "scenic railway" has been completed at a cost of $10,000.

A new interurban electric railway from Ft. Wayne to Bluffton, and running thence to Marion, which will shorten the distance between Indianapolis and Ft. Wayne by 17 miles, is proposed by the Ft. Wayne, Bluffton and Marion Traction Company, which filed articles of incorporation this week. The capital stock is $550,000. The directors of the new company are Frank H. Cutshall, S. L. Morris, H. E. Vandermark, F. C. Baade and F. H. Schmidt.

The announcement that the Indiana Railway Company, with extensive interests in Northern Indiana, will buy the Chicago and South Shore Electric Railway between Laporte and Michigan City, has been followed by the official statement that the purchasing company will build immediately from South Bend to Laporte. Through cars from South Bend to Michigan City are promised by January 1st. The receiver's sale of the Chicago and South Shore Company's line between Laporte and Michigan City, as ordered by the Federal Court, will be held at Laporte on May 26th. The system is estimated to be worth nearly $500,000.

Work on the survey of an electric railway from Gas City to Hartford City has been begun. The new line is being promoted by W. B. Dodds of Marion, who is backed by the Indiana Northern traction interests.

Robert P. Woods has been appointed engineer of the new traction line being built between Indianapolis and Terre Haute. The contract for the work has been taken by George Townsend.

The fight between the Hen Island dam interests, which furnish the electric light and power for South Bend, Mishawaka and Elkhart, and the Elkhart City Electric Company is ended by the purchase of the latter by Charles A. Capen, who is believed to represent the Hen Island syndicate. The consideration is said to be $250,000, which is less than the plant cost.

The Tippecanoe Hydraulic Company is the name of a new company incorporated this week to utilize the waterpower in the Tippecanoe River near Monticello. The capital stock is $50,000. A. A. McKain of Indianapolis is president. It is proposed to build four dams about six miles apart, the first to be built at once at Norway, one mile north of Monticello. In this plant the company will invest $100,000. The company proposes to furnish electricity for lights and power to Lafayette, Logansport, Delphi, Monticello, Brookston and Frankfort. Mr. McKain has purchased all the land adjacent to the power sites. There is much interest manifested in the project, which is deemed perfectly feasible. S. S.

## Michigan.

Detroit, April 29.—J. C. Hutchins, president of the Detroit United railway, states in a letter to the Chamber of Commerce, that upon May 1st he will arrange his schedules for standard time. Several hundred manufacturers have agreed to change to standard time on this date. All clocks, tickets and schedules will be changed accordingly.

The bill recently introduced in the Michigan Legislature giving electric railways the right of eminent domain in laying lines across country has passed the House with few dissenting votes. The bill has met with practically no opposition except that offered by the steam roads.

The Detroit United railway has refused to grant the request of motormen and conductors for an increase in pay from 23½ cents to 25 cents an hour, with 30 cents an hour for overtime. The men will hold a meeting soon to decide whether to strike. The men say that the increased cost of living demands more pay.

The Detroit, Ypsilanti, Ann Arbor and Jackson electric line has announced a half-hourly service between Ann Arbor and Ypsilanti commencing May 1st. A new type of open car of the tourist style will be put on this local line.

Negotiations have been entered into with Chas. A. Chapin, president of the Indiana and Michigan Power Company, with regard to utilizing the dam and power plant at Buchanan, Mich., as well as other power utilities representing 50,000 horsepower, for a proposed Chicago to Cleveland electric railway.

Mayor Codd has expressed his belief that Detroit could save $100,000 a year if all the public utilities of the city were run on a municipal basis. C. G. W.

## Northwestern States.

Minneapolis, April 29.—The contract for the new electric-light plant for the Brown County Insane Asylum has been let to LeClair Brothers of Green Bay, Wis. It will cost about $5,000.

The South St. Paul (Minn.) Power, Heating and Lighting Company has applied for a franchise. E. Erick is one of those most heavily interested. The company is capitalized at $15,000.

The 12-year extension to the street-railway franchise secured in 1901 by the Duluth-Superior Traction Company from the Superior (Wis.) council has been declared void by the courts. The original franchise does not, however, expire for 14 years.

O. E. Logan has let the contract for the construction of a large power plant at Sheldon, Iowa.

The Lee Electric Light Company proposes to expend about $50,000 in improvements at Shenandoah, Iowa.

J. E. Houghland of Eldon, Iowa, proposes the construction of a trolley line from Ottumwa, Iowa, to Jefferson City, Mo.

The Peterson Light, Heat and Water Company of Iowa Falls proposes building a power line to Alden.

All of the necessary franchises have been granted to the Mankato and St. Peter (Minn.) Railway and Lighting Company, and the company says that the trolley line connecting the two cities will be completed within 18 months. R.

## Rocky Mountain States.

Boise, Idaho, April 28.—The Utility Power Company has been incorporated in this city with a capital stock of $300,000, by J. L. Weaver, Frank Martin, L. J. Weaver of Boise; Henry Fitch and B. A. Dure of New York.

The telegraph line between Globe and Bowie, Ariz., is to be rebuilt, and two wires will probably be strung, one for the Western Union and the other for the Gila Valley railroad.

The trustees of South Boise, Idaho, have granted a franchise to the Boise Traction Company to operate an electric railway. Secretary Donaldson of the company states that work will be commenced as soon as material can be gotten on the ground and that the line will be in operation during the summer.

The City Council of Payette, Idaho, has granted three franchises to William and Sinclair Mainland, eastern capitalists, one for a gas plant, another for an electric-light plant and the third for electric railways. Work on the light plant must begin within 12 months and cars must be running on the railways within 18 months.

E. Crutcher and associates have been granted per-

## Pacific Slope.

San Francisco, April 27. [illegible] Francisco, representing the Ladd-Baumann syndicate, [illegible] operate an electric railroad between Watsonville and Hollister via Chittenden, and between Watsonville and Santa Cruz, Cal.

At a recent meeting of the Central Contra Costa County Improvement Association held in Walnut Creek, Cal., $25,000 was pledged as the basis of a fund for the building of an electric railroad to connect Walnut Creek with Oakland, Danville and Concord, Cal. A. Rudgear of San Francisco is interested in the project.

The Joshua Hendy Machine Works of San Francisco have the contract for the electric-lighting system to be placed in the Donohoe Building at Market and Taylor Streets. The contract amounts to $3,000.

The trustees of Bakersfield have adopted an ordinance granting a franchise to the Bakersfield and Kern Electric Railway Company for the construction and operation of an electric railway along the streets of Bakersfield, Cal.

A. L. Selig, manager of the Edison Electric Company of Los Angeles, has been in Ventura recently with a view of determining the feasibility of making Ventura, with other towns of Ventura county, a distributing point of its electric system.

The Town Council at Sumas, Wash., has granted a franchise to the Farmers' Mutual Telephone Company to install a system in the town of Sumas, and to the Sumas Electric Light, Power and Water Company to install an electric-light and a water system, work on the latter system to commence inside of 60 days. The plants will cost about $20,000.

H. W. Fellows of Spokane, Wash., has placed a proposition before the city of Goldendale, Wash., to construct an electric-light plant in the latter city involving an outlay of about $50,000. Power will be developed from the falls of the Little Klickitat.

The Portland, St. Johns & Vancouver Railway Company has been incorporated at Portland, Ore., with J. V. Beach as president and O. F. Paxton vice-president. The company will build an electric railway from the south end of Union Avenue, Portland, to a new landing on Shaws Island. Work is to begin at once.

The Spokane and Big Bend Railway Company has been incorporated at Spokane, Wash., with the object of building an electric line from Spokane through the towns of Creston, Reardan, Davenport and other places, to the mouth of the Spokane River. The capital stock is $3,000,000. The incorporators are W. H. Plummer, F. C. Robertson, D. R. Cameron, Thomas Hyde and F. B. Gregg.

Sealed bids will be received by William T. Searles, town clerk, Sebastopol, Cal., until June 6th for a franchise to construct and operate poles, wires, transformers and other conductors for the transmission of electricity for electric-light and power purposes, and to operate electric-light and power systems in Sebastopol, as applied for by the Sebastopol Light, Power and Water Company.

F. M. Clough, general manager, and J. B. Robinson, chief engineer of the Diamond Match Company, with headquarters at Chico, Cal., have been in San Francisco recently arranging details for the inauguration of construction work on an electric road from Chico southward to a point on the line of the Southern Pacific railroad at Orland or Willows.

It is reported that Chief Electrical Engineer Babcock of the Southern Pacific Company has left for Chicago with plans for converting the Oakland ferry steam lines into an electric road system.

William R. Hewitt, chief of the Department of Electricity at San Francisco, has submitted an estimate to the Board of Supervisors asking for $266,404.42 to conduct his department for the coming fiscal year. Following are the appropriations for material: Twenty-five thousand dollars for underground work; $57,320 for overhauling and repairs; $2,500 for three-inch paper conduits; $22,311.76 for a 2½-inch steel conduit system; $1,550.75 for standard installation; $135.46 for miscellaneous material and labor.

The Baker City Light and Power Company has been incorporated at Baker City, Ore., by C. A. Johns, J. H. Parker and F. N. Averill of that city. The capital stock is $400,000.

The Electrical Appliance Development Company has been incorporated by J. C. Ellis, Charles W. Mutton, Frederick T. Kitt and others of Sacramento, for the purpose of operating and controlling electric energy, etc. The principal place of business is Sacramento, Cal.

The Merchants Mutual Electric Light Company which is being formed by merchants of Santa Barbara, Cal., in opposition to the Edison Electric Company, is now ready to commence the construction of its plant at Santa Barbara.

The survey of the pole line from Eureka to Loleta, Cal., for the North Mountain Power Company has been completed, and it is understood that actual construction work will be rushed rapidly forward. A

sub-station is to be established at Loleta and the Fortuna Lighting Company will tap the line at that point.

The council of Harrisburg, Ore., has decided to bond that city for $3,000 for the purpose of establishing an electric-light and water system.

The San Diego Consolidated Gas and Electric Company of San Diego, Cal., is about to absorb the San Diego Gas and Electric Light Company of the same city. A large amount of new capital will be expended by the new company in the way of extensions to the existing plant. A.

## PERSONAL.

John L. Matson, superintendent of motive power for the Indiana Union Traction Company, has resigned and will go to Chicago and take a position with the Chicago and Milwaukee Electric Railway Company.

Dr. Brown Ayres, formerly of Tulane University of New Orleans, was formally inaugurated as president of the University of Tennessee at Knoxville on April 25th. In 1893 Dr. Ayres was one of the judges of award in the Department of Electricity at the Chicago World's Fair.

Gaston Harbison has assumed charge of the advertising and publicity department of the National Battery Company of Buffalo, N. Y. Mr. Harbison, for the last seven years, has been employed in the sales department of the Electric Storage Battery Company in its Cleveland, Baltimore and Philadelphia offices, during which time he has had valuable experience in the storage-battery field.

H. M. Warren, electrical engineer of the coal-mining department of the Delaware, Lackawanna and Western Railway Company, has been promoted to the supervision of the electrical work in all departments of the road. Mr. Warren is fitted for his responsible position, and on his meritorious supervision of the electrical work in the coal department for five years the promotion was made.

J. Walter Gillette has resigned the management of the Schuylkill Valley Illuminating Company, the Consolidated Schuylkill Gas Company, and the Montgomery and Chester Electric Railway Company, of Phoenixville, to assume the duties of general sales manager for the National Battery Company of Buffalo, N. Y. Mr. Gillette has had a wide and varied experience in designing, constructing and managing electric-light and railway properties in the United States and South America.

Maurice Coster, formerly manager in Chicago and later in the company's foreign service, will have charge of the export offices of the Westinghouse Electric and Manufacturing Company at New York. To this department will also be attached the office of general agent under the superintendence of Charles S. Powell. Mr. Coster and Mr. Powell have returned recently from Paris and London to take up their new duties. Prior to his departure for England Mr. Powell acted as manager of the Cleveland offices of the company.

Miss Marion H. G. Bell, daughter of Professor and Mrs. Alexander Graham Bell, was married on April 25th at Twin Oaks, Washington, D. C., to Mr. David G. Fairchild. Many scientific and society people of Washington attended the reception following the ceremony. Miss Bell is devoted to the study of electricity and has been an almost constant companion to her father in his researches. Mr. Fairchild is foreign explorer for the Agricultural Department and is the son of President George T. Fairchild of Kansas State Agricultural College.

A. G. Wessling of the Bullock Electric Manufacturing Company, Cincinnati, has recently made a tour of some of the colleges of the country where technical instruction is given in applied mechanics. At each of these he delivered a lecture on "Methods of Control for Variable-speed Motors," treating of the subject with especial reference to motors for driving machinery tools. Mr. Wessling gave a history of the growth and development of the various methods used by his company for obtaining variable speed. His explanation included both the three and four-wire methods.

John Verity died at Willingford, England, recently. While only 41 years of age he had had considerable experience in gas and electric-lighting industries. He traveled in the United States and became acquainted with Thomas A. Edison when incandescent lamps were still a laboratory production. Returning to England, he joined the firm of B. Verity & Sons, which was originally founded by his grandfather in about 1820. In the early '80's this firm was one of the first to recognize the future of electric lighting, and is among the few firms still existing which exhibited at the Crystal Palace Electrical Exhibition in 1882. Soon afterwards, upon the death of his uncle, the business came under the control of John Verity, who, from the first, devoted his energies to the progress of electrical work.

## ELECTRIC LIGHTING.

The Sterling Electric Light Company has sustained a severe fire loss. O. P. Sells is manager.

The Baker Light and Power Company has been incorporated with a capital of $400,000 and will succeed the Rock Creek Power Company and the Baker City (Oregon) Gas and Electric Company.

The Georgetown Water, Light, Heat and Power Company of Georgetown, Ky., has been incorporated with a capital stock of $250,000. The stock will be divided equally among David J. Hauss and Ross Holzman of Cincinnati, R. W. Nelson and F. X. Long of Newport and S. L. Allen of Georgetown.

The city water tank at Ogden, Iowa, collapsed recently, precipitating the contents to the roof of an electric-lighting plant below. Charles Morgan, an employe, was at work in the building at the time, and afterward was found unconscious, half drowned, under the debris of the roof. The entire town was deprived of water and electric lights for a time. The tank was of wood.

## ELECTRIC RAILWAYS.

Work on the proposed electric railway between Bonner Springs and Kansas City, Kan., promoted by John McDaniel, is to be begun at once, the Trust Company of America having taken $2,000,000 of the bonds, it is said.

The business men of Minoa, N. Y., have organized the Minoa Improvement Association, with C. H. Hamblin as president. The object is first to construct an electric railway to Syracuse, and then to arrange for an electric-lighting system and other improvements.

President Thomas Higgins of the Manitowoc (Wis.) and Three Rivers interurban railway states that plans are now under way for the extension of the line to Neenah, Wis., to connect with the territory extending from Fond du Lac on the south to Green Bay on the north.

It is reported that at Schenectady, N. Y., recently, in the presence of a party of visiting railroad officials, the electric locomotive recently built for the New York Central terminal service broke all its previous records by attaining a speed of 83 miles an hour, pulling a heavy train.

At a meeting of the stockholders of the Rock River Traction Company in Prophetstown, Ill., new officers were elected, with Levi Waterman of Geneseo, Ill., as president. The board of directors was authorized to increase the capital stock of the company from $200,000 to $1,500,000. The directors were also authorized to issue bonds for $1,500,000.

W. E. Brice, president of the Mason City and Clear Lake electric railway, and L. S. Cass, president of the Waterloo, Cedar Falls and Northern trolley road, announce that they have consolidated the two systems. They contemplate constructing lines from Mason City to Waverly, Iowa, and from Sumner to West Union, the system when completed is to comprise 200 miles of trackage.

The first assessment on the underwriting has been made for the Washington, Baltimore and Annapolis electric railway. It amounts to 20 per cent. The engineers are now at work on the line and it is believed that construction work will commence by July 1st. Managers of the syndicate believe they will not have to call for more than 40 per cent. of the underwriting and that money may be borrowed or bonds sold to supply funds.

The property of the Kanawha Traction Company, owning the street-car system in Charleston, W. Va., has been sold to W. C. Sproule of Wilkesbarre, Pa. This property was purchased about 15 months ago by Judge Peter S. Grosscup and W. O. Johnson of Chicago, Fred Paul Grosscup of Charleston and others, who have operated it since. It is understood that the new owners will extend the line 30 or 35 miles up the Kanawha River in the coal region.

The traffic figures for the month of April have been issued by the three leading elevated railroad companies of Chicago, and each made a gratifying showing. The Metropolitan and South Side companies show a small increase over the month of March, as well as a substantial gain over the traffic of April a year ago. The traffic of the Northwestern fell only slightly behind the large showing made in March, but made the greatest gain in the daily average, compared with April last year.

The Edwardsville (Ill.) Intelligencer of April 21st says: "Outraged nature was revenged on man slightly yesterday for the inroads the march of progress makes. The Allen electric line is being pushed through the timber on the west side of town, and in driving a cut back of the old Sherman place Contractor McInerney's men severed all the roots on one side of a giant oak. The big tree seemed to occupy a perfectly safe position and to be sound throughout, but some hours later, without any warning, it crashed down, blocking the advance of the graders, and crushing one of the mules to death."

## PUBLICATIONS.

The Electric Machinery Company of Minneapolis, Minn., is a manufacturer of high-class alternating-current machinery, and one of its latest bulletins is descriptive of revolving-field alternating-current generators and rotary converters, 1,000 kilowatts and under. The bulletin contains a very good general description of these machines, and the company stands prepared to give full data as to standard sizes, weights, floor space, etc. The machines are of the revolving-field type.

The Cincinnati Electrical Tool Company of Cincinnati has issued a small bulletin describing briefly its electrical grinders and drills. Power for their operation may be taken from an incandescent-light socket using direct current, the machines being wound for 110 and 220 volts.

The Century is publishing a series of articles on "Great Inventions Described by Their Inventors." It began in the May number with Mr. Brush's article on "The Arc-light," to be followed by papers on "Electric Traction" by Frank J. Sprague; "The Transmission of Power" by Nikola Tesla, and "The Air Brake," by George Westinghouse.

The Journal of Proceedings of the Northwestern Electrical Association has been issued by Secretary T. R. Mercein. It contains in full the proceedings of the 13th annual convention which was held in Milwaukee, January 18 to 21, 1905. The officers, directors and various committees are given, one correction to this list being that President C. H. Williams is now located at La Crosse, Wis., instead of Madison, having recently become general manager of the Wisconsin Light and Power Company of the former city.

In the field of direct-current generators the Northern Electrical Manufacturing Company of Madison, Wis., has many desirable types of machines to offer as shown by its latest bulletin upon this class of apparatus. The statement which the company makes at the beginning of the bulletin sums up very tersely what it believes its machines are capable of doing, being to the effect that "the unique feature of Northern literature is that in most every case the apparatus illustrated represents machinery purchased by someone to do something better or cheaper than has been accomplished before."

"The prevention of accidents is more to be praised than bravery at the time of an accident" truthfully asserts the Consolidated Engine-stop Company of 100 Broadway, New York, in the pamphlet which it has issued concerning its engine-stop and speed-limit system. This system is designed automatically to shut off the steam to an engine in case of emergency, and can also be operated from points about the building to accomplish the same result if an employe is caught in the machinery, in case of fire in the engine room, etc. A detailed description is given in the pamphlet of the working parts and the operation of the system as a whole.

The Rolfe Electric Company of Rochester, N. Y., has some practical ideas when it comes to the matter of the publication of attractive and useful advertising literature, as is shown by the little booklet which it has issued upon the subject of electrical laws and rules of practice. These rules give the fundamental definitions and formulas used in everyday electrical work and also a number of useful conversion tables. Besides dealing in a general line of electrical apparatus, the company has the sole manufacturer's license for the Schwarze Universal bells under the Schwarze patents, for the eastern, middle and southeastern states.

Each succeeding publication of the Westinghouse Companies seems to attain to a higher degree of excellence, if possible, than the preceding one. One of the latest of these products is a handsome booklet upon "The Westinghouse Companies in the Railway and Industrial Fields," containing as a frontispiece a fine half-tone likeness of George Westinghouse. Every phase of the railway industry as exemplified in the diversified products of the companies is touched upon, and in the matter of illustrations nothing is left to be desired. The publication contains 68 pages and 131 illustrations picturing and describing a wide variety of apparatus from the incandescent lamp up to the modern steam turbine.

## SOCIETIES AND SCHOOLS.

The annual convention of the National Water Works Association will be held at West Baden, Ind., on May 8th, 9th, and 10th. It is expected that many persons interested in waterpower electrical plants will attend the meeting this year. The railroads have provided for reduced rates. J. M. Divin of Charleston, S. C., is secretary.

A bulletin of the summer session of Armour Institute of Technology, Chicago, has been issued. The summer courses offered by the Institute are designed to meet the wants of special students and teachers who desire to extend their knowledge of science and technical subjects. The session begins June 26th and ends August 4th. It is advised that those intending to enter apply early, as the Institute reserves the right to withdraw any course outlined in the bulletin for which there is not a sufficient number of applications.

A meeting of the National Conference on Standard Rules was held in Boston on April 21st. The principal business transacted related to the notice on the flyleaf of the National Code relative to the approval of the code by the conference and the endorsement of the national organizations. It is the

desire that the notice on the flyleaf of the code be strictly accurate, and, therefore, the conference voted that an historic statement be made on the flyleaf to the effect that the current edition is based upon the code drawn by the conference in 1896 with the various amendments and additions since that time on behalf of the National Board of Fire Underwriters. The notice is then to be followed by the names of the organizations represented at the conference.

## MISCELLANEOUS.

The second great pyramid of Ghizeh was struck by lightning slightly below its apex during a violent thunderstorm recently. Several huge stones were dislodged and were precipitated to the sands below. The storm was the most violent experienced in Egypt for 15 years. It is reported that none of the pyramids has ever been struck by lightning before.

## TRADE NEWS.

Joseph Beeler has engaged in the electrical construction and repair business in Ottawa, Kan.

The Cascade Gas and Electric Fixture Company has bought the stock of Cox & Calderwood and moved it to the store at 214-16 Cherry Street, Seattle, Wash.

Owing to increase in business, F. E. Pfannmueller & Co., dealers in new and reconstructed power equipment, have moved to larger quarters, and are now located at 1134 First National Bank Building, Chicago.

Owing to rapidly growing business, the Roberts & Abbott Company, engineers at Cleveland, Ohio, has moved to larger and more commodious quarters in the Citizens' Building. It formerly had offices in the Electric Building.

Lieut. Col. Frank Heath, commandant of the Frankford Arsenal, Philadelphia, Pa., is inviting sealed proposals until May 22d for furnishing the arsenal with electrical supplies during the next fiscal year. Detailed information will be furnished on application to Colonel Heath.

The Germania Electric Lamp Company of Harrison, N. J., has been incorporated under the laws of New Jersey with $125,000 capital. George Campbell is president; S. G. Waterman, vice-president and Edward Campbell, secretary and treasurer. The company expects to build a new factory this summer to enable it to keep up with home and export orders.

The American Electric and Controller Company, heretofore located at No. 12 Dey Street, New York, has taken offices in the Electrical Exchange Building, 136 Liberty Street, New York, where it has on exhibition a line of its specialties. The company announces that it has ready for distribution eight bulletins upon its Rheostat, electrically operated switches, automatic induction-motor starters, solenoids, etc. When requested it will furnish free of charge a suitable binder in which the bulletins can be preserved.

Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until 3 p. m. on May 26th, for the wiring for incandescent lighting, complete, at the postoffice, Kankakee, Ill., in accordance with the drawings and specifications, copies of which may be had at the above address or at the office of the superintendent at Kankakee.

The American Electrical Works desires to advise its friends and customers that it has removed its Chicago offices from No. 82 Lake Street to Suite 506 Merchants' Loan and Trust Building, where it will be pleased to receive all communications relative to the business of the company. Its telephone number will remain the same as heretofore. Mr. F. E. Donohoe is the western agent of the company.

The bureau of supplies and accounts of the Navy Department is inviting sealed proposals until May 16th for furnishing eastern navy yards with the following: Schedule 234—electric bells, push buttons, ammeters, circuit breakers, conduit and fittings, wire; schedule 236, battery testers; schedule 237, motors, cable, conduit and fittings, conductors, etc. Blank proposals can be obtained at the bureau or at the navy pay office in New York.

The Milwaukee Electric Company has discontinued business and desires to sell its plant, which is located at West Allis, just outside the city limits of Milwaukee. The buildings have been built but three years and are thoroughly equipped in all departments. The plot of ground consists of six acres. The plant is located so that the tracks of the Chicago, Milwaukee and St. Paul and the Chicago and Northwestern railroads run into the main building.

In consequence of the increase of its business, the H. W. Johns-Manville Company of New York has found it imperative to establish more branches in order to facilitate the handling of its business, and as a convenience to its customers. The new branches are in the West—San Francisco, Seattle, Kansas City, Los Angeles, Little Rock and Minneapolis. With these in addition to the old branches, the company now has eighteen branches, covering the entire United States and Europe.

At the annual meeting of the stockholders of the Joseph Dixon Crucible Company of Jersey City, N. J., the old board, consisting of Edward F. C. Young, John A. Walker, Edward L. Young, William Murray, George T. Smith, Joseph D. Bedle and George E. Long, was unanimously re-elected. The board of directors re-elected the former officers, namely, president, Edw. F. C. Young; vice-president and treasurer, John A. Walker; secretary, George E. Long. Judge Joseph D. Bedle was also re-elected as counsel.

## BUSINESS.

[redacted]

list every line of new [redacted] arrangement and cla[redacted]

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pany as the general western selling agents for D. & W. enclosed fuses and safety devices will mail one of these catalogues to any user of electrical material on request.

A Boston dispatch of May 1st says that a movement to merge the companies engaged in the manufacture of street-railway cars is in progress. Options have been secured, it is said, on the Laconia Car Company of Boston; the J. G. Brill Company of Philadelphia; the St. Louis Car Company, St. Louis, Mo.; the Mason Manufacturing Company of Springfield, Mass.; Bradley Car Company of Worcester, Mass., and the Jewett Car Company of Newark, Ohio. It is planned to have one corporation with a capital of about $50,000,000.

One of the large contracts secured recently by the Allis-Chalmers Company was for the extension of the hydraulic, turbine and electrical equipment of the San Joaquin Power Company in California, where 3,000 horsepower will be installed. Besides the hydraulic turbines for producing this power, the additional machinery will consist of two 1,000-kilowatt Bullock waterwheel type generators, seven 350-kilowatt transformers with exciters, and other electrical machinery. The generators will produce a three-phase 60-cycle alternating current at 550 volts, running at 450 revolutions per minute. The voltage of this current will be raised for transmission purposes to 19,500 volts.

The Electro-dynamic Company of Bayonne, N. J., announces that it has secured spaces Nos. 1 and 2, Section O, in the main exhibition building at the International Railway Congress, to be held in Washington, D. C., May 3d to 13th. It will exhibit in these spaces one of its type 5S four-to-one interpole variable-speed motors belted to a generator. It will also have on exhibition frames of its different sizes of motors running from one horsepower at a speed ratio of four to one up to 10 horsepower at a speed ratio of four to one. The company states that it is rapidly enlarging its scope of operation for the interpole motor and will, within the next 90 days, be prepared to sell at least 200 varieties of constant and variable-speed motors, running up as high as 150 horsepower.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued (United States Patent Office) April 25, 1905.*

787,900. Plug and Spring-jack Switch. William W. Dean, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed January 14, 1902. Renewed September 28, 1904.

A connecting plug is provided with an outer shank or sleeve adapted to engage the thimble of the jack. An inner contact piece is inclosed by the shank and insulated therefrom, the contact peice having an axial bore at the end. A contact spring is adapted to enter the bore and makes engagement with the inner surface when the plug is inserted in the jack.

787,905. Telegraphic Relay. Eugene Ducretet, Paris, France. Application filed April 10, 1901.

In a sensitive telegraphic relay are a rigid metallic plate, a rotatable disk, a movable frame, a spring arranged to act upon the disk, an antagonistic spring, and a regulating screw controlling the spring by means of the disk to give the required sensitiveness to the frame.

787,929. Telephone Switchboard. Charles T. Mason, Sumter, S. C., assignor to the Sumter Telephone Manufacturing Company, Sumter, S. C. Application filed September 8, 1904.

A parallel series of jack strips, each strip containing several spring jacks, is supplied with a series of drops individually and removably supported between adjacent rows of jack strips without separating the parts of the several drops. Contacts on the jack springs and springs on the drops engaging the contacts to connect the respective jacks and drops as the latter are placed in position on the jack strips are essential parts. (See cut.)

787,930. Telephone Switchboard. Charles T. Mason, Sumter, S. C., assignor to the Sumter Telephone Manufacturing Company, Sumter, S. C. Application filed February 4, 1905.

Combined in a drop are a magnet, a pivotal armature co-operating therewith, a pivotal shutter co-operating with the armature to lock the shutter in retracted position and to lock the armature in attracted position, and means projecting beyond the face of the drop for restoring the shutter after it has been actuated.

787,936. Selective Signaling Device. Charles H. North, Cleveland, Ohio, assignor to the North Electric Company, Cleveland, Ohio. Application filed June 19, 1903.

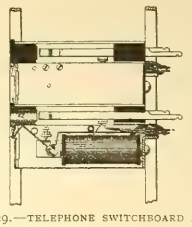
Two oppositely disposed and oppositely and permanently magnetized pole pieces have between them a single-core electromagnet without the normal field. The bare pole pieces are respectively adjacent to the permanently magnetized pole pieces, movable armature parts being operated upon mutually by the permanently magnetized pole pieces and by the pole pieces of the electromagnet. The mechanism of the device is actuated by the armature parts.

787,957. Electrically Heated Curling Iron. Jules Szöllösy, Brighton, England, assignor of one-half to Louis Hyman, Brighton, England. Application filed January 11, 1905.

One member of the curling iron is provided with a heating coil the terminal wires for which are carried through one of the handles of the instrument.

787,969. Registering Apparatus for Telephone Exchanges. David A. Yoder, Toledo, Ohio. Application filed August 25, 1904.

A motor running at practically constant speed co-operates with registering and counting trains with which electromagnets are associated. Means connect the registering train with the motor device during the excitation of the controlling magnet, and other means actuate the counting train upon the excitatio of its magnet.



NO. 787,929.—TELEPHONE SWITCHBOARD APPARATUS.

787,990. Electrical Interrupter. Thomas J. Murphy, New York, N. Y. Application filed September 14, 1903.

In an electric interrupter is a gap in a circuit having a low coefficient of self induction. A condenser is arranged to be discharged across the gap, while an induction coil renews the charge of the condenser. A magnetic field is arranged to react upon electric current in the gap.

788,039. Device for Feeding Hydrocarbon to Vapor Burners. Norman P. Fraser, Carsonville, Mich., assignor of one-half to George C. Fraser, Carsonville, Mich. Application filed August 25, 1904.

The only electrical feature of the device is an electric alarm, which gives warning when the pressure in the tank reaches a predetermined point, the pointer of the pressure gauge when reaching that point closing the circuit of the bell.

788,100. Electrical Panel Board. Hubert Krantz, New York, N. Y. Application filed December 6, 1904.

Cross bars on the board are supported in a plane at a distance away from the plane in which the bus bars are placed, and fuses are connected to the cross bars at points approximately in line with the bus bars crosswise of the board.

788,130. Combined Cable Head and Pole House. Frank B. Cook, Chicago, Ill. Application filed December 28, 1903.

In the cable head is a series of tubular fuses with clamping springs for the respective fuses suitably mounted on the cable head and adapted to automatically clamp the fuses in place. One clamping spring for each fuse exerts a torsion on a portion of the latter when it is in place, and suitable connection terminals are supplied for the respective circuit conductors.

788,152. Fire-alarm and Fire-extinguishing Apparatus. James Hartley, Philadelphia, Pa. Application filed July 1, 1904.

The apparatus is adapted to be held in position near the ceiling and contains the two terminals of an electric alarm circuit, which are normally held apart by an easily fusible solder member. In case of fire the solder is melted and the contacts allowed to meet.

788,166. Electrical System of Heating. Arthur D. Newton, Hartford, Conn. Application filed July 9, 1904.

A heating system for electric cars is described in which there is a traveling contact to ground or a return wire. A thermostatic device operates a cut-out, which makes or breaks the circuit through the heating apparatus, according as the temperature falls or rises beyond certain limits.

788,199. Fire Alarm. James Fiddes and John F. Watt, Aberdeen, Scotland. Application filed January 23, 1905.

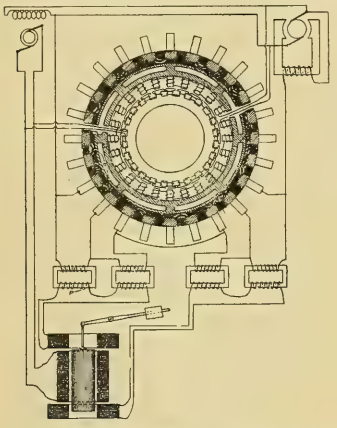
A system of weighted levers is arranged so that the levers are held in normal position by wires. When the wires are heated sufficiently to cause them to expand the levers move relatively and close the circuit of an electric bell.

788,253. Electric Sparking Device for Explosive Engines. Charles S. Dutton, Perth Amboy, N. J. Application filed January 26, 1904.

An igniting plug is located in the cylinder of the engine, a terminal in the line of an electric circuit is connected with the igniting plug. A metal piece is moved by a shifting or actuating rod into and out of contact with the terminal.

788,272. Means for Obtaining Redressed Currents. Luigi Magrini, Milan, Italy. Application filed October 20, 1903.

For redressing the current or currents in a single-phase or polyphase alternating-current circuit, a number of choking coils are inserted in series into the main of each circuit. Two choking coils, each of which connects one end of one of the series coils with the opposite end of the other are provided with a device for varying the impedance of each of the coils synchronously with the phases of the alternating current flowing through the circuit. This consists of a frame on which the coils



NO. 788,278.—POTENTIAL REGULATOR.

are secured at suitable angles to each other, while two diametrically opposed laminated iron pieces are caused to revolve by a synchronous motor, alternately facing the cores of the coils.

788,278. Potential Regulator. Edwin H. Porter and Burleigh Currier, Philadelphia, Pa. Application filed October 7, 1904.

Associated with a direct-current field-magnet circuit is a source of alternating electromotive force dependent upon the direct-current field-magnet circuit, with means for translating the alternating electromotive force into unidirectional electromotive forces of opposite signs whose algebraic sum is zero. Other means automatically vary some or all of the unidirectional electromotive forces so that their algebraic sum is greater or less than zero in response to variations in the alternating electromotive force, the unidirectional electromotive force being in series with the direct-current field-magnet circuit. (See cut.)

788,279. Alternating-current Rectifier. Edwin H. Porter and Burleigh Currier, Philadelphia, Pa. Application filed October 7, 1904.

A source of alternating electromotive force operates a synchronous motor, the revolving element of which carries a commutator made up of a number of insulated bars. Brushes bear on the commutator and opposing and equal electromotive forces of alternating direction are applied between adjacent brushes in series with a work circuit, the whole arranged to successively synchronously short-circuit all electromotive forces of one sign.

788,280. Electric Railway. Leon W. Pullen, Philadelphia, Pa., assignor to the Wireless Railway Company. Application filed July 18, 1904.

A circuit-closing switch box for electric railways is described, which contains a contact block for current to the collector of the car.

788,290. Protected Third-rail System. Isaac C. Thorne, Glencove, N. Y. Application filed January 2, 1904.

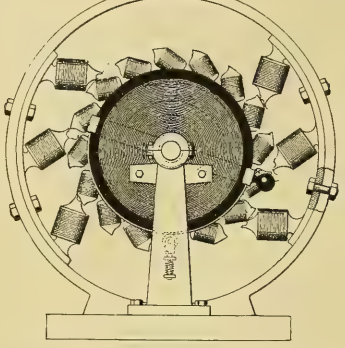
Co-operating with an exposed primary conductor from which current is superficially derived is a second exposed safety conductor arranged adjacent to the first conductor and forming part of an auxiliary normally open circuit. A feeder is normally in electrical connection with the primary conductor and cut-outs deenergize the primary conductor when the two conductors are electrically connected for the passage of the current from the primary conductor to the safety conductor.

788,291. Dynamo or Motor. John A. Titzel, Sr., Franklin, Pa. Application filed November 9, 1901.

The dynamo-electric machine is provided with a frame having an annular member, a cylindrical armature being concentric with the member. Several sector-shaped blocks detachably engage the annular member and are provided with field magnets. Means adjust at will the relative positions of the blocks. Brushes supply the currents to the sector-shaped contacts and means controllable at will shift the position of the brushes, for the purpose of energizing the armature magnets in a different order relatively to the positions occupied by the stationary field magnets, thus reversing the direction of rotation of the armature. (See cut.)

788,315. Method of Electrolytic Separation. William Hoopes, Pittsburg, Pa. Application filed November 30, 1904.

The method of refining metals consists in electrolyzing a solution of the metal to be refined in anhydrous ammonia by the passage of the current through the solution, using as an anode a mass of the metal containing impurities of such a nature that all of them will remain undissolved, or, if dissolved, will remain in solution, the pure metal only being deposited on the cathode.



NO. 788,291.—DYNAMO OR MOTOR.

788,329. Pressure-controlled Electric Switch and Air Gauge. William J. Pugh, Davenport, Iowa, assignor to the Automatic Electric Pump Company, Davenport, Iowa. Application filed August 20, 1904.

An angular switch lever, pivoted at its bend, has a contact on one arm with means engaging the other arm of the lever to open the switch. An electromagnet holds the switch closed until a pressure-controlled device moves the switch until it can be snapped open.

788,365. Dynamo-electric Machinery. John H. St. Hill, Mawdsley, Taunton, England. Application filed September 17, 1902.

A Z-coil has a straight part, which lies in the neutral zone and close over and parallel with the coil of the armature which is undergoing commutation. Two field-magnet cores are situated in such manner that the two cores are excited by the coil.

788,385. Signal Mechanism. James C. Waldo, Sharpsburg, Pa., assignor of one-fourth to John J. Forster, Avalon, Pa. Application filed October 19, 1903.

Electromagnetic devices unlock the mechanism which holds the signal in a fixed position.

788,411. Electric Switch. Wesley D. R. MacDiarmid, Ottawa, Canada, assignor of four-tenths to Edward B. Bates, Ottawa, Canada. Application filed January 23, 1904.

A thumb switch is described in which a shaft extension of the push button is provided with a spiral groove. A follower for the groove is rotated when the button is pushed, causing a contact bearer to revolve and close the contacts of the switch.

788,440. Block-signaling System. Elmer G. Stuckey, Leavenworth, Kan. Application filed December 13, 1904.

An electric block-signaling system comprises an incoming circuit and an outgoing circuit for each end of the block, a common electromagnet for the two incoming circuits and one for the two outgoing circuits. A common circuit-controlling device is operated by the two common electromagnets, the signal-actuating circuits for each end of the block being connected with the common circuit-controlling device. A common armature is adapted simultaneously to open one of the signal-actuating circuits and to close the other, while an electromagnet in each of the incoming circuits is adapted to actuate the common armature.

788,450. Electric Reciprocating Tool. Paul Centner, Verviers, Belgium. Application filed January 24, 1905.

A device for obtaining a magnetic field having a rectilinear reciprocating motion, consists of a stator formed of two parallel groups of iron laminæ secured side by side and having notches in which are arranged conductors forming a biphase winding through which two alternating currents of different frequency are made to pass, so as to produce a reciprocating rectilinear motion to be imparted to a moving induced part arranged parallel to the stator and composed of two sets of iron laminæ having notches in which is arranged a winding of a developed squirrel-cage form.

788,452. Telephone Transmitter. Henry P. Clausen, Chicago, Ill., assignor to the American Electric Telephone Company, Chicago, Ill. Application filed August 20, 1902. Renewed February 8, 1905.

In a telephone transmitter comprising a main diaphragm there are supplemental front and back mica diaphragms and a non-yielding connection between the front supplemental diaphragm and the main diaphragm. A bridge back of all the diaphragms is non-yieldingly connected to the center of the back supplemental diaphragm and a non-yielding connection is placed between the marginal portion of the two supplemental diaphragms. Front and back electrodes in the chamber are provided between the two supplemental diaphragms, the front electrode being movable with the main diaphragm and the back electrode being rigid with the bridge, granular carbon being interposed between the electrodes.

788,473. Armature. Charles W. Johnson, Norwood, and William Cooper, Cincinnati, Ohio, assignors to the Bullock Electric Manufacturing Company. Application filed July 16, 1903.

An armature core comprising laminated sections, has separators between the sections, the separators having cut-away portions, and the laminæ having lips integral therewith turned over the separators and into the cut-away portions.

788,477. Aerial Telegraphy. James F. King, New York, N. Y. Application filed June 23, 1903.

A vibration circuit having capacity connected therein is connected with a normally closed generator circuit. Means create an arc in the normally closed circuit and connect the arc in the oscillation circuit in multiple with the capacity.

788,493. Incandescent Electric Lamp. Herschel C. Parker, New York, N. Y. Application filed July 2, 1904.

In an electric lamp is a highly refractory non-conducting tube, permeable to light. A conductive but resisting core of free particles is tightly packed within the tube, the ends of the core offering less resistance to current than the intermediate portion. Circuit terminals are held in the end portions of the tube.

## EXPIRING PATENTS.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on May 1, 1905:

381,907. Electropneumatic Railway and Conveyor. T. A. Connolly and A. A. Connolly, Washington, D. C.
381,915. Electric-lighting Apparatus for Railroad Cars. H. E. Dey, New York, N. Y.
381,938. System of Telephonic Intercommunication. J. A. McCoy, Medford, Mass.
381,953. Electric Penholder. C. W. Reitler, Denver, Colo.
381,968. Electromagnetic Motor. N. Tesla, New York, N. Y.
381,969. Electromagnetic Motor. N. Tesla, New York, N. Y.
381,970. System of Electrical Distribution. N. Tesla, New York, N. Y.
382,001. Electric Gas Lighter. C. W. Holtzer, Brookline, Mass.
382,098. Apparatus for Preparing Secondary Battery Plates. A. F. Madden, Newark, N. J.
382,110. Protector for Electric-lamp Sockets. C. P. Reilly, New York, N. Y.
382,112. Automatic Switch for Secondary Batteries. J. S. Sellon, Hatton Gardens, county of Middlesex, England.
382,165. Automatic Temperature Regulator. W. S. Johnson, Milwaukee, Wis.
382,174. Armature for Dynamo-electric Machines. R. Mackie, Troy, N. Y.
382,183. Apparatus for Producing Metals by Means of Electrolysis. J. Ombolt, Gossnitz, Saxe-Altenburg, Germany.
382,195. Telegraph Receiver. C. Selden, Baltimore, Md.
382,249. Automatic Electric Gas Burner. E. E. Bailey, West Everett, Mass.
382,253. Fire-alarm Signal Circuit. W. Carroll, Chicago, Ill.
382,279. Electromagnetic Motor. N. Tesla, New York, N. Y.
382,280. Electrical Transmission of Power. N. Tesla, New York, N. Y.
382,281. Electrical Transmission of Power. N. Tesla, New York, N. Y.
382,282. Method of Converting and Distributing Electric Currents. N. Tesla, New York, N. Y.

## SPECIAL MENTION.

Articles of incorporation have been filed at Albany, N. Y., by the Bausch, Lomb, Saegmuller Company, which is to have its headquarters at Rochester. The new company will manufacture astronomical, physical and other instruments, the Bausch & Lomb Optical Company of Rochester to be the sales agent. George N. Saegmuller will be in active charge of the new plant.

The Pennsylvania Limited, says the management of the Pennsylvania Lines, is the finest train on wheels; time, Chicago to New York, just 23 hours. The train leaves Chicago daily at six p. m. It is made up of a compartment observation car, library car and Pullman's best sleepers. There is a ladies' maid to look after the comfort of ladies and children; excess fare charged on this train. C. L. Kimball, assistant general passenger agent, No. 2 Sherman Street, Chicago, will be glad to furnish any information upon application.

The Herzog Art Furniture Company of Cleveland, Ohio, has recently ordered from the Allis-Chalmers Company one 100-kilowatt, three-phase, 60-cycle, alternating-current generator. This will be belt driven and is to furnish current for lighting and power purposes in the Herzog company's factory. With it will be installed an exciter, switchboard and several motors, ranging in size from five horsepower to 20 horsepower. Heretofore electrical-driving apparatus has not been in use in this factory and it is believed that the change will be conducive both to economy and better general results.

The Canadian Westinghouse Company recently sold to the Edmonton (Alberta) Street Railway Company a 200-kilowatt railway generator and a number of double equipments of railway motors. The City of Edmonton is the most northerly point on the American continent to operate an electric street railway. Another recent sale made by that company was a 500-kilowatt enclosed-type turbo-generator unit for the Canadian Pacific Railway Company. This unit is to be installed at Fort William on the Canadian Pacific and to be used for supplying power to the various grain elevators at that point. The unit is to operate three-phase, 600-volt, 7,200 alternations, 3,600 revolutions per minute.

# WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXVI. CHICAGO, MAY 13, 1905

## Twenty-four-hour Service from Small Central-station Plant at Odell, Ill.

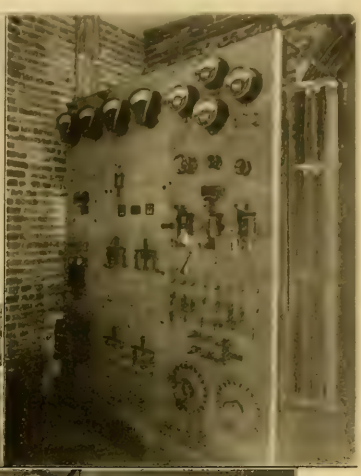
Electric lighting plants of large size, including in their equipment the most fully developed types of machines, are not the only ones worthy of description; the smaller stations are of course much more numerous, and their operation presents conditions which demand careful and intelligent study. The manager of a plant of this sort has his own particular problems to meet, and although to the uninitiated the operation of a small plant of a few hundred kilowatts or even less may seem to be clear sailing, such is far from the case, and the matter of keeping the stream of dollars always flowing in the right direction requires the same careful attention to details that is necessary in the large city plant.

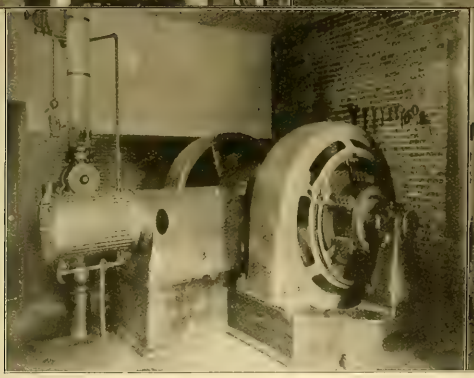
A plant which is a fair example of what may be accomplished in a small place is that of the Odell Electric Company of Odell, Ill., which is a town of about 1,100 inhabitants. This plant furnishes to the citizens of Odell 24-hour service, which is rarely met with in plants of this character. Aside from the advantage of all-night lights, consumers may avail themselves of current for other purposes during the day, and this class of service is naturally encouraged as a day load. Besides lighting, the company furnishes current for about 40 electric fans, a number of sewing machines, printing-press motor, dentist's motor and a harness-shop equipment. Direct current is used, a storage battery being installed in connection with the plant, a brief description of which follows.

Fig. 2 is an exterior view of the power house, which contains besides the electrical plant the pumping apparatus for the waterworks system, also operated by the Odell Electric Company.

Electricity is generated by a single boiler and generator unit. The boiler, which is shown in Fig. 5, is of the Johnson Bros. make, internally fired, and of the Scotch marine type fitted with an Adamson furnace. The nominal capacity is 100 horsepower. Since the picture was taken a Little Giant stoker has been added to the boiler, which is highly satisfactory in its operation. This stoker is provided with a hopper into which the coal is shoveled. From the hopper the coal is automatically fed down and falls through rows of separating fingers or bars. At this point a jet of steam is admitted, and, striking the coal, literally blows it back into the furnace, the finer pieces separated out by the fingers being blown farther back in the furnace than the larger pieces, producing the best conditions for good combustion. A 50-foot steel stack, shown at the right in Fig. 2, furnishes the necessary draft. The other stack shown in the picture is for an old boiler that was used in connection with the pumping plant before the electrical plant was installed, about two years ago. Since that time, however, the one boiler furnishes steam for both plants, except in cases of emergency.

The engine and generator are shown in Fig. 4. The generator is a General Electric 75-kilowatt, direct-current, 250-volt, shunt-wound machine, and is direct connected to a Ball 13 by 14-inch simple engine developing 112 horsepower at one-quarter cut-off. Steam, before it is admitted to the engine, [illegible] the boiler is passed through this heater and is heated by the exhaust from the engine. A six by four by six-inch Worthington duplex pump and a [illegible] used in connection with this part of the installation.





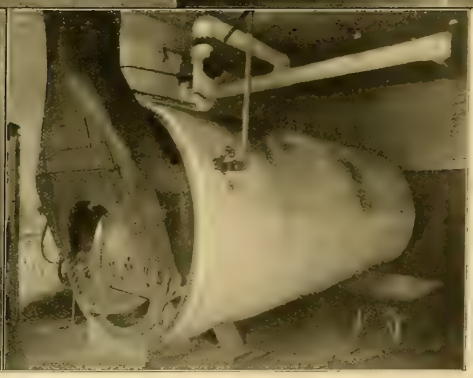


Fig. 1. View in the Battery Room. Fig. 2. Exterior of Plant, Showing Waterworks Tank. Fig. 3. Three-panel Switchboard
Fig. 4. Direct-current Generating Unit. Fig. 5. Boiler (Photograph Taken Before Stoker was Installed).
SMALL CENTRAL-STATION PLANT IN ODELL, ILL., WITH UP-TO-DATE FEATURES.

Current from the generator is carried to the switchboard shown by Fig. 3. This board consists of three panels, as shown in the picture. The panel to the left is the generator panel and is fitted with a voltmeter, ammeter, field rheostat, generator switch and total-output wattmeter.

The distribution panel is placed in the center of the board and is supplied with a voltmeter connected to two switches, which are arranged to throw it onto either of the two centers of distribution, which are located on the east and west sides of the town, respectively.

The battery panel is on the right-hand side of the board. One ammeter on this panel measures the current to the booster, which is used in charging the end cells of the battery. A voltmeter on this panel is connected to measure the voltage on either side of the battery, the line voltage and the booster voltage. Two ammeters are placed in the circuits leading to the two sections of the battery. They are fitted with zero-center scales, allowing the current to be measured on either charge or discharge. The other apparatus on this panel consists of an overload circuit breaker on each side of the line, two single-throw single-pole knife switches,

a switch for the armature circuit of the booster and also an underload and overload circuit breaker for the booster. The connections of this panel are shown by Fig. 6.

The battery, which is shown in Fig. 1, is composed of two sections—one on each side of the three-wire system. There are 124 cells in all, made by the Gould Storage Battery Company. Twenty-one of these cells are end cells for regulation. There are 11 plates to each cell, with a total area of active material of 411 square inches per plate. The electromotive force of each cell fully charged is 2.63 volts, the density of the solution being kept at 1.225. The battery has a discharge capacity of 25 amperes for 12 hours and is capable of a discharge of 50 amperes for three hours.

In general the method of operation is to start up the dynamo at dusk and run till midnight, the battery floating upon the line and acting as an equalizer. From midnight till dusk of the next day the battery carries the whole load, at which time it stops discharging, and commences recharging when the generator is again started up.

Besides the day load already alluded to there are connected to the system over 3,000 incandescent lamps and 25 arc lights, of which 20 are for street lighting. Everything but the street lights is metered, which is also unusual in a lighting system of this size. A base rate of 15 cents a kilowatt-hour is made, with reductions to large consumers down to 10 cents a kilowatt-hour.

In addition to the lighting plant the company operates the waterworks system, using a 12 by 14-inch Ingersoll-Sergeant air compressor for lifting the water from a 1,291-foot well into a reservoir, from which it is pumped to the tank 120 feet high, shown in Fig. 2.

The president of the Odell Electric Company is W. Buchanan, and his son, W. M. Buchanan, is the secretary. E. L. Barrett has charge of the operation of both the electric and water plants. Secretary Buchanan says that he has received inquiries from all parts of the country relative to matters concerning the operation of this interesting little plant, especially in regard to the storage-battery feature, which marks it as unusual among small-town lighting installations.

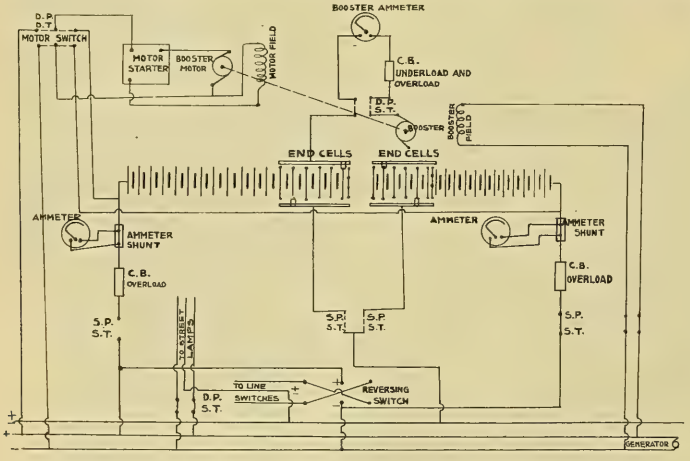



FIG. 6. CONNECTIONS OF BATTERY SWITCHBOARD PANEL IN ODELL ELECTRIC PLANT.

## Electrical Fires from Peculiar Causes.

A rather unusual fire was caused, according to the quarterly fire report of the Electrical Bureau of the National Board of Fire Underwriters, by a roll of wire fencing. The stock in a store room consisted of rolls of fencing, part of which were piled near an exposed service switch and fuse blocks, one of the rolls resting against a nearby gas meter. An employe in selecting a roll brought it in contact with the live terminal. Current arced to the gas meter in which two holes were burned, and the escaping gas was ignited.

Heat from an incandescent lamp in another case resulted in a fire. The lamp was lying on a counter when some cotton goods were thrown over it. When the current was turned on the heat generated in the confined space by the lamp soon set fire to the fabrics.

Another instance is cited in which in finishing a ceiling installation of panel construction in a building two nails were driven through the flexible tubing and insulation of electric wires, and extended to within about one-sixteenth inch of a gas pipe, which was located, together with the wires, in the ribs of the ceiling. These conditions existed for six or seven years, and caused more or less trouble during lightning storms, but the installation always tested free from grounds. Lightning finally penetrated the gas pipe and ignited the gas.

## Signaling Arrangements on the District Railway in London.

In anticipation of the more strenuous conditions caused by the shorter headway planned, the District Railway Company of London has installed a system of signaling for which great improvements over all earlier systems are asserted. This plant presents features of more than ordinary interest and is moreover the first installation of its kind in England.

The section of line between Hanger Lane Junction and South Harrow has now been worked electrically by the District Railway for over a year, with results that augur well for its success on the more important sections of the line. The length of this trial section is about five miles of double track, and it is divided into block sections varying in length from 1,400 feet to about 3,500 feet. On the District Railway generally there are both positive and negative insulated traction rails, the running rails not being used for the traction current. The space between stations is usually divided into two blocks, that is, a "starting" and a "berth" block, and the signaling is on the "normal-clear" principle.

The signals themselves are of the ordinary mechanical type and in no way specially adapted for power or automatic working; consequently they are being replaced by special arms with Westinghouse electropneumatic signal motors fitted close under them and the ordinary counterweight abolished for one directly on the signal arm, as shown in Fig. 1. The motors are enclosed in cast-iron casings, and, being essentially strong and simple, are not affected by climatic conditions. They are controlled by small pin valves worked by means of electromagnets in the local signal circuit. Signal cabins are required only at each end of the branch, or where there is a cross-over road; in the latter case they are normally closed, being opened only when required.

An automatic stop prevents trains from overrunning home signals. This consists of an iron arm between the track rails, as shown in Fig. 2, actuated by a compressed-air motor acting in unison with the adjoining signal motor. When the signal goes to "danger," this arm is elevated to a position in which it engages with a cock on the air-brake system of the train; thus the brakes are instantly and automatically applied if, for any reason, the driver should run past the signal.

The principles of the system may be best understood by reference to the diagram (Fig. 3). One of the track rails is electrically continuous through the whole length of the plant and constitutes the positive conductor from the generator to the individual track sections. The other rail is cut up into block sections by means of special rail joints insulated with fiber. All uninsulated rail joints are bonded to ensure electrical continuity. Power for the operation of the system is generated at 65 volts pressure by motor generators placed centrally, the negative terminals of which are connected to an insulated negative main running the entire length of the system. This main is connected to each section of the sectionalized track rail at a point near the latter end of the block, i. e., the end at which the train leaves, as distinct from the end at which it enters. It will be seen, then, that there is a potential difference of approximately 65 volts between the continuous (positive) rail and the insulated negative main.

FIG. 1. ELECTROPNEUMATICALLY OPERATED SIGNAL ARM OF LONDON DISTRICT RAILWAY.

Resistances are interposed in the connections between the negative main and the sectioned rail which reduce the potential difference between the rails to from three to six volts, according to the length of the block and various local conditions.

Consider now the circuit for a single block unoccupied by a train; the current from the positive brush of the dynamo flows along the continuous rail and thence through the two relays, one at each end of the block, and through the ballast between the rails, all in parallel, to the sectioned rail. From this it flows through a relatively large resistance to the negative main and back to the generator.

Now, suppose a train enters the block. Obviously the current flows through the practically negligible resistance of the car wheels and axles from one rail to the other, and the relays are shunted, with the result that the signal is allowed to go to "danger."

The "track-battery" resistances connected between the negative main and the sections of the sectionalized rail prevent the generator from being short-circuited when the track circuit is shunted by the axles of the train. In fact, these resistances bear such a relation to the combined resistance of the roadbed from rail to rail and the two relays, all in parallel, that the shunting of the track cuts out only a small percentage of the total resistance of the circuit. Thus the current increase in a circuit when shunted is not great; this is important, as it is advisable to keep the track potential as nearly as possible constant. An increase of the total current, resulting from the blocks being occupied by trains, affects the potential between the rails of unoccupied sections, increasing the transmission loss in the negative main.

Next to be considered are the circuits of the track relays which control the signal circuits. The track coils of the relays are permanently connected across the rails at that end of the block at which the relay is placed. Between the pole-pieces a polarized armature is suspended from a pivot. This armature bears a winding of considerable resistance and is connected between the positive rail and the negative main through a contact, operated by the track-coil armature, which is closed when the track coils are energized. To the polarized armature is rigidly connected an arm which actuates a contact, the function of which is to open or close the local circuit controlling the signal motors. The

operation of the relay is then as follows. When a difference of potential exists in the normal direction between the rails, i. e., when there is no train on the block, the relay track coil is excited and draw up the armature which closes the circuit through the polarized armature. The polarized armature is then attracted to one of the poles of the relay, and, swinging over, closes the contact in the local signal circuit.

As already mentioned, there are two relays in each block, one at each end; these are duplicates and operate normally in a precisely similar manner, each working a contact in the local signal circuit. The contacts are in series and unless they are both closed no current can flow through the signal magnet, and the signal will therefore remain at "danger" by gravity.

The position of the apparatus when the block is empty has been indicated above. Both relays being energized, the local signal circuit is closed and the electromagnetic valve operating the pneumatic signal motor consequently open, admitting compressed air to the motor which holds the signal arm "off." As soon as a train enters the block the relays are short-circuited by the car axles and thereby de-energized, permitting their armatures to drop, thus breaking the circuit through the polarized armature coils. The polarized armatures then swing back from their position in contact with one of the track-coil pole pieces, and in doing so break the signal circuit at two points in series. The electromagnet operating the admission and exhaust valves of the pneumatic signal motor is de-energized and the exhaust is opened, permitting the signal to return to "danger" by gravity.

Experience has shown that the greatest obstacle to the success of automatic signaling, on electric railways in particular, is the liability of the relays being operated by extraneous currents so as to cause a false "clear" indication when danger should be shown. The particular claim of the system under consideration is that it is impossible for an extraneous current, from whatever source, to bring the signal arm to the "off" position when it should stand at "danger."

Although in the present system it is possible for the extraneous currents to energize either one or both relays while the train is in the block, these latter are so interconnected that it is not possible for them both to be energized in the normal direction at the same time by extraneous currents.

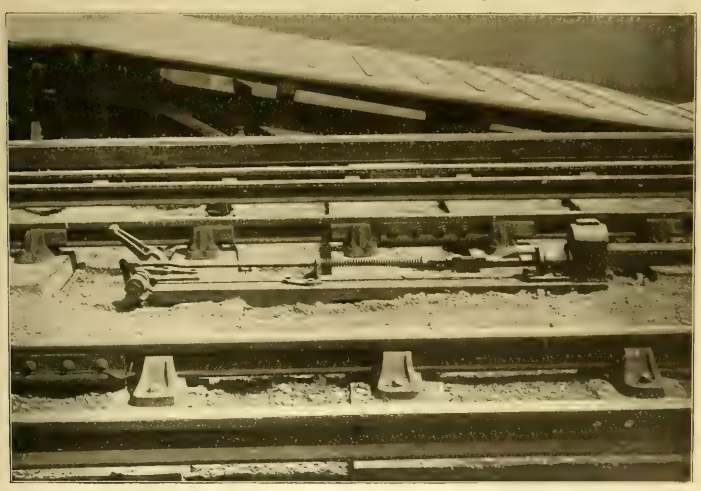


FIG. 2. AUTOMATIC TRAIN STOP ON TRACKS OF THE LONDON DISTRICT RAILWAY.

The various conditions which may occur with a train in the section may be catalogued as follows:

Both relays shunted, no extraneous current; one relay shunted, the other energized normally; one relay shunted, the other energized reversely, and both relays energized, one normally and one reversely.

As will be plainly seen, the circuit through the signal magnet is designed to be always open at one point when a train is in the section, and often at two.

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The United Railways and Electric Company has engaged architects to prepare plans and specifications for a new electric power house on Harford Road, Baltimore.

## High-pressure Line Construction for Alternating-current Railways.[1]

By Thurston Varney.

Of the various methods of current supply heretofore employed the overhead conductor is believed to be the only one capable of developing [illegible] or permanent operation with trolley pressures running up into thousands of volts. The present paper will describe some preliminary work which has been carried out on a practical scale with overhead conductors. Several classes of construction have been designed; of these the least expensive type employing bracket arms will be described first.

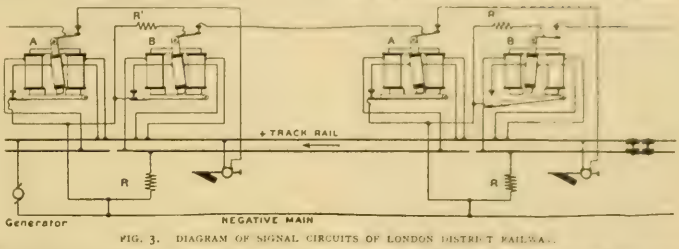


FIG. 3. DIAGRAM OF SIGNAL CIRCUITS OF LONDON DISTRICT RAILWAY.

This system [bracket-arm] consists of a single line of wooden poles spaced well apart and fitted with bracket arms and steel catenary suspension cable for supporting the trolley wire. The bracket arm is a T-iron supported by a tension rod at its outer end and fitted at the inner end with lugs which partly embrace the pole and to which they are bolted with lag screws.

The insulator is of corrugated porcelain, cemented to a malleable-iron sleeve which in turn is slipped over the bracket arm and held by clamps and set screws. The porcelain insulator has a groove at its center surrounded by a malleable-iron collar similar to a pipe clamp. This collar has an eye on the lower side into which the hooks of a clamp which carries the steel-supporting cable or messenger are inserted. Wheel trolleys will probably be used to a considerable extent with the lower pressures. Guard loops are provided to prevent breakage of the porcelain in case the trolley should leave the wire under a bracket.

The guard loops are also of service in temporarily supporting the cable while it is being run out and pulled up. The trolley and messenger are run out together and the former is supported from the messenger at occasional points by temporary tie-wires. The tension in the messenger cable is adjusted to give the proper sag, and the trolley wire is pulled up tight enough to take out all kinks and bends. Both trolley and messenger are then anchored. The messenger is next clamped to the insulators and the trolley is permanently supported from the messenger by means of hangers or clips which are adjusted in length in such a manner as to hold the trolley horizontally. By this means the tension in the trolley is slightly relieved and allowance is made for expansion and contraction. The hangers are stiff and, being placed only 10 feet apart, correct any tendency of the grooved trolley wire to twist. This insures that the smooth lower surface will always be downward, a feature especially necessary when bow or sliding trolleys are [illegible] during a period of two months.

| Date. | Temperature. | Span No. 1. | Span No. 2. |
|---|---|---|---|
| | | Span. | Span. |
| 12-22-04 | [illegible] | [illegible] ft. [illegible] in. | 21 ft. 5.1 in. |
| 12-27-04 | 32.5 | 21 ft. 2.0 in. | 21 ft. 3.6 in. |
| 1-4-05 | 36.3 | 21 ft. 4.1 in. | 21 ft. 5.5 in. |
| | | Span. | Span. |
| 12-22-04 | 4.7 | 20 ft. 7.0 in. | [illegible] ft. [illegible] in. |
| 12-27-04 | 2.2 | 20 ft. 6.8 in. | 20 ft. 7.4 in. |
| 1-4-05 | 14.7 | 20 ft. 7.4 in. | 20 ft. 7.9 in. |

The greatest temperature variation noted on the 120-foot spans was 36.3° F., and the corresponding changes in height at the centers of the spans were 2.1 inches and 1.9 inches, respectively. For the 96-foot spans the temperature variation was 37.6 degrees and the corresponding changes in height were 0.6 inch and 0.5 inch, respectively.

The combined weight of the messenger, 000 trolley wire and hangers averages one pound per foot, which gives a tension in the messenger cable with 120-foot span and 24-inch sag of about 900 pounds. The tension with 96-foot span and four-inch sag is about 3,500 pounds.

For best results with this form of construction both as regards cost and operation the following arrangement is considered satisfactory: The spans should be 120 feet long on straight track, reducing the length as may be necessary on curves. The messenger to consist of a 0.4375-inch galvanized Bessemer steel cable composed of seven strands and having an ultimate strength of about 6,000 pounds. The trolley wire to be 000 grooved section supported in horizontal position by hangers placed 10 feet apart. The messenger cable is to be pulled up to a minimum cold-weather sag of about 11 inches, corresponding to a tension of about 2,000 pounds.

For conditions where bracket arms cannot be used, cross-span work may sometimes be employed. For this purpose the arrangement indicated in Figs. 1 and 2 has been designed. The difference between this arrangement and the bracket-arm construction is the substitution of a 0.4375-inch steel span cable for the bracket. Other details are practically the same.

For the heavy-service requirements of steam roads

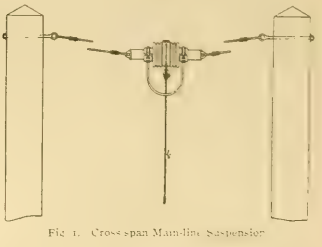

Fig. 1. Cross-span Main-line Suspension.

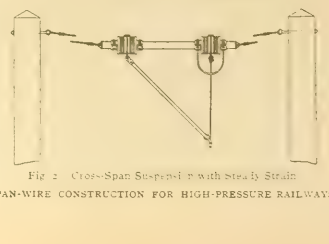

Fig. 2. Cross-Span Suspension with Steady Strain.

SPAN-WIRE CONSTRUCTION FOR HIGH-PRESSURE RAILWAYS.

[1] Abstract of a paper presented at the meeting of the American Institute of Electrical Engineers in New York, March 21, 1905.

having from two to four tracks the construction described above is not adequate; a more substantial equipment and one which will not encroach upon the present standard clearances is necessary. Obviously the best form of support to accomplish this result is a bridge long enough to span all tracks with ample clearance on the sides and overhead, and stiff enough to carry all of the overhead conductors without undue vibration. Bridges of this character are at present in use on many roads to support semaphores and other signal apparatus.

It was first thought advisable to run the messenger cable over bridges. It is necessary, however, to provide an unobstructed view of the signal apparatus, and it is accordingly considered preferable to make the bridge high enough to permit the semaphores to be suspended below the truss.

Fig. 3 indicates a signal bridge which has been devised for a four-track road, carrying beside the semaphores the four sets of cables and trolley wires suspended below the truss. This construction is a decided advantage in erecting, as the cable and trolley wire can be run out along the track and lifted into place. Massive porcelain insulators will be used mounted on heavy pipe and fitted with collars having soft lead strips under them. From these the cables will be hung by means of bolted clamps. By anchoring all cables to the bridges after being drawn up to a uniform tension the effect will be to steady the bridges. For roads having wide

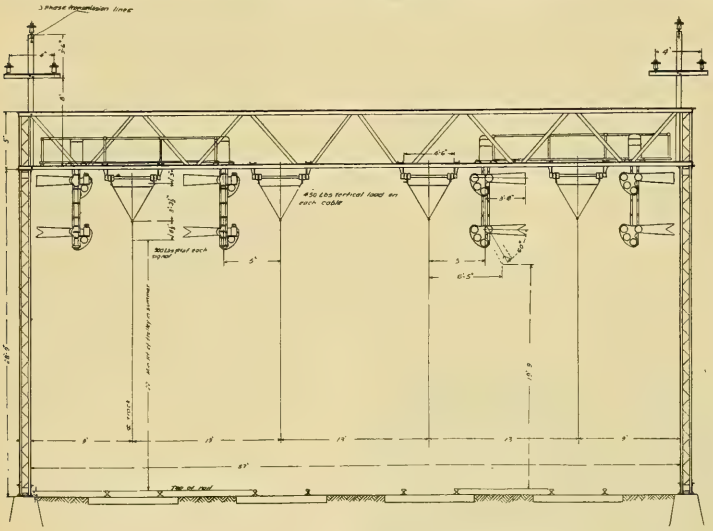

FIG. 3. BRIDGE FOR CARRYING SIGNALS, TROLLEYS AND TRANSMISSION LINES FOR FOUR-TRACK ROAD.

rights-of-way comparatively light bridges steadied with guy cables may be used, but for most cases a substantial structure similar to those now used for signal towers will probably be preferable. It will be noted, however, that owing to the comparatively long intervals between signals only a few of the bridges carry semaphores; the others may be made lighter.

Spans of 300 feet for straight tracks appear to be satisfactory, not being so long as to permit undue vibration in the cables, and not so short as to require a large number of bridges per mile.

For the messenger cables 0.625-inch extra-high strength steel strands are suitable. With a 0000 grooved trolley wire and hangers spaced 10 feet the average load per foot on each cable is 1.43 pounds, and with a vertical sag of 2.7 feet the tension is 6,000 pounds. In a rough climate wind and sleet will at times increase this tension; assuming that the tension may be doubled a factor of safety of about 3.5 will still remain, as the breaking strength of the cable is about 40,000 pounds.

For use in localities where milder weather conditions may be assumed, lower grades of steel may be used having breaking strengths for the same weight per foot of 25,000 pounds and 19,000 pounds. These latter cables are somewhat easier to handle and would be sufficiently strong for most conditions.

The sag given above is taken to be the cold-weather condition and for 100° F. rise the sag would be about 4.4 feet, or a variation of 1.7 feet. In Fig. 3 this allowance is made in the height of the bridge, so that the lowest point of the trolley wire will be 22 feet above the track. It is not believed that the variation will be this much on account of the giving of the supports and other causes.

For curves the length of span will be decreased; and when necessary to hold the wire in the center of the track radial pull-offs will be used, secured to strain insulators. These will be mounted on latticed poles which in turn will be braced by guy anchors.

For sharp curves the radial pull of all the messenger cables would be severe, and it is intended to provide at the tangent points anchor bridges which will have trusses stiff enough in the horizontal plane to stand the strain of slacking off the cables about one-half. These anchor bridges will then be held by long guys running out a considerable distance from the bases of the bridges and anchored to cross-ties or channel irons buried in the ground and concreted.

Regarding the efficiency of the insulation employed, it may be stated that, under snow-clad conditions, 2,500 feet of iron bridgework and five miles of single-catenary construction showed under test a leakage of one ampere at 6,000 volts.

### Discussion (in Abstract).

Calvert Townley, New Haven, Conn.: I think we should observe a considerable degree of caution in recommending extremely high-voltages right away. It is one thing to construct a 10,000-volt system across the open country that is very sparsely populated and it is quite another thing to recommend the construction of a high-voltage trolley system for general service on interurban roads or for a system that is to pass through thickly populated centers. We can, of course, provide safeguards in the way of grounds whenever anything goes wrong, but it is a very different proposition to have a moving vehicle with 500 or 600 volts on its wiring and to have connection with 1,000, 2,000, 6,000 or 10,000 volts. I do not mean to say that we ought to neglect the advantage of using high tension, but I do believe that we should observe a considerable amount of caution in jumping to high voltages. Of course, we want to standardize the practice ultimately and we have got to reach that—indeed, we have pretty much reached it in the 600-volt trolley system—but I have not heard enough evidence of satisfactory practice on any of these lines to make it clear to me that we have reached a time where we could standardize without the danger of making some very serious mistake.

A. H. Armstrong, Schenectady, N. Y.: I believe in keeping the trolley tension as low as permissible, or as low as possible, in order to do the work that is required. There is no need, in my opinion, in going to 6,000 or 8,000 volts if 3,000 will serve the purpose. The apparatus is increased in cost, the liability to a breakdown is increased and it involves an unnecessary expense. We have the ability to go to any potential desired. I believe the 3,000 volts already in use in our suburban work is high enough for the present.

There is another way of looking at the matter. With 3,300 volts at the sub-station it is possible to operate cars of 40 or 50 tons 50 miles an hour on a half or one-hour headway, with sub-stations placed fully 20 miles apart, assuming, of course, that the sub-station fed into a common trolley line. It is a question how much trolley line you want to cut out in case of accident, and I think 20-mile blocks are surely sufficient for perfect mechanical operation. A higher trolley potential is an undue refinement, and, in my opinion, is not called for by operative conditions.

When you come to the operation of heavy freight trains, 2,000 or 3,000 tons, where the motors must reach 1,500 horsepower, it is time enough to consider potentials higher than 3,000 volts; but even in those cases I have found that 5,000 or 6,000 volts amply takes care of all conditions involved—not only of the sub-stations as far apart as may be permitted, but the line drops, the cost of apparatus, and all the operating conditions are perfectly satisfactory.

The position of the trolley has been alluded to. Now, there are three lines in operation at the present time using high-tension current. Two of these lines have the trolley located over the center of the track and one at the side of the track. It seems to me that there are arguments in favor of both locations. A center trolley permits the use of the same trolley wheel or bow for both city and suburban trackage. Many of our city systems are so constructed that a bow cannot be used and a separate trolley wheel would have to be provided. It is doubtful, therefore, if suspending the trolley in the center of the track will effect any economy or any reduction in the number of trolley wheels and base required. A side-suspended trolley opens another suggestion—it necessitates the use of a separate bow or trolley wheel for the high-tension portion of the line, which has some advantages in safety of operation and also in the facility of changing over from alternating to direct current and vice versa; so that the operation of both sets of lines, one using the center trolley and the other the side trolley, will be watched with considerable interest, and I think we are hardly in a position yet to standardize either one position or the other.

The frequency of hangers between the supporting cables and the trolley itself is also an open question. The Pontiac line is operating with a single connection placed midway between the poles. The Indianapolis and Cincinnati line has a support every 10 feet. Neither line is operating as yet at full speed, and we cannot say how much convenience or inconvenience will be occasioned. I think, however, for high speed it will be unnecessary and inadvisable to suspend the trolley more than once or twice between poles in order to get full use of the greater flexibility of the system afforded by infrequent support.

Joseph Sachs, Hartford, Conn.: I am very much astonished to note that notwithstanding some railroads in Europe have been equipped with insulators consisting of material other than wood or porcelain, no mention has been made of the merits of those insulators. It is interesting to note that our early low-tension trolley systems experience the 500-volt work taught us that porcelain, while a good insulator when not struck by a stone in the hands of a small boy, was not a good insulator when subjected to the practical conditions of every-day usage. On the 500-volt service the motor insulator has been finally perfected, until today it has reached a stage where it is considered to be a pretty perfect device.

Mr. Varney: The steam-railroad men guard their heights most rigorously. The New York and New Haven railroad will not permit any trolley wires to cross its tracks at a less height than 21 feet. If on steam railroads any such distance as that is absolutely required, then a considerable change will have to be made in the location of the proposed overhead trolley wire. Furthermore, from the standpoint of safety to life through populous centers it seems to me that a trolley wire of 15,000 volts running under bridges and viaducts is a pretty dangerous thing to have around, particularly for the small boy, who likes to lean over the fence on a bridge and see what happens when he "monkeys" with the wire.

The remarks of Mr. Armstrong, I think, are particularly pertinent as to the continuity of service by having fewer transmission lines, having one trunk line connecting all sub-stations and having the sub-stations nearer together than is contemplated by the higher trolley voltage.

President Lieb: I think it might be well to add that undoubtedly a great deal of credit is due to the pioneer builders of this high-tension trolley line, Messrs. Ganz & Co. of Budapest; but I think it also might be stated that the line in question could hardly be considered a trunk line. While it is a branch of the Adriatic railway system, it is rather a spur from the main line; and while I do not remember the exact conditions as to the intensity of traffic, the impression that I got in reading the details of the number of trains per day, freight and passenger, would lead me to believe that it was anything but a heavy line and not at all approaching our trunk-line conditions over here.

F. N. Waterman, New York: It is 200,000 ton-miles a day. The lightest traffic is three trains simultaneously, and the heaviest eight trains.

## Future Meetings of the Institute.

The annual meeting of the American Institute of Electrical Engineers will be held in New York on May 16th, at which time the result of the election of officers will be announced and other official business of the association transacted. Two interesting papers on the general subject of safety devices will be given at this meeting as follows: "Relays," by George F. Chellis, instrument tester, Interborough Rapid Transit Company, New York, and "The Proper Limit of Duplication to Secure Reliability of Service," by H. W. Buck, electrical engineer, Niagara Falls Power Company, Niagara Falls, N. Y.

The Chicago branch will hold its next meeting May 23d, at which the recent New York papers of George A. Damon and Theodore Varney on single-phase railways, with considerable new mat-

ter in addition, will be directed. The original paper will be upon "Light Electric Railways," by J. R. Cravath.

## A "White Coal" Plant Near Bellegarde, France.

By A. de Courcy.

At a point lying some 15 miles from its outlet from Lake Leman, the Rhone has a considerable fall and also a flow of great capacity. The power afforded by the river was utilized for some time past in various small hydraulic plants, and some of these were connected with the town of Bellegarde by different methods of transmission, so as to furnish energy ("white coal," in the striking French phrase) for the different industries in that locality. As these industries kept on increasing, and at the same time the use of hydro-electric plants became general, it was decided to erect a large hydraulic station at this point which should generate current for use at Bellegarde. The first part of the plant which forms the subject of the present description was erected by the Rhone Land and Waterpower Company. A number of alternators were installed by Brown, Boveri & Co. of Baden, who also carried out the remainder of the electric equipment, while the hydraulic part came from the Swiss firm of Escher, Wyss & Co. Later on, as the demand for current increased, a considerable addition was made to the plant, and it then passed under the control of the Société Française des Forces Hydrauliques du Rhone. The same kind of electric and hydraulic apparatus was used as before, but having somewhat larger units. Owing to this fact, the station has a uniform appearance, although constructed at different stages.

Fig. 1 is a general view of the interior of the station, with the Brown-Boveri alternators and exciters, which are operated by vertical-shaft turbines; also the two switchboards of the plant. The Bellegarde plant has been in very successful operation for several years past in its present state, and has a total capacity of 10,000 horsepower. As most of the power supplied by the station is utilized within

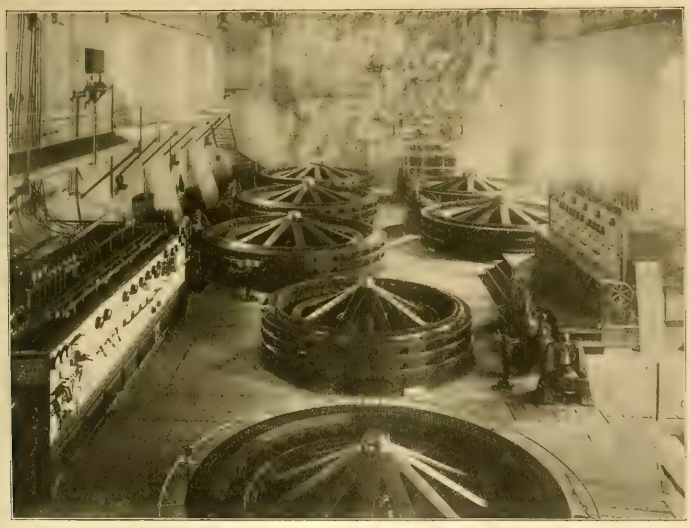

FIG. 1. INTERIOR OF HYDRO-ELECTRIC PLANT NEAR BELLEGARDE, FRANCE.

a short distance from the latter, a high voltage was not needed, and it was decided to use three-phase current at 1,000 volts and 47.5 cycles. In the present case the exciters are separate, and each one is provided with a separate turbine with vertical shaft. (See Fig. 2.) The completed plant contains 16 turbine-dynamo units, comprising eight alternators for the main lines and eight exciters. The alternators are of different capacities, varying from 800 to 1,500 horsepower, while the exciters vary from 30 to 50 horsepower.

The generating station is situated on the banks of the Rhone. The water is brought from the dam by a tunnel hollowed in the rock, followed by a penstock. The head of water varies from 11 to 14 meters. Turbines of 1,500 horsepower have been installed. They run at some 114 revolutions per minute. The piping which leads to the turbines is 2.6 meters in diameter. Regulation of the turbines

[illegible] carried out by means of a governor [illegible] deadening [illegible] by a leather [illegible] and [illegible] controlled by a governor upon the [illegible] pressure, furnished from a [illegible] in front of or behind the piston of the [illegible] tor, so as to give the proper [illegible] turbine.

The Bellegarde plant contains the following series of three-phase alternators, all driven by turbines with vertical shafts: One alternator of 800 horsepower running at 143 revolutions and giving 1,000 volts, one alternator of 1,200 horsepower at 114 revolutions and 1,000 or 2,000 volts, four larger machines of 1,500 horsepower at the same speed and voltage, and two others of 900 horsepower at 130 revolutions per minute. The frequency in all cases is 47.5 cycles. The characteristic feature of the 1,500-horsepower alternators is the revolving field. It is known as the umbrella form, and this construction is said to be a decided advantage over a revolving part having a bearing at the top and held by an upper cross-arm. The arms of the wheel slant up toward the top of the shaft, and this leaves a space below in which is mounted a bearing held by a set of cross-arms on the under side. The bearing is double and has an upper and a lower part. The upper bearing is thus placed in the plane where the magnetic forces are exerted, and in consequence it is in the best condition for resisting these latter. Owing to this disposition the shaft is guided over a length which is quite sufficient to prevent any vibration of the end which lies above the bearing.

The wheel, or support, which carries the pole pieces of these machines is of cast iron, and there are 50 pole pieces placed around the periphery. The field coil here used is formed of a bare copper band of rectangular section, which is wound so as to give the best resistance to the centrifugal force. The windings are insulated from each other by paper bands.

The armature which surrounds the field and forms the exterior body of the machine is formed of a cast-iron ring, built in an upper and a lower half and bolted together. It compresses a magnetic portion formed of laminated iron rings. The cast-iron rings are each divided into two halves by a diameter and are bolted together so as to make it easier to assemble the machine. The armature ring rests upon a set of radial cross-arms which are very solid. These cross-arms hold the main bearing in the center, as before noted. Three sets of 25 coils form the winding of these armatures, with one set of coils per phase. Each coil occupies four slots of the armature and a slot contains four wires. The winding is insulated from the mass by means of micanite tubes made in a single piece without joints.

The rings which bring the exciting current to the revolving field are placed below the bearings, and the part of the shaft lying between the rings and the hub of the wheel is hollowed in the center for this purpose. These alternators are asserted to have

[illegible] the plant started, is divided in seven panels, of which the first is used for the 800-horsepower al-

FIG. 2. EXCITER ON VERTICAL SHAFT IN BELLEGARDE HYDRO-ELECTRIC PLANT.

ternator, the second for the 1,200-horsepower, the third for the 1,500-horsepower machine, and the remainder of the panels for the feeders working at 1,000 volts. The second switchboard, shown on the right in Fig. 1, was installed somewhat later, and is of a more modern construction. The switchboard apparatus is mounted upon an iron framework, and the marble panels are fixed to the front of the latter. An iron grating is used to give protection at the front and the sides. The iron framework is made in two halves, and these are divided over the whole length of the board by a central passageway for the attendants. The present switchboard has six white marble panels, all of which are mounted on the front side. Five of the panels are used for the alternators and one for connecting the new and the old switchboards in parallel.

It is to be remarked that the four alternators of 1,500 horsepower and also the 900-horsepower machine are built so as to give two voltages by changing the connections, thus obtaining either 1,000 volts or 2,000 volts, as desired. This latter voltage is adopted on some of the feeders which go to different points at some distance from the station. Owing to this arrangement, the new switchboard is provided with a double set of bars, one of which is used for the feeders which work at 2,000 volts. The regulation of the main voltage is carried out by using rheostats in series with the alternator fields, but here they are made to work in connection with a set of load-regulating rheostats, so as to keep the load and voltage constant upon the exciters. Thus the turbines of the exciters, which are not provided with speed regulators, can always work at constant speed.

Referring again to the type of exciter which has been adopted here (Fig. 2), a somewhat novel form will be noted. All the exciters operate at 450 revolutions per minute and give a voltage of 110 for the alternator fields. At present there are eight exciters in all, comprising one each of 30 and 40 horsepower, four rated from 40 to 50 horsepower and two of 30 horsepower. The turbines for the exciters are of the Francis type, working on a 11 to 14-meter head of water, and they are all of the same size—40 horsepower.

A preliminary prospectus is available of the Electrical Exhibition, to be held at Olympia, London, from September 25th to October 21st, inclusive. The prospectus expresses the intention of the organizers of the exhibition to make it as complete as possible in view of the vast strides which have been made in the industrial and domestic applications of electricity. The general rules and conditions governing the exhibits are now ready, and copies can be obtained from the organizing managers, Messrs. F. W. Bridges and G. D. Smith, Balfour House, Finsbury Pavement, London, E. C.

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## DATES AHEAD.

Association of Railway Telegraph Superintendents (annual meeting), Read Hotel, Chattanooga, Tenn., May 17th and 18th.

National Electric Light Association (annual convention), Denver, June 6th, 7th and 8th, and Colorado Springs, June 9th, 10th and 11th.

American Institute of Electrical Engineers (annual convention), Battery Park Hotel, Asheville, N. C., June 19th to 23d.

National-Interstate Telephone Association (first convention of consolidated telephone associations), Chicago, June 21st, 22d and 23d.

National Electrical Contractors' Association (fifth annual convention) and Electrical Exhibition, Mechanics Hall, Boston, Mass., July 15th to 22d.

Ohio Electric Light Association (annual convention), Hotel Victory, Put-in-Bay, August 16th to 18th.

International Association of Municipal Electricians (annual convention), Erie, Pa., August 29th, 30th and 31st.

Old-Time Telegraphers' and Historical Association (annual meeting), New York city, August 29th to September 1st.

American Electrotherapeutic Association (annual meeting), Academy of Medicine, New York city, September 19th, 20th and 21st.

American Street Railway Association (annual convention), Bellevue-Stratford Hotel, Philadelphia, September 25th to 29th.

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AFORETIME when we witnessed, half-affrighted, the fierce combat that raged in the English technical press over the municipal telephone service in dear old Glasgow—that bright particular example and earthly paradise of cities, in the opinion of all public-ownership propagandists—we little thought that the day would come when the controversy, with its taunts severe and retorts uncourteous, would be transferred to our own fair Chicago. But it is even so. A Chicago daily newspaper sent a correspondent to the Scottish shrine of municipalization, and he was not long in discovering that the telephone situation there held possibilities in the way of interesting "copy." That started it. The man on the ground was unfavorably impressed with the municipal exchange, but we have those at home who know better, and they are not slow to confer on newspaper readers the benefits of their knowledge. And so we see the familiar heading "Glasgow's Telephones" in the correspondence columns of the Chicago daily papers. This is indeed grievous—a warmed-over edition of a vociferous transatlantic dispute that had been stilled but not settled. But the municipal-ownership appetite appears to be insatiable and to grow by what it feeds upon.

---

CONSIDERABLE attention has been paid by the secular press to an article on "Electrical Music for the Portland Exposition," by W. E. Brindley, published in the Western Electrician of February 25th last. The author announced, as a forthcoming feature of the Lewis and Clark Exposition, Dr. Thaddeus Cahill's invention for producing music at a distance. The invention was not described in detail; indeed the writer gave the impression that all the details were not worked out. The principle was stated to be the employment of an electrical generator that would set up, by depressing certain keys, the exact numbers of vibrations required to produce the notes of the musical scale. The sound is produced upon metallic disks, not at the place of operation, but at a distance, and a number of receiving stations may be connected to one transmitting station. This is the outline of the scheme briefly described by Mr. Brindley. We published the article as one of considerable interest, but did not indorse the invention in doing so, for we know little of Dr. Cahill and his work. Mr. Brindley stands sponsor for his own statements, although we see no theoretical reason why electrical impulses, to be translated into musical sounds, could not be transmitted in the manner outlined. But it is hardly correct, so far as we are concerned, for the Chicago Daily Tribune to say that "the Western Electrician and other papers devoted to electrical interests speak of the invention with such an air of certainty that little doubt remains of the practicability of the new music-making machine." That is assuming a bit too much.

---

UNITS AND STANDARDS of electrical measurement were discussed by the Institution of Electrical Engineers in London last month, following the report of the St. Louis Electrical Congress of last September. Familiar questions such as those relating to the true value of the volt and the ampere, the comparative usefulness of Clark or Weston standard cells, the practicability of the C. G. S. units, names for the magnetic units, and the like, were discussed, but, as was to be expected, no definite conclusions were formulated. Lord Rayleigh raised the interesting point that the value of the ohm appeared to have been accepted as correct too readily; he believed that the ohm should be taken as the first principal standard, and was of the opinion that the ampere, rather than the volt, should be the second principal standard, as the errors and corrections of the ohm would then have no bearing upon the errors and corrections of the ampere. As to whether the Clark or Weston cell should be adopted as the standard cell, Lord Rayleigh thought that the great advantage of the latter cell, with its very small temperature coefficient, pointed to the desirability of adopting it as the standard cell, but at present he thought we knew too little of it to set it up in place of the Clark cell. Dr. R. T. Glazebrook, referring to the discussion at St. Louis, said they were not dealing so much with absolute units or considering whether the C. G. S. units were the best obtainable, but were endeavoring to settle a satisfactory reproducible unit to be used throughout the world. It was not necessary to discuss the ohm or the value of mercury, because it had proved satisfactory in practice, and the volt and ampere only remained to be dealt with. The trouble arose from the various standards in use in different countries not being as nearly identical as was possible, and the object of the international conference which it was proposed to hold, and to which the British, French, German and Italian governments had agreed, was to establish a universal standard.

It thus appears that the international commission recommended by the Chamber of Delegates of the St. Louis Congress is in a fair way of realization. This conference will probably be held before long, and steps should be taken at once to secure the adhesion of the United States government. At this conference it is likely that only those countries having legislation on electric units will be represented, and it has been suggested that two delegates represent each country. The discrepancies between the laws relating to electric units and other questions bearing on nomenclature and the determination of units and standards will doubtless be considered. Provision will probably be made for securing the adhesion of other countries prepared to adopt the conclusions of the commission. In the end the commission may become a permanent one. The first meeting of this important body will be awaited with interest.

---

THREE MONTHS ago, in discussing the subject of the inadequate compensation of college professors, both in classical and technical schools, the Western Electrician said: "The whole teaching force of the country receives a far smaller compensation than the importance of its vocation entitles it to obtain. Wealthy men, in endowing colleges and establishing foundations, may well bear in mind the worth and needs of the faithful, underpaid professor and make specific provision for adequate salaries." Thereafter—on April 27th, to give the exact date—it was announced, on behalf of Andrew Carnegie, that he had established a fund of $10,000,000 to provide annuities for college professors who from age or other physical disability are no longer in a position to render the most efficient service. The income from this benefaction (controlled by a board of trustees consisting, in the main, of college presidents) should be $500,000 a year, and this sum is to be used to provide a "dignified pension system for a body of most worthy, self-sacrificing and poorly paid men" and also to offer "an opportunity to the trustees of a college to retire members of the faculty who have faithfully served the institution for many years, and to replace such men with young, vigorous and efficient professors."

Mr. Carnegie's generous donation has excited a great deal of interest in the United States, Canada and Newfoundland, for it applies to all three countries. In general, it has been warmly praised, although here and there a discordant note has been raised. There are some professors who look with something like disdain on the proposal that they shall accept the great ironmaster's bounty in their declining years. To such it will probably be pointed out that the acceptance of a pension will be in no wise compulsory. To this the dissatisfied ones may perchance reply that the pension system detracts from the dignity of the teaching profession. The rejoinder to this will probably be that the college professor has no more occasion to be proudly sensitive than a half-pay officer of the army or a great man of letters like Dr. Samuel Johnson.

There is a homely old proverb about a gift horse, but while we would be the last to criticize this magnificent benefaction, we could wish that some of its proceeds could be used to increase the salaries of the teachers actually at work. The pension idea is very promising, certainly, but we do not see but that the "worthy, self-sacrificing and poorly paid men" will still be underpaid. In all diffidence we might inquire whether the better plan, if it could be arranged, would not be to pay adequate salaries in the teaching profession, thereby attracting first-class men. Perhaps the prospect of a just remuneration during his working term would be more pleasing to the "young, vigorous and efficient" professor than that of an allowance during the retirement or semi-retirement of his closing years.

## International Railway Congress.

The seventh session of the International Railway Congress opened in Washington on May 4th with a large attendance both from this country and abroad. The day before was given up to registration, the regular business of the congress beginning on Thursday, the 4th. On Saturday, May 1st, the foreign delegates began to arrive. Among the most prominent of these delegates were M. [illegible] Marmezouls, ex-minister of public works of France, representing the province of Averyon, and president of the General Council of Railways. He expects to make a close study of the railway systems of this country. Others were Messrs. de Pelleris Latouch, a director of the French Line; Anvert, general manager of the North of Spain railway; Boell of the South of France railway; Brisse of the Eastern Railway of France; Collot of the Paris Girdle railway; Paul Dubois of the Paris-Orleans railway; Charles Dubois of the Belgium railway; Le Grain of the South of France railway; Henri d'Eichtal of the French Midland railway; Edmardo Lopez of the Spanish government; Mutz, a prominent railway engineer, and representing the Eastern railway of France; Mosfre of the French Northern railway; Perouse of the French Department of Public Works, which has a supervision over the French railways; Randt of the French Western railway; Lowey of the Madrid and Portugal railway; Tablodosh of the South of Spain railway, and Jules Charles-Roux, the new president of the French Line.

On May 4th Stuyvesant Fish, president of the Illinois Central railroad and of the American section of the congress, made the principal address at the opening session. Vice-president Fairbanks opened the meeting with a brief address. The ceremony was attended by nearly 500 delegates. Three hundred of the delegates were foreigners, and nearly every railroad of importance in the world was represented.

During the course of his remarks Mr. Fish gave statistics showing that the railroads in England and Ireland in the last few years have increased their traffic 54 per cent., while those in the United States showed a gain of 47 per cent. He continued:

"Not only is the number of passengers carried much greater in Great Britain than in this country, but it has increased more rapidly there than here. This is in some measure due to the introduction of electric traction trolley lines in the United States. But, with regard to freight, the conditions are reversed."

President Fish then announced the five sections into which the congress is divided for discussion. Mr. Fish was made chairman of the first section to consider ways and works; T. N. Ely, second section, locomotives and rolling stock; Sir George Armitage, third section, lighting and heating of trains, automatic block system, baggage and express and suburban traffic; Mr. Perouse of Paris, fourth section, slow freight and suburban traffic, bookkeeping, regulation of works, and Ernest Gerard, fifth section, light railways.

The handling of suburban passenger traffic was treated in papers given on Friday. Concerning this branch of the service, A. W. Sullivan of the Illinois Central said that both in Europe and this country the problem of the proper handling of this class of traffic is one of the most troublesome to be dealt with. In all countries suburban traffic is increasing rapidly. The rates of fare given in this country are nearly one-half that of regular fare.

Reports from 32 railways handling suburban traffic in this country were given. These roads operate in 16 cities with an aggregate population of nearly 12,000,000. The problem, the speaker said, is one of expeditious handling, depending on stations and cars so constructed as to occasion the minimum of delay in loading and unloading and the maximum speed in transmission.

Section 5 reached the conclusion that light railways, when they are really tributary to main lines, are unquestionably useful auxiliaries; that the liberal ideas of Austria-Hungary on this subject should be emulated.

An interesting subject taken up on May 9th was that of autocars and automobiles run on railroad tracks where traffic is light. That these would become common seemed to be the expression of the congress. The chief engineer, traffic manager and chief electrician of the French Northern railway read papers on the subject. They said the saving in expense of operation would bring this about.

At the New Willard Hotel on the evening of May 9th a banquet was held, at which Secretary Taft was the guest of honor. He declared that rate legislation must come, and that soon, and his remarks were listened to with interest.

Much besides the regular work of the congress had been planned for the entertainment of the guests. At the German and French embassies there were receptions held nearly every evening. Trips were made as opportunity offered to the Capitol and other government buildings and to the new Union passenger station being erected. With the general round of receptions and banquets and with the many sights to be seen in Washington, the guests found it hard to meet all their social obligations.

So far as the American railroad men are concerned, the appliance exhibit held almost as much [illegible] at the congress itself. [illegible] ing Washington brought the [illegible] force on the road of the [illegible] order from their superiors [illegible] display.

The occasion of the congress [illegible] for interchange of ideas between the foreign engineers and their friends on this side of the water. One occasion of the kind was a [illegible] ner by the American Society of Swedish Engineers, which was given to a number of the earlier arrivals to the congress who stopped in New York. This affair was held at the society's clubhouse in Brooklyn on the evening of April 26th.

The Swedish government railways were represented by Victor Klemming, member of the board of directors and chief of the rolling-stock department; A. Corin, traffic manager; Hjalmar Vikland, chief of permanent way and works; I. Petterson, engineer permanent way and works department; Harald Lemcke, district manager.

The Stockholm-Westeras-Bergslagens railway was represented by F. W. H. Pegelow, managing director, and Th. George Betts, chief of motive power department.

Capt. Victor Stahle, general manager, represented the Stockholm-Rimbo railroad. The Frovi Ludvika railroad was represented by John Johnson, managing director; the Norwegian state railways by Managing Director and Minister of Finances E. Sunde.

The delegates were escorted from the Manhattan Hotel to the clubhouse by Mr. G. P. Wern, manager of the Rawson-Morrison Manufacturing Company; Mr. C. J. Mellin, chief engineer, American Locomotive Works; Mr. H. Fernstrom, chief engineer, New York Central and Hudson River Railroad Company; Mr. J. H. Hallberg, consulting engineer; Mr. F. Clarholm, vice-consul from Sweden and Norway, who formed the reception committee.

During the dinner many interesting references were made by the Swedish delegates, referring to the electrification of the state railways, and America may soon hear of the results which will be obtained from the experimental tests of high-voltage single-phase locomotives, which will soon be tried by the Swedish government.

[A more extended reference to the congress, particularly in relation to light and electric railways, will be given next week.]

## Programme of the Denver-Colorado Springs Convention.

Should any of the members of the National Electric Light Association have become impressed with the idea that sightseeing and entertainment are to be the only features, or even the most prominent features, of the twenty-eighth convention to be held in Denver and Colorado Springs, June 6th to 11th, they are destined to disappointment.

President E. H. Davis, with the help of Secretary Farrand and Assistant Secretary Billings, has prepared a programme that will make the business sessions better attended than ever before, and he intends to have the papers and reports fully discussed. Among the numbers already in press are the following:

Wrinkles .....H. C. Abell, Editor
Question Box.....Homer E. Niesz, Editor
The Nernst Lamp, Its Present Performance and Commercial Status.....By E. R. Roberts
Report on Purchased Electric Power in Factories.....By E. W. Lloyd, Chairman
Report on Present Methods of Protection from Lightning and Other Static Disturbances.....By Alex Dow
Some Investigation of Inductive Losses...By E. P. Dillon
Insulation Testing Apparatus and Methods..By C. E. Skinner
The Choice of an Insulated Cable.....By Wallace S. Clark
New Business Methods for Central Stations.....By John Craig Hammond
Sign and Decorative Lighting.....By LaRue Vredenburgh
Automatic Synchorizing of Generators and Rotaries.....By Paul MacGahan
Series Alternating-current Motors for Industrial Work.....By Clarence Renshaw
Long-distance High-tension Transmission in California.....By John A. Britton
Report of the Committee on Progress.....By T. Commerford Martin

The Question Box is so voluminous that it seemed for a time impossible to get the cover on, but it has finally been closed and is in the hands of the printers. Mr. Abell reports about 120 "wrinkles," and about a dozen papers and reports are still to be printed, in addition to two or three reports that will be discussed in executive session and will not be in print.

Secretary Farrand says that the "flow of soul" that the entertainment committee is preparing will not be allowed to interfere in any manner with President Davis' "feast of reason," and every central-station manager will be amply repaid for the time and money he may expend in attending the convention.

The general programme of the Denver-Colorado Springs convention is as follows:

MONDAY, JUNE 5TH.

Arrival of delegates. Reception by local committees. Informal reception, with music, at headquarters, the Brown Palace Hotel.

TUESDAY, JUNE 6TH.

Morning—Business session in ordinary of Brown Hotel. Addresses of welcome by Governor Jesse F. [illegible] luncheon for ladies [illegible] Orpheum for the ladies (if theater is open).

Morning—Business.
Afternoon—Business. Street-car rides for the ladies.
Evening—Business. Serenade by the George W. Cook Drum Corps.

[illegible]

[illegible] Springs.
[illegible] of the famous scenic points. Visits to the power plants. Trips up Pike's Peak.
Evening—Dance and concert at the Broadmoor Casino.

[illegible]

All Day—Special trains to the Cripple Creek district and return.

SUNDAY, JUNE 11TH.

All Day—Trips to the [illegible] rado Springs, each delegate taking those he was unable to take on Friday.

Monday and Tuesday will be devoted to excursion parties arranged for those desiring to go over the Moffat Road and the Loop.

## Electricity and Gas Legislation in Illinois.

By a vote of 24 to 16 the Senate of the Illinois Legislature refused to pass the measure giving to all cities and villages of the state the right to regulate the rates to be charged by private companies for gas and electric light. Central-sation men from the smaller cities of the state are pleased, but some of them fear that they will have the fight all over again two years from now unless the experience of Chicago, which has been given regulating and even selling powers, should be such as to discourage the advocates of public control.

Despite serious opposition the Senate and House finally passed the bill giving Chicago the double power of regulating the price of gas and electricity furnished by private companies and of selling electricity not needed for municipal purposes. By the selling power the city is authorized to sell surplus electricity from such plants as the new Horatio N. May station (illustrated and described in the Western Electrician of April 8th), perhaps for power purposes, during the daytime when the current is not needed for street lighting. At least that is the theory, although how this is to be accomplished, in view of the great demand for street lighting and the impracticability of supplying the two classes of service without overlapping, it is difficult to see. However, the selling grant is encumbered by so many restrictions that it is not likely soon to affect to an appreciable extent the commercial electric-lighting and power business of Chicago.

The section of the bill containing the enabling grant as passed by both houses of the Legislature (but not at this writing signed by the governor) is as follows:

Section 1. That upon the adoption of this act, in the manner hereinafter provided, the city of Chicago shall have power and authority to sell surplus electricity for heat, light and power within the corporate limits of said city, and is hereby empowered to prescribe by ordinance the maximum rates and charges for the supply of gas and electricity for power, heating, and lighting furnished by any individual, company, or corporation to such city or inhabitants thereof. Such rates and charges to be just and reasonable, and prices may be fixed for a period not exceeding five years, and in case corporate authorities of any such city shall fix unjust and unreasonable rates and charges, the same may be reviewed and determined by the Circuit Court of the county in which said city is situated. Provided, that nothing in this act contained shall be construed as enlarging the power now conferred by law upon said city, to own, construct, or acquire electric-lighting plants, or permitting said city to sell electricity so long as the same is needed for light, heat and power for municipal purposes.

Almost the entire first floor of the new building of the Union Electric Light and Power Company, at the corner of Tenth and St. Charles streets, St. Louis, has been given over to an electrical exhibit demonstrating the various ways in which electricity may be used. An electric kitchen is in operation, luncheon being served each day from 10 a. m. until four p. m. Electric chafing dishes, egg boilers and coffee percolators are shown in operation. On one side of the large floor machine tools of various types are shown. The exhibit includes pumps, dough mixers, ice-cream freezers, candy pullers, dishwashers and organ blowers—all operated by electricity. The entire room is brilliantly lighted by Meridian lamps.

## Test of a 5,000-kilowatt Alternator.[1]

By L. L. Gaillard.

The following paper is intended to give a general description of the series of tests made on each of the alternators installed in the Seventy-fourth Street (Manhattan) power station of the Interborough Rapid Transit Company of New York City. The object of the tests was to obtain characteristic curves of the machines and to determine how nearly they conformed to the contract requirements and the manufacturer's guarantee.

Each machine is a 5,000-kilowatt 11,000-volt 25-cycle 75-revolution-per-minute Westinghouse alternator, direct connected to a double horizontal-vertical Allis compound engine.

It may be well to preface the account of the tests with the following extracts from the contract specifications giving certain data obtained from the calculations of the manufacturer, and certain guarantees upon which was based the acceptance or rejection of the machine by the purchaser.

A guaranteed full-load efficiency of 96.5 per cent., to meet which guarantee the total permissible losses in the alternator are therefore 181,300 watts.

The full-load field current equals..... 202 amps.
The full-load armature current equals..... 263 amps.
The armature copper loss equals:
$263^2 \times 0.4 =$ .....27,667 watts.
The field resistance equals..... 0.85 ohm.
The resistance of the armature equals..... 0.4 ohm.
The field copper loss equals:
$202^2 \times 0.85 =$ .....34,683 watts.
Total copper losses = .....62,350 watts.
Total allowable iron losses, based on 96.5 per cent. full-load efficiency, .....118,950 watts.

The efficiency on non-inductive load will be:
At one-quarter load = not less than.....90.00 per cent.
At one-half load = not less than.....94.50 per cent.
At three-quarters load = not less than.....95.50 per cent.
At full-load = not less than.....96.50 per cent.
At 25 per cent. overload = not less than.....97.00 per cent.

The efficiencies are based on $I^2R$ loss in the armature and field coils and on the armature iron loss. Friction is not included.

The current in the armature when short-circuited with normal no-load field current, will equal three times full-load current.

The regulation at 100 per cent. power factor will equal 6 per cent.

After running for 24 hours at full-load at 100 per cent. power factor, the rise in temperature in no part will exceed 35° C.; and at 25 per cent. greater load, with the same power factor, for 24 hours, the rise in temperature will not exceed 45° C.

The following measurements and tests were made on the alternator:

Measurement of armature iron loss.
Resistance of armature winding.
Resistance of field winding.
$I^2R$ loss in armature.
$I^2R$ loss in field.
Efficiency at various loads.
No-load saturation curve.
Short-circuit characteristic.
Regulation (calculated).
Insulation puncture test.
Temperature rise under load.

Armature Iron Loss.—It being entirely impracticable to measure this loss in the usual manner, the following interesting method was adopted:

The alternator armature is built up of the following amounts of sheet steel, worked at magnetic inductions given below:

234,000 cubic inches, 90 per cent. solid, @ 65,500 C. G. S. lines per square inch.
16,500 cubic inches, 90 per cent. solid, @ 91,100 C. G. S. lines per square inch.
20,300 cubic inches, 90 per cent. solid, @ 76,500 C. G. S. lines per square inch.

The iron losses were determined from a measurement of the losses in sample rings made from the material of which the armature was built up. These samples were annealed in the ovens with the armature laminations, were painted the same as these laminations, and then built up into test rings and compressed until their volume contained 90 per cent. solid metal. The rings were then wound for test purposes and the losses at the different inductions, mentioned above, were measured with a sensitive wattmeter.

The dimensions of the test samples were: Outside diameter, 12 inches; inside diameter, eight inches; thickness (compressed to 90 per cent. solid), two inches; cross-section, two inches by two inches, four square inches; mean circumference, 31.416 inches; volume, 125.66 cubic inches.

The calculations of 90 per cent. solid material in samples were based upon specific-gravity tests made on samples cut from the steel bars from which the sheets were rolled. The average specific gravity of several samples was 7.847, which gives 3.91 cubic inches per pound for 90 per cent. solid material. The weight of the sample, on the basis of these calculations, should therefore be 32.13 pounds.

About 20 sample rings were built up and each sample was wound with 72 turns of No. 18 B. & S. annunciator wire, wound in 12 groups of one layer, and six turns each, with the groups symmetrically disposed around the circumference of the ring.

The iron loss in each sample was measured at each of the three inductions mentioned above, viz.:

(a) 65,500 C. G. S. lines per square inch = 10,155 C. G. S. lines per square centimeter.
(b) 91,100 C. G. S. lines per square inch = 14,124 C. G. S. lines per square centimeter.
(c) 76,500 C. G. S. lines per square inch = 11,860 C. G. S. lines per square centimeter.

The voltages required for each of the three inductions at 3,000 alternations were obtained from the following calculations:

B = Maximum induction per sq. cm.
E = Effective volts.
n = Periods per second.
t = number of turns.
a = Sectional area in sq. cm.

$E = \pi/\sqrt{2}\ a\ n\ t\ B\ 10^{-8}$.

Reducing this formula to area in square inches and alternations per minute, we have:

$E = .2388\ a'\ n'\ t\ B\ 10^{-8}$

Where a' = sectional area in sq. in. = 4
n' = alternations per minute = 3,000.

The voltage at the various inductions is then as follows:

(a) $E = .2388 \times 4 \times 3{,}000 \times 72 \times 10{,}155 \times 10^{-8} =$ .....20.96
(b) $E = .2388 \times 4 \times 3{,}000 \times 72 \times 14{,}124 \times 10^{-8} =$ .....29.15
(c) $E = .2388 \times 4 \times 3{,}000 \times 72 \times 11{,}860 \times 10^{-8} =$ .....24.48

The losses in the samples were measured by carefully calibrated instruments, and the alternator used for supplying current for the purposes of the test gave a wave of almost exactly sine form.

The average results of measurements on the 20 samples was as follows:

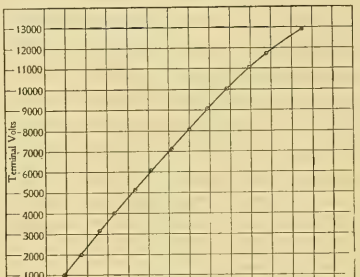
(a) 0.1340 watts loss per cu. in.
(b) 0.2320 watts loss per cu. in.
(c) 0.1724 watts loss per cu. in.

The total watt loss in the armature was, therefore, as follows:

(a) $234{,}000 \times 0.1340 =$ .....31,380 watts.
(b) $16{,}500 \times 0.2320 =$ ..... 3,821 watts.
(c) $20{,}300 \times 0.1724 =$ ..... 3,492 watts.

Total, 38,693 watts.

The impracticability of making an accurate determination of the iron losses after the machine had been assembled is to be regretted, as the method adopted and just described contains probabilities of error which cannot be predetermined or eliminated. The armature casting is made in six sections and the sheet-steel laminations are each no greater than six feet in length, thus making in the magnetic circuit six butt and numerous lap joints. The losses due to these breaks in the magnetic circuit are, of course, neglected when the determination of the iron losses is made in the manner just described, but it is probable that they are of so small a value when compared with the total losses as to be negligible.



RUNNING SATURATION OF 5,000-KILOWATT ALTERNATOR.

Resistance Measurements of Armature and Field.—These measurements were made by the usual drop-of-potential method, the temperature of the winding and of the room being observed. The resistances as measured were then calculated for a room temperature of 25° C. and the $I^2R$ losses calculated on this basis.

Resistance of armature:

Phase 1—2 R = 0.2325 ohm at 25° C.
Phase 2—3 R = 0.2332 ohm at 25° C.
Phase 1—3 R = 0.2329 ohm at 25° C.

2 times combined resistance of three phases =
$0.2325 + 0.2332 + 0.2329 = 0.6986$.

Total armature resistance therefore equals

$$\frac{0.6986}{2} = 0.3493 \text{ ohm}$$

Resistance of field at 25° C. = 0.8206 ohm.

Efficiency.—As noted above, the efficiency is based on the armature iron losses and the field and armature $I^2R$ losses. The iron losses were determined as described above, and from the resistance values as obtained by measurement, the $I^2R$ losses in field and armature have been calculated for various loads from 25 per cent. to 125 per cent. of full rated load. These appear in tabulated form below, and following in a curve plotted from the calculated efficiencies.

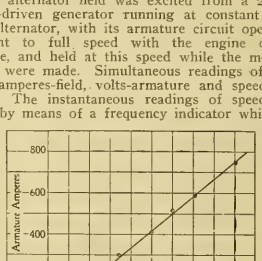
In calculating the field $I^2R$ loss, 208.1 amperes was used as full-load field current, this value being obtained in the following manner:

Field current corresponding to terminal voltage on open circuit plus armature resistance drop = 198.5 amps.
Field current necessary to give full load armature current on short-circuit = ..... 62.5 amps.
Full-load field current is the vector sum of above, or .....208.1 amps.

| | ¼ Load. | ½ Load. | ¾ Load. | Full Load. | 1¼ Load. |
|---|---|---|---|---|---|
| Iron loss, kilowatts..... | 38.69 | 38.69 | 38.69 | 38.69 | 38.69 |
| Armature $I^2R$ loss, kw. | 1.51 | 6.04 | 13.59 | 24.16 | 37.75 |
| Field $I^2R$ loss, kw..... | 35.54 | 35.54 | 35.54 | 35.54 | 35.54 |
| Total losses, kw..... | 75.74 | 80.27 | 87.82 | 98.39 | 112.98 |
| Output, kw..... | 1250.00 | 2500.00 | 3750.00 | 5000.00 | 6250.00 |
| Input, kw..... | 1325.74 | 2580.27 | 3837.82 | 5098.39 | 6361.98 |
| Efficiency, per cent..... | 94.29 | 96.89 | 97.71 | 98.06 | 98.24 |

No-load Saturation.—The no-load saturation curve was obtained in the following manner:

The alternator field was excited from a 250-volt steam-driven generator running at constant speed. The alternator, with its armature circuit open, was brought to full speed with the engine on the throttle, and held at this speed while the measurements were made. Simultaneous readings of volts-field, amperes-field, volts-armature and speed were taken. The instantaneous readings of speed were made by means of a frequency indicator which had been previously carefully calibrated. Below is given in tabulated form the instrument readings from which the saturation curve has been plotted. As some of the readings were taken at a frequency higher than 25 cycles (due to the engine speeding up), the armature volts at these points were corrected for this difference in speed by decreasing them in proportion to the increase in speed.



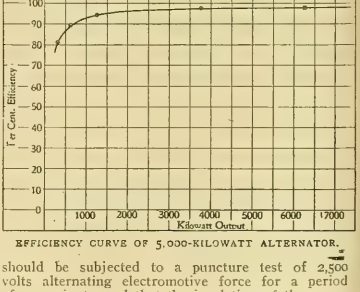
SHORT-CIRCUIT CHARACTERISTIC OF 5,000-KILOWATT ALTERNATOR.

| Frequency. | Amps. Field. | Volts Field. | Volts Armature. Observed. | Volts Armature. Corrected |
|---|---|---|---|---|
| 25.0 | 17.5 | 15.3 | 1,000 | 1,000 |
| 25.0 | 33.5 | 29.4 | 1,983 | 1,983 |
| 25.0 | 51.4 | 44.8 | 3,140 | 3,140 |
| 25.0 | 66.0 | 57.3 | 4,010 | 4,010 |
| 25.0 | 86.0 | 74.5 | 5,150 | 5,150 |
| 25.0 | 101.8 | 87.3 | 6,100 | 6,100 |
| 25.2 | 121.8 | 103.5 | 7,190 | 7,133 |
| 25.2 | 139.0 | 117.8 | 8,120 | 8,055 |
| 25.2 | 157.2 | 131.8 | 9,150 | 9,077 |
| 25.2 | 176.2 | 150.0 | 10,100 | 10,019 |
| 25.2 | 198.0 | 168.5 | 11,160 | 11,070 |
| 25.5 | 214.0 | 183.0 | 11,970 | 11,640 |
| 25.2 | 240.2 | 218.0 | 13,020 | 12,916 |

Short-circuit Characteristic.—For this test the armature terminals were short-circuited, the alternator run at full speed and the armature current measured at different values of field current. The tabulated readings and the curve plotted from them are given below:

| Speed, R. P. M. | Field Amperes. | Field Volts. | Armature Amperes. |
|---|---|---|---|
| 75 | 50.0 | 36.0 | 210.0 |
| 75 | 68.0 | 50.0 | 300.0 |
| 75 | 100.0 | 74.5 | 421.6 |
| 75 | 120.2 | 89.5 | 516.0 |
| 75 | 141.2 | 105.5 | 588.0 |
| 75 | 181.0 | 140.5 | 744.0 |
| 75 | 193.3 | 158.0 | 798.0 |

Insulation Test.—The contract specifications required that after the machine had been assembled the insulation of the field winding from the frame should be subjected to a puncture test of 2,500 volts alternating electromotive force for a period of one minute, and that the insulation of the armature winding from the frame should be tested at a potential of 25,000 volts for 30 minutes.



EFFICIENCY CURVE OF 5,000-KILOWATT ALTERNATOR.

As the armature coils had been exposed to moisture for some time before being assembled, it was thought advisable to give them a drying out before subjecting them to the puncture test. For this purpose the armature was short-circuited and the machine run at about two-thirds full speed with sufficient field current to give about 500 amperes in the armature. This heat run was kept on for about 60 hours, then the machine was shut down and the windings carefully wiped off and allowed to cool to the temperature of the room before the insulation test was made.

The insulation tests were made by using a 250-kilowatt, 40,000 to 360-volt, 25-cycle, oil-cooled transformer, the low-tension winding of which was connected in series with a water rheostat, to the 400-volt, 25-cycle station bus bars. The potential of

1.- From The Electric Club Journal. The author is electrical superintendent with the Interborough Rapid Transit Company of New York.

the high tension side of the transformer was measured with a 50,000-volt electrostatic voltmeter which had been previously calibrated.

It may be of interest to note that when the test potential was first raised to 25,000 volts, and for some minutes thereafter, a considerable static discharge was noticed taking place over the surface of the windings. As the test was prolonged, this static gradually decreased in intensity, until after the lapse of about 20 minutes it almost entirely disappeared.

Regulation.—The specifications for this machine provide that "a load of 263 amperes per terminal at 11,000 volts electromotive force and at 100 per cent. power factor may be thrown off, and the electromotive force will rise six per cent., with constant speed and constant excitation."

It has not been found convenient to make an actual measurement of the regulation of the machine, but from the data and characteristic curves it has been calculated. This calculation was made by the usual magnetomotive force method, and the regulation was found to be 4.5 per cent. This figure is undoubtedly too small, as this method of calculation invariably gives results more favorable to the machine than those obtained from actual test.

Temperature Measurements.—A number of determinations of the temperature rise in field and armature conductors and in armature laminations were made after the machine had been running under load for a sufficient length of time to have reached a constant temperature.

The following results represent the average rise in temperature above the surrounding air of the various parts of the machine after a run of 17 hours at an average load of 5,000 kilowatts:

| | |
|---|---|
| Temperature rise above air: | |
| Field winding | 22.5° C |
| Armature winding | 22.6° C |
| Armature laminations | 25.5° C |

The performance of the eight alternators, of which this one is representative, has been so excellent and the temperature so greatly below the guarantee, that their rating has been increased from 5,000 to 6,000 kilowatts.

Testing Synchronizing Connections.—After the first machine had been installed it became necessary to make sure of the correctness of the synchronizing connections of each of the others as it became ready for operation. For synchronizing, dark lamps and a dial synchronizer are used.

To make an absolutely certain test of the synchronizing connections, the following interesting method was adopted: When the second machine was ready for service, the main switches of both Nos. 1 and 2 were closed, tying the machines to the bus. Full-load field current was put on each alternator, and both engines were started simultaneously and slowly brought to full speed together. If the lamps remained dark and the synchronizer indicated exact synchronism, no better check could be had on all connections. Had there been any wrong connections in the armature circuit of one machine, making a short-circuit when the two machines were tied together, this would have been indicated on the ammeter in the armature circuit immediately after the machines started. The relay would also have operated immediately to open the armature switch.

After the two machines had been brought to full speed (tied together) they were then cut apart and synchronized in the usual manner. This method was used with great success on all the machines, a separate bus bar being used for the purpose.

The city of Kenosha, Wis., has been enjoined from interfering with the Kenosha Electric Railway Company's cars pending the suit brought by the company against the city.

## X-ray Congress in Berlin.

The international congress [illegible] tenth anniversary of the [illegible] tar was held in Berlin [illegible] was of high value to the [illegible] latest applications and developments representing the results obtained by eminent experimenters were compared and discussed and the [illegible] able for the physicians of the world.

Professor Röntgen, although he had, it was said, promised to be present, and although [illegible] on the programme, displayed his extreme modesty by his absence, saying he felt incapable of meeting the large throng gathered to glorify his work. He therefore telegraphed his acknowledgment from Würzburg, Bavaria.

The treatment of cancer by the X-ray rather than by the knife created the most important discussion. Professor Lassar of Berlin, who is regarded as an authority on diseases of the skin, read a paper in which he said he had had only three failures in this cure for cancer in some hundreds of cases he had treated, but only where the growths were not deep seated, because the healing effect of the ray only penetrated to a depth of one-fifth of an inch. The ray seemed ineffective for larger growths. Gangrenous cancer growths, he said, were also removed by the rays. He spoke of the necessity of extreme care in the use of X-rays and warned of their dangerous properties.

Professor Imelmann of Berlin read a summary of reports on 60 cases of cancer treated by Dr. Comas of Lisbon, whose results were as successful as those obtained by Professor Lassar. Professor Unger of Berlin was skeptical regarding cures in serious cases. He said he knew of no cure of cancer of the breast. Professor Sjoegren of Stockholm agreed with Professor Unger, but Professor Wolgemuth of Berlin cited an instance of a woman 75 years of age who was cured of cancer of the breast after 72 applications, three applications being made each week.

Professor Gocht of Halle exhibited a clock-like invention that rang an alarm when the ray reached the burning point.

Among the Americans who were present at the congress were Prof. Charles Lester Leonard of Philadelphia, president of the American Röntgen Society; Dr. George Kunz of New York and Dr. J. Rudis-Jicinsky of Cedar Rapids, Iowa.

## Contractors' Convention and Electrical Exhibition in Boston.

The National Electrical Contractors' Association will hold its fifth annual convention and exhibit in Boston on July 15 to 22, 1905. For this purpose the entire Mechanics Building, containing 83,000 square feet of exhibit floor space has been engaged, and this space is now being rapidly sold to the manufacturers and jobbers throughout the country. The convention meets during the week in the same building.

The convention will be entertained by the Electrical Contractors' Association of Massachusetts. The committee appointed to have charge of the exhibition consists of Messrs. J. P. Coghlin, F. L. Barnes, A. T. Sampson, F. A. Richardson and T. T. Kelly. This committee has secured the services of Chester I. Campbell, 5 Park Square, Boston, to act as general manager of the show.

The association includes in its membership leading electrical contractors of 15 states. The electrical exhibition will include all standard and special supplies and apparatus used for lighting, heating, power work and general construction. Applications for space will be considered in the order in which they are received.

## Chicago Street-railway Situation.

[illegible] to three years more. In supp[illegible] tion and gives the city possession, any time it wants to take them over, of the lines [illegible] Street to Fortieth Avenue.

The idea of Mayor Dunne is that these streets can be made the nucleus of a complete West Side system, streets in which there are either tracks the franchises for which [illegible] all being used to complete it. Already, on a motion made during the Harrison administration, bids have been advertised for the building of a street-car system in these streets and such others as are needed to make a complete West Side system, Mueller law certificates to be used in payment for the work. As the Western Electrician goes to press it is said that the mayor has called a conference of his advisers, including B. J. Arnold, to consider plans for the immediate municipalization of this line.

An incident in Union Traction affairs which caused considerable comment was the resignation a few days ago of Managing Receiver John C. Fetzer, under whose guidance during the last year the company's income was materially increased. No successor to Mr. Fetzer has yet been named by Judge Grosscup, but several names connected with the Chicago City Company have been mentioned as those of probable successors.

## Time Signal Around the Globe.

As a feature of the opening of the International Railway Congress in Washington, D. C., a telegraph signal was sent around the world at midnight on May 3d and completed the circuit of the globe in seven seconds. The signal was sent from Washington, and in the room from which Mr. Morton, the secretary of the Navy, opened the switch was placed a large ball encircled by a line of red lights, representing the world. The lights were labeled with the names of the cities through which it had been planned to transmit the signal, and as the signal passed through the cities the respective lamp on the big ball representing that station lighted.

In the Chicago Hydrographic Office Lieutenant Wilson was in readiness to receive the signal. At 10:55, western time, the instrument which was on the circuit over which the signal was to be sent began to click off the seconds from the standard timepiece in Washington. An electric light also flashed with each impulse, marking the seconds. At 11 o'clock a long flash and a louder click indicated that the signal was on its way around the world. The method of receiving the signal in Chicago and other cities in the United States was nothing unusual, as it was very similar to the way in which standard time is received hourly from Washington. Frequently of late at gatherings similar to the International Railway Congress now in session the government has sent these signals, and Lieutenant Wilson explained that the object was to show to the delegates the usefulness and convenience of standard time to railroads.

Laminated Ring and Clamping Device.

Armature End Connections, Showing Wooden Block Bracing.

End Connections of Armature Winding.

TEST OF A 5,000-KILOWATT ALTERNATOR.

## Deutsch System of Train Lighting.

Electric light is conceded to be ideal for railway passenger cars, and the axle-lighting or unit system has many advantages for general service if it can be maintained efficiently and cheaply. The advantages of the Deutsch system of train lighting are that each car carries its own equipment, and therefore permits of greater flexibility in the make-up of trains and no auxiliary compressing or charging plants are required.

In addition to the above it is important to note that the axle light is the one system of electric train lighting which can be gradually introduced on railway cars without entirely changing the existing lighting conditions.

The Deutsch system consists of a dynamo hung from the car body, a regulator located in any convenient place in the car, a transmission or drive and the usual storage batteries.

In this system the storage battery is intended to supply current for the lights when the train is standing or running at less than a specified speed. The battery can be relied upon to perform this service if it is properly charged when the train is running. It sometimes happens, however, with a belted machine that the belts slip or come off the pulleys so that in either case the batteries do not get their proper charge. If this continues the batteries do not act satisfactorily and are consequently blamed for the trouble. In winter months, especially when escaping steam or condensed moisture on the pulley faces make them as slippery as glass and when the lighting demand is heaviest this trouble becomes greatest.

For the above reason a battery charged by a generator operated by a properly designed gear drive is desirable.

The transmission system, as shown in Fig. 1, consists of a steel bevel gear provided with a suitable hub extension, forming a bearing immediately adjacent to the tooth face. The gear is attached to the axle and rotates therewith. Encircling the bearing is a steel strap to which a stud is electrically welded. This stud forms a bearing support for a rawhide pinion which is designed to coact with the steel gear and to which is fastened the shaft for driving the dynamo.

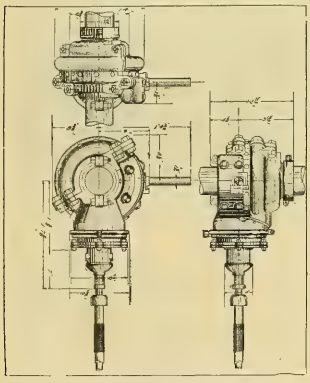


Fig. 1. Transmission Gear.

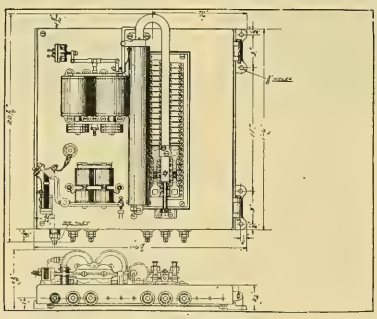


Fig 3. Diagram of Regulator.

DEUTSCH SYSTEM OF TRAIN LIGHTING.

The shaft is telescopic and provided with universal joints to allow for axle play and side motion of the truck on curves. Any tendency of the strap to revolve with the gear around the car axle is counteracted by a rod or arm projecting upward and flexibly supported by the truck frame. A steel gear casing is cast integral with the strap, thus making the gear casing, strap and pinion bearing in two pieces, which are bolted together and carried by the hub bearing of the gear. It can thus be seen that both the gear and pinion are supported directly from the axle, that is to say, the driving gear wheel is attached to the axle. The pinion meshing with the gear turns on a stud forming part of the strap which surrounds the gear bearing and moves coincidently with the gear wheel in every movement of the axle, thus insuring engagement of the teeth under all possible conditions.

The dynamo (Fig. 2) is rigidly suspended under the car body. There are no springs or devices permitting motion. The bearings are self-aligning and ring oiled. The wear on the bearings is insignificant, since there are no strains due to belt pull and the flexible nature of the shaft connection prevents any shock from being transmitted to the dynamo.

The accessibility of parts is exceptional. It is said the armature can be removed, a new one substituted and everything put in proper shape for immediate service in 15 minutes. Both bearings are the same size and all screws holding removable parts are standard and of the same size.

The casing can be removed, completely exposing the machine for inspection in one minute by simply slacking two wing nuts, and the armature or bushings can be renewed without disturbing a single electrical connection.

The essential parts of the regulator, a diagram of which is shown by Fig. 3, are an automatic switch, a controlling solenoid, an air valve, a cylinder, piston working in the cylinder and carrying electrical contacts on the rod and a resistance located in the shunt-field circuit of the dynamo.

In operation an automatic switch cuts the dynamo in and out of the lamp circuit above and below a specified train speed, that is to say, when the train runs below the specified speed the lights are on the storage battery, and above that speed they are on the dynamo. As the train speed increases and as the dynamo turns faster than the speed required for maximum output the controlling solenoid opens the air valve and admits air to back of the piston, which raises and carries with it the electrical contacts attached to its rod and cuts resistance in the shunt-field circuit of the dynamo, thus reducing its output. When the train speed decreases the air valve is closed by the controlling solenoid and the piston drops by gravity, thus cutting resistance out of the field circuit until the dynamo output is again at its normal maximum.

This regulator does not depend upon electrical means for its operation, but is driven by compressed air from the brake mechanism, thus insuring a reliable and dependable method of controlling the output of the dynamo.

A very small volume of air is required at about 15 pounds pressure. Its working is noiseless and there is no motion except when the train speed materially changes. There are no rotating parts to cause trouble and all electrical connections are simply and conveniently arranged.

The Electric Controller and Supply Company of Cleveland, Ohio, is the licensee of the Deutsch patents for the United States, Canada and Mexico.

## Stanley Transformer Patent Decision.

The United States Circuit Court of Appeals has rendered a decision in the suit brought by the Westinghouse Electric and Manufacturing Company for a preliminary injunction against the Montgomery Light and Power Company for alleged infringement of the Stanley transformer patent, reversing the decision rendered by the lower court. The court states that the lower court "held that the defendant's system of electrical distribution infringed the first and third claims of the Stanley patent, whether the length of the primary coil of its transformer had been ascertained by applying the Stanley rule or by some method of which Stanley was not the discoverer," and adds: "To this extent we agree with the court below." It further holds that its own decision in the suit of the Westinghouse company against the Saranac Lake company "was in effect that Stanley contributed to the prior art the discovery that the automatic and constant regulation of the pressure of the alternating current at the secondary terminals depended upon the co-ordination of the transformer to the generator and the invention that this could be effected by means of a primary wire of suitable length; that the first and third claims of the patent were for combinations which broadly included his invention."

The Court of Appeals, however, holds that in the present motion for preliminary injunction, the depositions deal "with an abstruse and recondite subject, and present conflicting theories which cannot safely be accepted without the searching elucidation which a cross-examination of the experts may afford." In view of the large importance of the controversy, the court concludes that the rights of the parties should be reserved for decision until the final hearing of the cause.

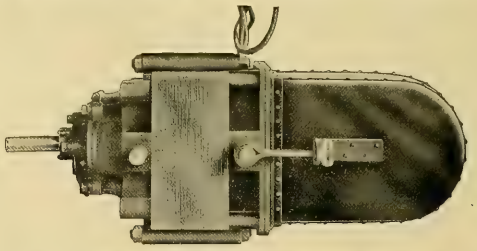


FIG. 2. DYNAMO USED WITH DEUTSCH SYSTEM OF TRAIN LIGHTING.

## The Brocksmith Dynamo and Its Combinations.

Manual training schools, as well as amateurs possessing private machine shops, will appreciate the advantages of sets of dynamo castings for experimental and demonstration work, for they combine the mechanical exercise of their construction, the electrical exercise of their windings, and show the practical result when completed. The mathematical theory of magnet design, field and armature windings, output, etc., may advantageously accompany the constructive work.

For the use of schools desiring to give their students exercises in armature and field winding, Parsell & Weed of 129-131 West Thirty-first Street, New York city, are prepared to furnish the Brocksmith dynamo completely assembled but without wire or winding. They have made arrangements with Mr. J. C. Brocksmith whereby he has authorized them to place on the market castings, material and blue prints for an extensive line of designs, a few of which are here briefly described. These machines are constructed for practical working as well as demonstration.

The Brocksmith dynamo, shown in Fig. 1, has four poles, therefore the armature coils do not pass diametrically across the ends of the armature, and thus they do not tend to build up around the shaft, as in a bipolar machine. This makes the winding of the armature easier than in most machines.

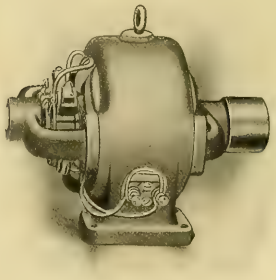


FIG. 1. THE BROCKSMITH DYNAMO.

The bearings are designed to have rigidity and can be easily machined and finished at one setting in the lathe. The bearings are furnished with brass linings in which the armature shaft runs, and in case of wear these can be readily removed and new ones substituted. The bearing casings form a suitable oil reservoir and the shaft is kept thoroughly lubricated by two oil rings in each bearing. The shaft is provided with oil flanges which return all surplus oil to the reservoir, and in this manner a continuous flow is maintained while the machine is running. The brush-holder parts are of novel design and are firm and substantial. The brushes can be readily removed for examination or renewal.

The output of this machine, when driven as a generator, is sufficient to supply the lights of a small residence (10 to 12 16-candlepower lamps), yet the parts are so small that they can be ma-

chined on a lathe swinging 10 inches over the lathe bed.

Those who desire an inexpensive form of direct-current transformer but one which does not permit of varying the voltage of the secondary circuit except by external resistance will find the Brocksmith dynamotor applicable for many purposes. It consists of a Brocksmith motor having an extra winding on the armature. This extra winding is connected to an independent commutator. The motor windings cause the rotation of the armature. The extra windings then act as a dynamo and their current is taken from their commutator at the end opposite the motor commutator.

The motor windings cause the rotation of the armature. The extra windings then act as a dynamo and their current is taken from their commutator at the end opposite the motor commutator.

Each winding occupies one-half of the armature slot, so the output is about one-half as much as when the machine is wound as a dynamo. As the armature reaction is compensated by the extra winding, there is no change in position of the brushes for varying output.

An interesting machine which will be found very

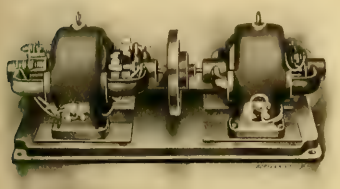


FIG. 2. BROCKSMITH DIRECT-CONNECTED MOTOR AND RECTIFIER.

useful by many who can obtain only alternating current from a central station but who wish to use direct current for various purposes is the Brocksmith alternating-current rectifier.

By making slight changes in the connections of the field and armature coils this machine may be used to rectify single-phase current of 50 or 100 volts and of 60 or 125 cycles. The amount of rectified current which may be taken from the brushes does not depend on the capacity of the machine as a motor but on the capacity of the transformer supplying current to it.

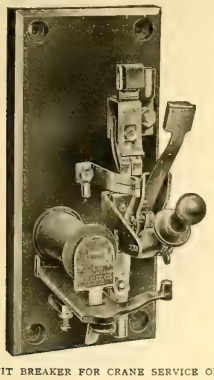
Electrical students and amateurs will appreciate the experimental facilities offered by this machine; thus, aside from its use as a rectifier, it may be used as a self-exciting synchronous motor, developing from one-tenth to one-eighth horsepower.

Fig. 2 shows a direct-connected motor and rectifier. When alternating-current rectifier is driven from some source of power it becomes a self-exciting alternator, supplying either an alternating or a rectified current, or both, up to about 100 watts output.

A desirable combination consists of a Brocksmith motor coupled to the rectifier and both mounted on one of the company's cast bed plates. This outfit comprises all the castings for a regular Brocksmith motor.

## Circuit Breaker for Crane Service.

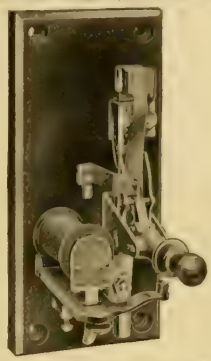
The accompanying illustrations show a 200-ampere circuit breaker especially designed for crane service, and which automatically limits the travel of



CIRCUIT BREAKER FOR CRANE SERVICE OPEN.

the hoist. The equipment consists of a standard circuit breaker, having a shunt trip coil substituted for the usual overload coil. The shunt trip coil is electrically connected to an auxiliary device placed on the shaft of the hoist motor. When the hoist reaches its predetermined limit of travel in either direction, the auxiliary device closes the tripping circuit and opens the breaker, disconnecting the hoist motor from the source of supply.

Circuit breakers of this type constituted the greater part of an order for 90 equipments of various capacities and voltages placed with the General



CIRCUIT BREAKER FOR CRANE SERVICE CLOSED.

Electric Company by the Morgan Engineering Company of Alliance, Ohio. This was the first order on an annual contract, by which the Morgan company will purchase General Electric circuit breakers exclusively for its cranes. The use of circuit breakers in crane work opens up a new field, and the General Electric Company has at present under consideration, for various crane manufacturers throughout the country, propositions similar to the one mentioned.

## New Westinghouse Apparatus.

With the more frequent testing of incandescent lamps there has arisen a demand for a standard instrument especially adapted for this work, and the Westinghouse Electric and Manufacturing Company has accordingly designed a lamp-testing instrument designed to fulfill the requirements of the dealer who must handle rapidly large numbers of lamps, and of the electrician who wishes to test lamps, one at a time, at different points, and who must therefore have a portable instrument quickly applied and detached.

In general design, construction and finish the lamp tester's volt-wattmeter, as shown in the accompanying picture, is similar to the other portable instruments manufactured by this company. In effect it is a portable wattmeter provided with a

LAMP-TESTING INSTRUMENT.

socket or receptacle for the introduction of the lamp to be tested, and with a switch for cutting out the series windings in order to enable the instrument to be used as a voltmeter, operating on the voltage winding alone. Connection is made by means of a pair of leads, the upper ends of which unite in a plug, to be screwed into the lamp socket on the lighting circuit, and the lower ends being provided with terminals for attaching to the binding posts. It requires but a moment to make the connection. When used in lighting installations the lamp to be tested is removed from the line and inserted in the receptacle on the volt-wattmeter, which is then connected to the socket from which the lamp was taken, and a test is made under the conditions which exist in service.

Two concentric scales are provided, one indicating volts and the other watts, and by the use of the switch which cuts the series winding in or out of the magnetic circuit the wattage of the lamp or the voltage of the circuit may be read. This

[illegible] suitable for use on either alternating or direct currents [illegible] ings are not necessary on direct currents [illegible] advantages of portability, ease of manipulation, long range of readings and extreme accuracy. It is mounted in a polished mahogany case 6¾ by 7¾ by 4¾ inches and has a removable cover. The scale is long, with large, open divisions, easy to read. The action is dead beat. The instrument operates on electromagnetic principles, having two light movable coils connected to the indicator and four stationary coils connected in series, the arrangement being such as to practically neutralize the self-induction of the system. It is not affected by external fields or changes in frequency and has powerful springs, giving ample governing force. It has a maximum capacity of 150 volts and 150 watts, which is ample for the service for which it is designed.

The well-known Wurts non-arcing arrester, manufactured by the Westinghouse company, has been in service now for over 12 years, and it is notable that the first changes in its mechanical mounting have only recently been found desirable. The old type of this arrester is used extensively both here and abroad for all conditions of service ranging through power, lighting, telephone service on high-tension transmission systems and wherever protection is desired within its range.

The new type, which is shown with the cover removed in the accompanying illustration, has the

NON-ARCING LIGHTNING ARRESTER.

same dimensions as the old arrester. The unit itself may be used as a repair part wherever this device has been employed. One improvement is the method of securing the non-arcing cylinders to the porcelain supports. These are firmly held in place by machine screws passing through holes in the porcelain supports and screwed in the line and ground contacts. Porcelain supports are molded to shape with the cylinder centers exactly spaced, thus securing an accurate air-gap adjustment. All the cylinders can be easily turned through any angle to present new surfaces for action. Line and ground leads are made in a secure manner.

The assembled porcelain supports and cylinders are separated from the iron box by rubber-covered wire. This makes an effective packing which insures the porcelain from breakage if the arrester be shaken or jarred, and the wire holds the packing in place.

The cover is screwed to the box, rubber gaskets keeping out all rain. The arrester is of the line type designed for connection to overhead feeders and circuits, the normal rating being from 500 to 1,250 volts double-pole and up to 2,500 volts single-pole.

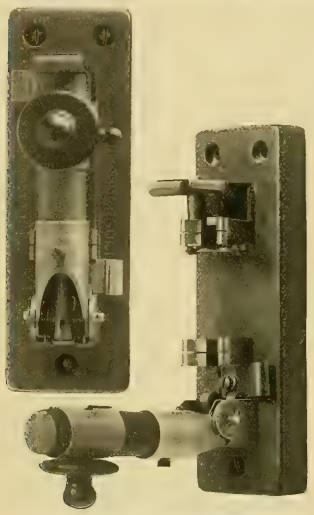
All the best electrical operating characteristics of the old-type arrester are retained, the improvements consisting of improved mechanical construction and consequently longer life and ease of inspection and repair.

In order to meet the demand for a compact and inexpensive circuit breaker for both alternating and direct-current circuits the Westinghouse Electric and Manufacturing Company has produced the type F breaker, which is shown open and closed in the illustration on the next page.

The circuit breaker is made in 12½, 25, 50 and

75 ampere sizes for 250 volts direct and 440 volts alternating service, being made in the overload type only. The tripping point is adjusted by turning the thumbscrew shown in the illustration, the range being from 90 per cent. to 180 per cent. rated capacity. The small insulating knob at the right of the contacts controls a tripping device, by raising which the breaker may be opened by hand.

By installing a breaker for each wire of the circuit, two for two-wire and three for three-wire circuits, the switch may be dispensed with and the circuit operated by means of the breakers alone. In this case the breakers are non-closable on overloads, the breaker on one side of the circuit opening when the breaker on the other side of the circuit is closed. An insulating knob is provided for closing. The only depth required in the containing



NEW ALTERNATING AND DIRECT-CURRENT CIRCUIT BREAKER

box is that required for the opening of the breaker. Current-carrying contacts are of copper, arcing contacts are carbon and are readily renewable. The lever arm is opened by a spring. The operating solenoid is inside of a fiber tube in the lower arm, which also conduces to a small and compact design. The parts of the breaker are mounted on a neat porcelain block, which is fastened to its support by three screws with countersunk heads.

## Foreign Trade Possibilities.

An electric tramway is to be built in Bilbao, Spain.

An electric tramway is projected to run from Cartagena to La Union, Spain.

The town of Muerzzuschlag, Styria, Austria, contemplates the erection of electric works.

The municipality of Watergraafsmeer, Holland, projects the installation of waterworks and electric lighting.

The town of Dakar, Senegal, is to install electric works for lighting and as motive power for a tramway line.

The city of Salzburg, Austria, will erect water-gas works and add extensive improvements to the municipal electric plant.

The city of Johannesburg, Transvaal, projects the laying of underground cables for its telephone system.

The state telegraphic bureau of Norway is open for proposals to supply it with six tons of bronze 1¼-millimeter wire.

The municipality of Bruck, Styria, Austria, will expend about $84,000 for the extension of its electric system and the improvement of the railway station.

The Direccion General de Correos y Telegrafos in Madrid, Spain, will purchase 65,000 insulators; also 20,000 impregnated telegraph poles.

The Empain finance group in Brussels has obtained the concession for constructing electric works and an electric railroad at Damascus, Syria. The working capital of the company will be $1,250,000.

The town of Durban, Natal, has voted the following amounts to be expended: For tramways, $108,330; for electric power and lighting plant, $150,000; for telephone system, $122,500; for sewerage work, $131,700.

It is reported that the Hudson River Power Company has increased its capital from $1,000,000 to $10,000,000.

## Notes on the Use of Rare Earths in Electric Illuminants.[1]

By Murray C. Beebe.

As scientists and engineers have come to a realization of the inefficiency of existing methods of illumination, the problem of improving upon these inefficient methods has received considerable attention. While the element, carbon, has heretofore been almost exclusively used commercially in both arc and incandescent lamps, the rare-earth oxides, so called, have recently been found to possess desirable properties for use as illuminants.

We are already familiar with the work of Auer von Welsbach in producing gas mantles of thoria and ceria. To use the rare earths in electric illuminants was a logical step. However, the problem possessed difficulties not encountered in the production of a serviceable gas mantle. We should remember that an illuminant, to be an improvement over the Edison or carbon-filament lamp in the matter of efficiency, must be capable of withstanding a higher temperature than the carbon filament for a length of time sufficient to make it commercially attractive. One might at first suppose that it would be difficult to improve upon the carbon filament in the matter of efficiency, or the ability of the filament to operate commercially at a very high temperature, since carbon is practically infusible and the rare earths are fusible. Carbon, however, slowly vaporizes at the temperature at which it operates in the incandescent lamp, and, finally, after 400 to 600 hours, has depreciated in light-giving power to such an extent that it is best to replace it. It is the vaporizing properties rather than the melting points of the materials, with which we are concerned in this problem. It has long been known that substances which are commonly regarded as insulators, such as glass and porcelain, become quite good conductors of electricity at higher temperatures.

Professor Buff, in 1854, read a paper "On the Conductivity of Heated Glass for Electricity," and "Faraday's Researches" gives a number of examples of such conductors. Jablochkoff, as you know, attempted to use refractory materials, such as lime, to separate and insulate the carbon electrodes of his Jablochkoff candle. He soon found that these supposed insulators in reality became conductors and emitted light by virtue of the current passing through them from one electrode to another. He even designed terminals with which to carry the current of electricity to the lime conductor, with the idea of making a lamp based on this principle. It is safe to say that were it possible to produce electricity as cheaply then as now, lamps of the Nernst type would have been known commercially much sooner than they were, for Jablochkoff's persistent attempts at commercial exploitation were baffled largely by the undeveloped state of electrical engineering.

That the rare-earth oxides are exceedingly refractory and do not readily vaporize at high temperatures makes the Welsbach mantle possible; that these oxides will conduct electricity when hot makes the Nernst lamp possible. Of all the oxides which conduct electricity but few are refractory enough for an efficient filament or glower. It was in determining the most desirable of these, and in fixing the best proportions to use that Nernst did his greatest work.

Ordinary red iron oxide, when formed into filaments and baked, will conduct electricity at ordinary temperatures, but such filaments do not withstand sufficiently high temperatures to be used as light sources. Magnesia and thoria, on the other hand, withstand exceedingly high temperatures, but these conduct electricity only with great difficulty. In general, mixtures of two or more oxides conduct better than a single oxide, and, in turn, the fusing point of the mixture is lower than that of either oxide alone. It seems that the vaporizing point is not necessarily lowered, judging from the fact that thoria and the small amount of ceria used in a Welsbach mantle, form quite a stable mixture, or possibly a chemical combination, while ceria alone or uncombined is a somewhat undesirable oxide from its rather marked tendency to vaporize.

It would be a long story to take up the various properties of all the rare-earth oxides and the possible combinations with one or more of the others. A mixture which is used largely in lamps of the Nernst type is composed of 85 per cent. zirconium oxide to 15 per cent. of yttria earths. Zirconium is not properly classified among the rare earths, though it is customary to do so. The term "yttria," as used here, means in reality a mixture of many oxides occurring together in certain minerals and closely allied in physical and chemical properties. Zirconia was used in comparatively large quantities for the first Welsbach mantles, and hence considerable attention had been given to various methods of producing it for such use. While many of the experimental glowers were made from zirconia bought from chemical supply houses, it was impossible to obtain uniform results from such material. Good zircon ore, which is a zirconium silicate, occurs in abundance in Henderson County, North Carolina, and this ore contains about 67 per cent. of zirconium as oxide. By treating this ore in the following manner quite uniform results are possible:

The ore is ground very fine in a ball mill and mixed with twice its weight of crude acid potassium fluoride. This is placed in an ordinary graphite crucible, and heated slowly until thoroughly fused, and the ore is completely dissolved. The fused mass is then ground and dissolved in hot water containing a quantity of crude hydro-fluoric acid equal to about one-tenth the weight of the fused mass. The silica remains undissolved as potassium silico-fluoride ($K_2SiFl_6$), and the potassium zirconium fluoride ($K_2ZrFl_6$) is drained off while boiling hot into a silver-lined vessel. Upon cooling, the filtrate develops crystals of potassium zirconium fluoride, and, doubtless, small quantities of other elements in similar crystal form. Iron and many other impurities which are present in the ore, or have been introduced by the use of crude reagents, remain in the liquor which is drained from the crystals. The crystallizing process may be much hastened by artificial cooling. Rinsing the crystals with cold water is likewise beneficial in removing all traces of the mother liquor. The crystals are gathered and fused in a platinum dish. By this means, any silica present seems to be vaporized off, and other impurities, like titanium, are made insoluble. The fused mass is ground and dissolved in hot water and crystallized as before. A few of the first crystals are removed; or, instead, alcohol may be added to the solution until a small amount of crystalline precipitate is formed. These first crystals contain much of the undesirable impurities. They are, therefore, removed and the crystallizing process is continued. The pure crystals are then dissolved in hot water and the solution is made rather acid by the addition of pure hydrofluoric acid. Ammonia is now carefully added to the hot solution until a small amount of precipitate is formed. If the solution of crystals has been made acid, the addition of ammonia, even until alkaline, will precipitate out iron and some other foreign metals, but will leave the zirconia in solution until it is cooled and diluted.

This method was found to be an exceedingly simple one for removing iron from zirconia, which, by other methods, is a troublesome operation. The hot filtrate, after removing the precipitate of iron, is dropped directly into a cold ammonia solution which at once precipitates zirconia as a hydrate. Up to this stage of the process it has been necessary to use vessels and utensils not affected by hydrofluoric acid. The last precipitate may be made in glass or wooden receptacles. The precipitate is washed several times by decantation, and then pressed out on suction filters, and, after a thorough drying by heat, is powdered and sifted through fine bolting cloth, and is then ignited in a platinum dish over a very gradually increasing temperature and with constant stirring. The ignition process requires several hours, or sometimes days, the final temperature being a good red heat. Traces of silica are removed by this operation.

The physical condition of the precipitate is dependent to a great extent upon the amount of hydrofluoric acid in excess. When precipitated from an almost neutral solution, the precipitate dries into hard pieces, translucent in appearance, and which are difficult to pulverize. With the greater excess of acid, the material dries in lumps resembling starch, in which condition it is much more suited to our purpose.

The zirconium made by this process seems to be reasonably pure. Precautions must be taken to keep out dirt, and to that end it has been found advantageous to purify the air admitted to the rooms where the glower materials are prepared by passing it through a water spray. An absolutely pure zirconia is not required, and though a trace of silica improves the efficiency and seems to diminish the initial depreciation of candlepower of a glower, it is a dangerous element to have present, for slightly more than a trace will cause a rapid change in potential difference at the glower terminals, besides causing lack of uniformity in the behavior of glowers of one batch, due to the fact that the silica becomes unevenly distributed among the glowers by evaporization and condensation occurring in a roasting process, which will be described later.

Although the purest materials make the best glowers for direct current, it cannot be said that an absolutely pure zirconia is desirable for alternating-current glowers. Silica is particularly undesirable in direct-current glowers. In general, a glower which operates well on direct current, showing almost no change in potential difference, will show a greater change when operated upon an alternating-current circuit.

The purity of the zirconia may be controlled, to some extent, by the number of times the material is crystallized during the purifying process, though each operation is attended with some loss of material. Physical properties are quite as important as chemical properties, and the procedure above described was evolved to give proper physical, as well as chemical, properties to the material.

After all, "Handsome is as handsome does," and the real test for the glower material lies in its ability to make good glowers. Test glowers have been made from hundreds of lots of zirconia, and

1. Paper read at the meeting of the Chemical Section of the Engineers' Society of Western Pennsylvania on March 23, 1905. Mr. Beebe is an electrical engineer of Pittsburg.

these tests, together with careful chemical records of each lot, have been the guide in developing the chemical process necessary for the production of good glowers. For direct-current glowers, a crystallizing process is also considerably used, but from a solution of zirconia in hot dilute hydrochloric acid. After two or three such crystallizations, it is necessary to precipitate from a hydrofluoric acid solution, as in the first process, to get the material into proper physical shape.

As to the yttria used, this is principally obtained from the minerals gadolinite or yttrialite. Gadolinite is found in Norway and Sweden, and also in Llano County, Texas. The Texas deposit seems to be confined to a very small district, and there is every evidence that it is a result of a volcanic eruption. It is found in crystalline form, associated with yttrialite, cyrtolite, fergusonite, rowlandite, allanite and other minerals. The ores from the Llano County district are radio-active, and the presence of a pocket in the quartz is generally indicated by bluish discolorations radiating from the pocket through some distance of the surrounding quartz. It is also claimed that the ores contain small quantities of confined helium gas. Gadolinite contains, roughly, 42 to 45 per cent. of yttria earths, 23 per cent. of silica, 13 per cent. iron as oxide, and nine to 12 per cent. of beryllia. Yttrialite contains 43 to 47 per cent. yttria earths, 30 per cent. silica, five to six per cent. ceria, didymia, and lanthan, as well as small percentages of urania. Fergusonite contains 32 to 42 per cent. yttria earths, 32 to 46 per cent. niobia. Rowlandite contains 47 to 62 per cent. yttria earths, 26 per cent. silica, and small percentages of iron and magnesia. Allanite contains 26 per cent. ceria and didymia, with a small percentage of yttria earths and considerable percentages of iron, calcia and alumina.

It is a comparatively simple matter to obtain and purify the yttria earths from gadolinite and yttrialite so that they are suitable for glower making. About 1,000 grams of ground ore are dissolved in crude aqua regia. The residue is filtered off and the solution evaporated to dryness, repeating this operation several times, or until all silica is removed. The neutral solution is then diluted to several liters and the addition of a hot solution of oxalic acid to the hot solution containing the earths, brings down the rare earths as oxalates, leaving iron and other impurities in solution. The oxalate is washed thoroughly with hot water and ignited, and the crude yttria earths are dissolved in dilute hydrochloric acid, just sufficient in amount to dissolve the oxide. To the rather dilute and neutral solution, which is cold, crystals of potassium sulphate are added in excess. After standing 24 hours, the cerium group has been quite thoroughly separated as double sulphates and the filtrate is then treated with ammonia to bring down the hydrates of the rare earths, thus freeing them of the great excess of potassium sulphate. The washed precipitate is dissolved in a quantity of pure hydrochloric acid, just sufficient to dissolve it, and again treated with boiling oxalic-acid solution, as before. This brings down the rare-earth oxalates in sufficiently pure form. The oxalates are thoroughly washed with hot water and ignited, and any remaining potassium is separated from the ignited oxides by washing upon a filter with hot water.

With the yttria, as well as the zirconia, physical properties are important, and the oxalate method gives an exceedingly fine precipitate, which requires no mechanical treatment.

Experiments indicate that the yttria earths of the greatest atomic weights give the most satisfactory results in glowers. In other words, ytterbia is better than yttria. Owing, however, to the great difficulty of separating the yttria earths from each other, which is so far possible only by laborious fractionation processes, entailing great losses, not much has been done toward using the higher atomic weight yttria earths beyond selecting ores which are rich in these earths.

The Llano County ores seem to be superior to the foreign ores in this respect, the atomic weights being:

| | |
|---|---|
| Yttrialite | 115 |
| Rowlandite | 107 |
| Fergusonite | 103 |
| Gadolinite | 100 |

while the foreign ores may be as low as 90 or 92.

The zirconia and yttria earths mixed in the proportions given above, namely, about 85 and 15, or 90 and 10, and about five per cent. of starch or gum tragacanth, are thoroughly mixed and kneaded into a hard dough and squirted by pressure through a die of proper size. This string, as it may be called, is dried and then broken into suitable lengths, which are roasted to an intense white heat in a platinum box. The pieces are then ready to have terminals placed upon them.

A Nernst terminal is made by winding stranded platinum wire about the end of the stick of material and then pasting over with a paste composed of ground glowers and zirconium chloride, thus forming a hard cement.

The Hanks terminal has the platinum embedded in the glower material, the operation being carried on by the aid of an electric arc in which the glower material is fused.

Certain it is that the mode of conducting the current is electrolytic in character. The specific resistance varies with the relative proportions of the constituents. In order to obtain glowers of the same specific resistance when using [illegible] earths of high atomic weights, as when low atomic weight earths are used, it is necessary to [illegible] the presence of the higher atomic weight [illegible] in proportion to the atomic weights.

Upon direct-current circuits the positive end of a glower generally runs much hotter than the negative end, and a black discoloration appears at the negative end, especially if impurities are present. In fact, this is one of the most certain indications of the presence of an impurity.

A glower operated in vacuum soon destroys the vacuum, probably due to oxygen gas liberated by electrolytic action. That all the current is carried by electrolytic means seems incredible, for the current carried per square unit of cross-section is far greater than can easily be accounted for by our usual conceptions of electrolytic laws. For example, upon direct current and calculated by electrochemical equivalents, the entire glower would be decomposed into the constituent elements in a very few minutes. Doubtless electrolytic decomposition and recombination do take place; but is it possible to account for the entire transport of current in this way? The assumption that the current is also carried seems unnecessary, in view of what is known of the power of highly incandescent bodies to ionize air to render it conducting. The air in the neighborhood of a glower is conducting, and to such an extent that the leakage currents from glower to heater had to be reckoned with early in the experimental work, and the difficulty was obviated by the use of a double-pole cut-out which disconnected the heaters completely from electrical connection with the remainder of the lamp after the glower started.

In connection with these speculations as to the real nature of the process by which the current traverses the glower, it is a fact that glowers which have operated for even a short time upon direct current, will, when the current strength is diminished sufficiently to maintain the glower at only a good red heat, explode with considerable violence. This may be accounted for by considering that the conductivity at low temperatures is insufficient to ionize the surrounding and contained gases. The means of conducting the current then being largely electrolytic in character, the combination of the products of electrolytic decomposition cannot so readily take place, since the ions cannot so readily traverse the length of the glower to combine at the lower temperature; consequently disruption occurs.

The suggestion that has so often been made, namely, that the current be reversed in direction at intervals, as, for instance, every time the lamp is started, is altogether impracticable, for the reason that a glower once operated upon direct current must never have its poles reversed, for a reversal means almost instant disruption. The potential difference across the terminals of the glower immediately after such a reversal is lower, indicating something analogous to polarization effects as we know them in aqueous electrolytes.

In general, with the Nernst terminal, the potential difference across the glower at the normal current value is the same with alternating or direct current. With the Hanks terminal, or embedded type, the potential difference with direct current may be as much as 20 volts lower. The Hanks terminal will operate on direct current, but not satisfactorily as a commercial proposition. The life of the alternating-current glowers is greater upon high frequencies than upon low frequencies, again suggesting electrolytic conductivity, at least in part.

The small glowers, up to 0.5 ampere, are made solid in cross-section, the largest ones are generally made tubular; and, in fact, one-ampere glowers must be made so. The reason for this is not that greater efficiency is sought by increasing the ratio of surface to volume, which is, of course, a fallacy, but inasmuch as the glower possesses a decided negative temperature coefficient as regards electrical conductivity, the center of a large glower would become molten before the outside surface reached an efficient temperature, the center being the better conductor. Glowers which have been greatly overrun, often exhibit this truth by the appearance of a nodule of molten material which has spurted out to the surface.

### Glower in Vacuum.

A glower will operate in vacuum, but the vacuum rapidly deteriorates, as before stated. A blue aurora or luminous haze surrounds the glower thus operated, either with direct or alternating current, and has been thought to be due in some way to vaporized metal (zirconium or yttrium) recombining with the slight amount of oxygen liberated. This idea seems plausible from the fact that objects such as wire or glass near the glower become coated with a white deposit of the glower oxides in a comparatively short time.

It would seem that oxygen necessarily plays a part in conducting the current, for a glower in an atmosphere of hydrogen or nitrogen behaves similarly to the one operated in a vacuum. In carbon monoxide or dioxide the glower exhibits the same characteristics as in air. The glower operated in vacuum exhibits a peculiar sluggishness [illegible]

It is an inherent property of these oxides, and a depreciation [illegible] during the first hour. There is then a slow diminution of intensity of light, also inherent, and seemingly accompanying the tendency of the glower to change from an amorphus to a crystalline structure. A rise of potential difference across the glower terminals is usual, though it is possible to counteract this tendency, at least in part. The effect of a rise in potential difference, obviously, is to diminish the intensity of light, by permitting less current to traverse the glower, running on a constant-potential circuit.

With carbon incandescent lamps, the useful life or smashing point is considered to be that number of lamp-hours during which the candlepower decreases 20 per cent. from the initial candlepower. Nernst lamps are similarly rated, counting as initial candlepower that measured after the initial decrease above mentioned.

Other causes of depreciation in candlepower are blackening of the enclosing glassware and reflecting surfaces. In this connection, the blackening is due largely to platinum which has been vaporized and deposited upon these surfaces. It has been found that the purest platinum is far better than that containing iridium or other of the platinum group, since pure platinum vaporizes much more slowly than alloys with these other metals.

It is to produce uniform chemicals and glowers in which the tendency to depreciate in light intensity and increase in potential difference shall be a minimum, that makes the problem so intricate and so fascinating, and still capable of much improvement.

Curiously enough, not the least of the problems to be solved in the development of the Nernst lamp was to overcome the tendency of porcelains to conduct electricity, the very property which, in the case of the rare earths, made such a lamp as the Nernst possible. A heater is necessary to start the glower. The heater is made by winding fine platinum wire upon a porcelain tube. It was necessary to produce a suitable porcelain which would withstand the high temperature necessary, and at the same time not conduct electricity. A porcelain composed of kaolin, alumina and silica is sufficiently refractory and porous to withstand the heat, and is an almost perfect non-conductor at high temperatures. The porcelain piece upon which the glowers and heaters are mounted is also of the same composition.

Another form of heater used more abroad than in this country is helical in shape and the glower is mounted in its axis. This is made of pure kaolin and after squirting into tubes about a millimeter in diameter and winding with fine platinum wire and covering over the wire with a paste, the small tube is bent into a helix upon a mandrel, a pointed blow-pipe flame playing upon the kaolin tube at the point where it bends on to the mandrel.

### Possibilities of Self-starting Filaments.

Many oxides will conduct at room temperature. A mixture of iron and tin oxides, about 70 iron to 30 tin, will start without preliminary heating and withstands rather a high temperature. There are many other similar combinations, likewise other possibilities exist, such as carbides, silicides and borides, operated either in vacuum or gases.

A Nernst glower may be made to conduct current at low temperatures by running it for a short time in a rarefied atmosphere containing a carbon gas. If to a globe in which a glower is operating in a good vacuum an amount of hydro-carbon gas is admitted sufficient to lower the vacuum even less than a millimeter, the potential difference across the terminals of the glower will decrease rather rapidly and in the space of a few minutes, or even seconds, the glower will have become a conductor when cold; or, in other words, self-starting.

The following experiment was tried:

A glower was mounted in a glass bulb and in the axis of a carbon filament of a helical shape. The bulb was exhausted well and sealed off. The carbon filament was used four or five times to start the glower, alternating current being employed. After the glower had run a few hours it was noted that it was changing color at its terminals. The discoloration gradually crept toward the center and after about 24 hours the glower could then be started without preliminary heating. Apparently enough of the carbon filament was oxidized during

the short time it was in use to give a slight quantity of free carbon monoxide in the bulb, the source of oxygen being the glower itself.

It is uncertain whether this gas was effective in reducing some of the glower material to its metallic form, or whether a conducting carbide was formed by the action of the carbon gas upon the glower materials. The former explanation seems preferable for the reason that it is noticed that the darkened portion at the negative end of direct-current glowers is of higher conductivity than the glower proper, and it seems quite likely that this deposit is a metal separated out by electrolytic action. Metallic zirconium, for example, withstands very high temperatures in the open air without oxidizing, and its melting and vaporizing points where air is excluded must be very high.

Many possibilities exist, such as are suggested by the above experiments, and many of them have been tried. Boron carbide, for example, withstands very high temperatures and is a conductor while cold, though it seems to vaporize somewhat too rapidly; at least this was the case with samples tried which probably were not very pure.

A Nernst glower, as well as those composed of thoria, magnesia and almost any of the refractory oxides may be made conducting by treatment with a hydro-carbon gas. Sodium and potassium vapor also effect a reduction to the self-starting condition, though not generally so readily as carbon.

There is a broad field still open and much that is not known of the properties of the rare metals. Oftener than not the supposedly pure metal is very impure, and the properties generally ascribed to it are in reality those of its carbide or other little known combination. Note the difference in properties of pure iron and iron containing even less than one per cent. of carbon. Is it not a fact that almost nothing is known of the physical properties of the rare metals? A good example of this point, and one bearing directly on our subject, is the recently developed tantalum lamp, the filament of which is a fine thread of tantalum metal. Tantalum metal until recently was not known to possess properties which now make it a promising addition to electric illuminants.

More or less experimental work has been done, particularly in Europe, in using the rare earths in electric arcs with the idea of obtaining better efficiency and more pleasing light. Lamps have even been tried with electrodes composed entirely of the rare earth oxides, though at the present time the greatest advances in arc lighting are being made along the lines of introducing such elements as boron and titanium into the electrodes.

## The Mercury-vapor Discharge Gap.

One of the applications of the mercury-vapor lamp is found in the operation of certain forms of X-ray and space-telegraph apparatus. This type of apparatus was recently described in an interesting manner by Mr. F. von Keller to the members of the Engineers' Club of Philadelphia. In the course of his lecture, which was accompanied by demonstrations with various mercury-vapor devices, Mr. von Keller in speaking of the mercury-vapor discharge gap or interrupter, said:

The negative electrode opposes the flow of current until the lamp has been started. However, had the voltage across the lamp been sufficiently high, say, 10,000 volts, the initial resistance would have been overcome and current would have been able to flow freely without the special starting of the lamp. Now it is necessary, in the production of X-rays and in wireless telegraphy, to have extremely sudden periodic discharges of current through the wave-producing apparatus, and these discharges are furnished by the insertion of a discharge gap in the circuit of the wave-producing apparatus from an alternating-current supply of high voltage. This alternating current is constantly changing, and may change from a maximum to a zero value at the rate of, say, 120 times a second. If the supply voltage is high enough, the negative-electrode resistance of the discharge gap is broken down whenever the alternating-current supply reaches a high value during its periodic change. The current then flows freely through the wave-producing apparatus, but ceases to flow as soon as the supply voltage has again dropped to a low value.

One is surprised to find how rapidly the mercury electrode responds to these extremely rapid periodic changes of voltage, but it has been established in a series of actual tests that the discharges through the wave-producing circuit become very sudden and highly efficient through the insertion of a mercury-vapor discharge gap. The interrupter presents the following advantages over an air spark gap, which is now commonly used to produce these sudden discharges. It is not subject to any kind of deterioration, as there are no metal surfaces to corrode or to burn off. The discharge is more sudden, and there is less opposition to the passage of the current after the initial resistance has been broken down, so that the waves emitted become more distinct by use of the vapor discharge gap. This little tube [illustrating] presents such an interrupter. You see it is a small glass container, which is pumped to a high degree of vacuum. Its two electrodes are both metallic mercury. It requires about 10,000 volts to break down the small space between the mercury puddles, but only about 14 volts are necessary to maintain the flow of a continuous current after the current has once been started. On shaking the mercury up in the tube you will notice that a clicking sound is emitted. This shows that there is a high degree of vacuum in the tube.

## BOOK TABLE.

Short Course in Alternating-current Testing. By Fitzhugh Townsend. New York: D. Van Nostrand Company. 1904. Pp. (5½ by 8½ inches), 32, with 10 illustrations. Price, 75 cents.

The pamphlet bearing the above title consists of a synopsis of a course of lectures on alternating-current laboratory work which is given to the senior mechanical engineers at Columbia University, including the principal commercial tests of alternating-current machinery. These tests are of a practical nature and are about all that would appeal to anyone besides the laboratory student. To one dealing with alternating-current machinery and having only a limited knowledge of the subject these few pages may be found of value.

Experimental Researches on the Flow of Steam Through Nozzles and Orifices. By A. Rateau. (Translated by H. Boyd Brydon.) New York: D. Van Nostrand Company. 1905. Pp. (six by 7¾ inches), 76, with four illustrations and four plates. Price, $1.50.

Since the advent of the steam turbine, in which the velocity of the steam plays a more important part than its expansive force, a reinvestigation of steam in point of view of its velocity instead of its pressure, has been made necessary. Though considerable information has been published regarding the proportioning of nozzles and passages which permit the steam to transform its pressure into available energy, this information has been somewhat disjointed and scattered and unavailable from a practical standpoint. The experiments of such a well-recognized authority as Professor Rateau which are described in this book will be of especial value to the designer of steam turbines. The theoretical formulas concerning the flow of steam through nozzles and orifices were fully confirmed by a series of tests made by Professor Rateau in 1895 and 1896, and the results of these tests are here set forth in a logical and scholarly manner.

Practical Electric-light Fitting. By F. C. Allsop. New York: The Macmillan Company. (London: Whittaker & Co.) 1905. Pp. (4¾ by 7⅛ inches), 289, with 242 illustrations.

This book is one well deserving of praise, and one of the greatest indications of its popularity is the fact that this is the sixth edition. It is a thoroughly practical treatise for electrical wiremen and others who require practical instructions and diagrams rather than formulas. Hardly a subject connected with house wiring, current-distributing systems, meters, grounding devices, wiring rules and regulations (English), private installation work, etc., can be mentioned which is not touched upon in the book in its practical aspects. Electric heating and cooking apparatus, the wiring of show windows, ship fittings, portable lamps and electric radiators are among the subjects in the book which come in for their fair share of attention. Arranging the circuits in a large building, obtaining the proper sizes of conductors for the different parts of the system and testing out the wiring are all subjects which come up to the practical man every day and which are gone into quite thoroughly in the book with the aid of a number of plates which make the reading matter more easily understood. The work is one which will be appreciated by a large class of electrical constructors, who need a reference book which will tell them in plain language those things which they wish to know.

Electricity Control. By Leonard Andrews. London: Charles Griffin & Co. (Philadelphia: J. B. Lippincott.) 1904. Pp. (6¼ by 8¾ inches), 231, with 206 illustrations.

"Electricity Control" is a book which with accuracy may be said to treat of the "nerve center" of an electrical system; that is to say, with the switch gear and controlling apparatus. The work does not pretend to be merely a record of the most modern apparatus belonging to this class, for a considerable portion of it is devoted to descriptions of various kinds of devices, which have been abandoned, with explanations of the reasons for their failure. Neither does the author attempt to deal with all manner of switching apparatus, but only to that portion of the system between the generators and the distributing center. Thus it will be seen that the book is of a special nature, and for that reason is especially valuable for the thoroughness with which it goes into the limited field which it covers. Two chapters of especial merit are those devoted to circuit breakers and to reverse-current devices. Much depends upon the circuit breaker, and it is an important part of the installation. The chapter devoted to this subject treats of a large number of types of circuit breakers and describes thoroughly their design and method of operation. The chapter relating to alternating reverse-current devices touches upon a subject which is too often not given sufficient space in a work of this kind. Reverse-current relays as they are constructed today leave much to be accomplished before a satisfactory and at the same time cheap and compact instrument is produced, therefore this chapter will be read with much interest by many who have to do either with the design or operation of these instruments. A marked feature of merit in the book is the large size of the various illustrations which stand out boldly and are easily followed.

The Insulation of Electric Machines. By Harry W. Turner and Henry M. Hobart. London and New York: Whittaker & Co. 1905. Pp. (5½ by 8½ inches), 297, with 162 illustrations. Price, $4.50.

Of the many materials with which the engineer has to deal there is probably none with properties less understood than those of insulating substances. The insulation of cables—which, by the way, is not treated in this book—is about the only case in which the subject has been studied with any degree of exactness. The insulation of electric machines still remains the stumbling block in their design which gives the engineer more trouble than any other feature. Many believe that by mixing up a few gums, resins and oils a dielectric may be obtained which will maintain its waterproof and insulating properties indefinitely. Experience has too often proved, however, that this is not the case. In this book an attempt has been made to gather together as much reliable information as possible on the general subject of insulating materials. As an introductory consideration the matter of testing is taken up, with descriptions of some of the most useful methods for its performance. The next subject considered is the disruptive strength of various insulating substances, with some valuable curves. Mica and mica compounds, varnishes, paints, impregnated fabrics, paper, liquid insulators and the hundred and one substances which go to make up the insulators in common use are treated in the book. Not only are the substances themselves discussed but also the method of applying them to the various uses to which they are put, as, for instance, the insulation of field spools, the application of tapes and bands, the method of drying insulation, tools and accessories employed in insulation, etc. There is also a good chapter on specifications for insulation which is worth reading with care.

Gas Engines and Producer-gas Plants. By R. E. Mathot. (Translated from the original French by Waldemar B. Kaempffert.) New York: The Norman W. Henley Company. 1905. Pp. (5¾ by 8⅞ inches), 314, with 152 illustrations. Price, $2.50.

It has been so short a time comparatively since the gas engine has become a factor to be considered seriously in the design of a power installation that engineers as a rule are not as well informed with regard to this form of prime mover as they are with the steam engine. In the operation, too, of the gas engine much is new to the ordinary engine attendant. The suddenly increasing use of gas engines within the last few years has led to a multiplicity of types, which is another factor which contributes to the lack of accurate knowledge of the subject. Literature upon the design, construction and operation of these engines is, therefore, always well received, especially if it be well written and conveniently arranged as is the work of Mr. Mathot. The book is of a practical nature and indicates the precautions to be taken with gas engines working under normal conditions to keep them at their highest state of efficiency, and also how repairs are to be made in case of accident. Engines of less than 200 horsepower are primarily considered, the heavier engines to be treated in another work. Though gas engines are frequently operated by illuminating gas directly from the mains, there are many installations in which the gas is generated on the spot by a producer, and much reliable information is contained in the book concerning the various types of gas producers and their operation. Summed up in a few words the book is just what is required for the operation of a gas-engine plant by one feeling himself, perhaps, not quite as proficient in this direction as in steam-engine practice, and desiring a good reference book to which he may turn in case troubles arise with which his personal experience is inadequate to cope. The book is particularly well printed in bold type upon a good quality of paper and the cuts are good and form a valuable adjunct to the clearness of the explanations. In translating the work Mr. Kaempffert has placed the engineers of this country under obligation to him.

The gasoline motor car built by the Union Pacific railroad is to be given a long trip by which it is hoped to demonstrate the adaptability of gasoline motors for light freight and passenger service. Mr. Kruttschnitt, director of maintenance and operation, has planned a trip for the car from Omaha to Portland, then back, through the principal cities to New York.

## Ohio Telephone Notes.

Frank L. Beam has resigned the position of general manager of the Columbus Citizen Telephone Company to become manager of the Ohio Independent Telephone Association. Since the annual meeting Mr. Beam has been prevailed upon by many of the most prominent men in the business to take the position, as they felt that he is well fitted for it. He is now interested in properties that operate over 300 exchanges. Dwight E. Sapp, member of the executive committee of the association, says that this change marks the beginning of a vigorous campaign among the Independent interests. So far, they have had no one to look after matters, but with a manager in the field they will be able to keep in touch with all that is going on and take such action as is necessary. Mr. Beam will arrange to look after those companies that are still out of the association, and it is thought that most of them will become members within a short time.

Several of the street telephone boxes of the Cuyahoga Telephone Company were robbed a few nights ago. The company has offered a reward of $100 for the apprehension and conviction of the thieves.

The Cuyahoga Telephone Company of Cleveland has arranged to add several more sections to its switchboard, owing to the large amount of new business it is taking in.

The Tuscarawas Telephone Company is doing an excellent business since the completion of improvements that required an expenditure of about $25,000. New copper wire was put in for the old iron wire and the plant was rebuilt. The rates were also increased.

At Burlington the Burlington Telephone Company has been incorporated with a capital stock of $300.

A room on High Street, Columbus, has been leased by the Central Union Telephone Company for a public pay station. The exchange will be off the main street in the new building and a location had to be secured for the station. Six rooms in the new First National Bank Building have been secured for the offices of the division superintendent and sub-license agent.

The Bell company has arranged to remodel its exchanges at Painesville, Ashtabula and Conneaut and rebuild those at Geneva and Jefferson. For some time this section has been neglected and about all the business the company got was from the toll lines, but it seems that the local business will be sought in earnest now.

The Cincinnati and Suburban Bell Telephone Company has asked the City Council of Cincinnati for permits to build conduits on the heights about the city that are used for residence purposes. They propose to put the lines underground, at a cost of about $100,000.

It is announced that the Fitzsimmons Telephone Company of Cincinnati will be reorganized at once. The judgment held against the company by Pogue & Pogue has been dismissed, and Mr. Fitzsimmons has been given leave to answer.

The name of the Gemmill Telephone and Manufacturing Company of Orrville has been changed to the United Telephone and Switchboard Company.

The surplus of the United States Telephone Company for March is about $7,000, which is the best statement the company has ever made, with one exception.

The American Telephone Company, which was organized at Toledo a short time ago with a capital stock of $100,000, will take over the local plants at Perrysburg, Maumee and Whitehouse. Charles T. Chapman, E. H. Wickworth, James R. Kerper and others are interested.

Managers and agents of the Bell interests met in Toledo a few days ago to discuss the situation in the towns of Northwestern Ohio. They were tendered a dinner at the St. Charles by District Superintendent A. J. Mellen.

The Bell Telephone Company is arranging to put the greater proportion of its wires in Xenia in underground conduits.

The United Home Telephone Company of Brookville has been incorporated with a capital stock of $75,000 by N. W. Reinhart, A. M. Myers and others. C.

## New England Telephone News.

The New England Telephone and Telegraph Company announced on May 1st a substantial reduction in its rates in some of the more important classes of service for the Boston, suburban and outlying-district exchanges. The reduction in some cases amounts to nearly 20 per cent.

During the last year 31 shares of Bell telephone stock have been exchanged for American Telephone and Telegraph Company stock, 28 owned by Isabella J. Coleman and three owned by Henry C. Tyler, as guardian. This leaves only one share that has not been exchanged, and it is owned by Alexander Graham Bell.

At the annual meeting of the New England Telephone and Telegraph Company, held in New York May 1st, the board of directors was re-elected. Thomas B. Bailey was chosen to fill the vacancy caused by the death of Benjamin Dean. The officers are: President, Thomas Sherwin; vice-president, Henry S. Hyde; secretary, Edmund W. Longley; treasurer, William R. Driver; executive committee, Frederick P. Fish, Moses G. Parker, Thomas S. Sherwin. B.

## Indiana Telephone Items.

The Richmond Home Telephone Company and the Central Union Telephone Company are putting out flaming advertisements, boasting of superior service at low figures. The Home company alleges that the schedule of long distance rates adopted by it is from 25 to 50 per cent less than the rates previously charged by the Bell company, and, among other figures, that there are 166,255 Independent telephones in the state, against 25,000 Bell telephones. The company insists that the value of a telephone is now rated by the number of people you can reach. The Central Union leaves out figures and talks of a superior and much wider service and cheap rates. It speaks of connection with Chicago, St. Louis, Cleveland, Cincinnati, Louisville, Pittsburg, New York, Detroit and Washington.

The Central Union Telephone Company has just completed a new and modern exchange at Crawfordsville. The company held a three-day opening, or reception, on May 6th, 8th and 9th, to which all the citizens were invited between the hours of 10 a. m. and 9. p. m. An official accompanied visitors through the plant, pointing out and explaining the devices and appliances of the new and modern plant.

Ground has been broken for extensive improvements by the Indianapolis Telephone Company on the property that it now occupies on North Meridian Street, near the new federal building. The addition on the front of the lot will be two stories high, of pressed brick and stone trimmings. At the rear of the main building a five-story brick and iron building will be erected. This structure will be 52 by 92 feet, and in it will be built a complete new switchboard.

A tornado crossed Indiana on the night of the 4th inst. The storm swept everything down in the vicinity of Peru, hundreds of telephones being burned out.

The Edinburg Telephone Company has declared a dividend of six per cent. The directors have also decided to make many extensions and install new appliances.

Union electrical workers and linemen at Indianapolis and Columbus are on a strike, demanding an increase in pay from 35 to 40 cents per hour.

The Central Union Telephone Company has been denied the privilege of placing its wires underground. The petition was denied, on the ground that when the streets are opened up for such purpose it will be for a general underground-conduit system for all the wire companies.

The Indiana Appellate Court has decided that a telephone or telegraph company may not mutilate shade trees in front of private property. Damages in the sum of $500 was secured by Martin Kruger of Michigan City for the mutilating of shade trees in front of his home so wires could be stretched. The company contended, as a matter of defense, that the land on which the trees grew was public property and that the trees, therefore, did not belong to Mr. Kruger. The suit for damages was instituted on the assumption that the plaintiff owned to the middle of the street and that the shade trees were his property, and the Appellate Court affirmed the judgment for damages on that theory of the law. S.

## Telephone News from the Northwest.

The Grant County Rural Telephone Company of Milbank, S. D., has let contracts for the construction of 100 miles of lines.

The Tri-state Telephone and Telegraph Company has been granted admission to Winthrop, Minn., for a long-distance line.

The Lincoln County Telephone Company of Lake Benton, Minn., has arranged for extensive rural construction.

The Shakopee (Minn.) Telephone Company has bought the Market Gardeners' telephone system of Bloomington, Minn.

The Wheatland (N. D.) telephone exchange has filed articles of incorporation with $15,000 capital stock.

The Great Northern Telephone Company of Williston, N. D., has been incorporated with $50,000 capital stock.

The telephone company at Kenmare, N. D., has arranged for a new exchange office and a larger system.

The Zenith Telephone Company has arranged to add an additional switchboard to its exchange in West Duluth, Minn., making room for 200 lines.

The Northwestern Telephone Exchange Company has reduced rates for residence service at Red Wing, Minn., to 75 cents a month, from $1.25. The Red Wing Telephone Company has just started its new exchange.

The supplies for the proposed automatic telephone system at Sioux City, Iowa, have been received and it is expected that the system will be in operation by June 15th.

The county will establish its own exchange in the new courthouse at Des Moines, Iowa. Tele-

[redacted] submitted an ordinance for the regulation of telephone rates [redacted] and the Northwestern [redacted] pany is particularly affected by its requirements.

The People's Telephone Company [redacted] modern brick exchange building at Superior, Wis., this year.

## TELEPHONE MEN.

W. W. Emmons of North Platte, Neb., [redacted] charge of the Emporia exchange [redacted] porta, Kan., having purchased the stock of the [redacted] Frank Brown.

A. L. Tetu of Louisville, Ky., has accepted the position of general manager of the Independent Telephone Company of Nashville, Tenn. Mr. Tetu has for three years been general manager of the Louisville Home Telephone Company and the Independent Long-distance Telephone Company of Louisville. He is well known in the telephone field and active in the Independent movement. At Louisville he held the confidence of the officers of his companies and the respect of the employes and citizens. About 150 girl operators and the men employes presented him a gold watch and chain and before departing for Nashville a banquet was given in his honor by a few intimate friends, who presented him a fine smoker's outfit as a token of respect.

## NEW COMPANIES.

The Orange Home Telephone Company has been incorporated at Orange, Cal., with a capital stock of $100,000.

George W. Riddle and associates of Dallas, Texas, have organized the Texas Consolidated Long-distance Telephone Company, to build a line between Dallas and Fort Worth.

The Mount Pleasant (Ill.) Telephone Company, capitalized at $10,000, will operate a telephone system. S. O. Stout, U. G. Ragsdale and J. J. McManahan are the incorporators.

Among the telephone companies which have recently been incorporated are the following-named: Danville Rural Telephone Company, Danville, Kan.; Western Telephone Company, Big Springs, Texas; Robinson Mutual Telephone Company, Robinson, Kan.; Gage Telephone Company, Gage, Okla.; Yorktown Mutual Telephone Company, Yorktown, Kan.

## GENERAL TELEPHONE NEWS.

The Lawrence County Mutual Telephone Company of Mt. Vernon, Mo., is about to begin the construction of a rural line.

H. Susman, B. L. Susman and C. E. Harding have incorporated the Hyde County Telephone Company, with an authorized capital stock of $25,000, to construct telephone lines, with exchange office at Washington, N. C.

Announcement has been made of the purchase of the Frontier Telephone Company of Buffalo by the Consolidated Telephone Company of the same city. The Consolidated is a holding company, with a capital stock of $10,000,000.

The Great Western Salt and Soda Company of Ogden, Utah, has closed a contract with the Bell Telephone Company for the extension of the latter's lines from Warren to Little Mountain, where the plant of the salt company is located.

The Secretary of the Interior has called for bids, which will be opened June 1st at the office of the United States reclamation service at Glendive, Mont., for installing in connection with the Fort Buford reclamation project a telephone system having four telephone stations and about 70 miles of pole line. Specifications, blank proposals and full particulars may be obtained upon application to the chief engineer of the reclamation service, Washington, D. C., or to F. C. Weymouth, engineer, Glendive, Mont.

A suit instituted by the Illinois Manufacturers' Association against the Chicago Telephone Company was on hearing in Judge Holdom's court in Chicago this week. The proceedings arose from an injunction issued by Judge Tuley on a bill filed by the association in October, 1901, in which Judge Tuley held that the telephone company is prohibited by the ordinance of 1889 from charging more than $125 a year for a telephone. The plaintiffs seek to recover the amounts paid the telephone company in excess of $125 a telephone for the last five years. In many cases the rate paid was $175, and it is said that $2,000,000 is involved.

# CORRESPONDENCE.

## Great Britain.

London, April 26.—The proposals of the London County Council with regard to the purchase of the horse tramways in the north, at present leased to a company, have now been made public in detail. The facts concerning these northern tramways have been given in these notes at various times, and it is now only necessary to add that the lease expires in 1910, if it is allowed to run its full course. The terms in the lease with regard to the conversion of the lines to electric traction are such that, owing to the borough councils having a right to be heard in the matter, there is little likelihood of an agreement being reached. The London County Council highways committee, however, is of the opinion that, in order to expedite the introduction of electrical working, it would be profitable to purchase the remaining five years of the company's lease. The price of the profits so acquired is put at $600,000, in addition to which the company's rolling stock, horses, harness, plant, etc., is to be purchased at a valuation as part of a going concern. It is estimated that if the proposals above referred to were adopted the increased car mileage with the electrical working would be such as to give a profit of $2,200,000 annually, which, after meeting all charges, would leave $489,500 net profit annually. On the question of the system to be adopted the committee points out that the adoption of the conduit system throughout would involve extra capital expenditure to the extent of $2,300,000, as compared with a mixed system of conduit and trolley. Against this, however, the committee place, the advantages of adopting a uniform system of traction throughout London, which would give an increase of receipts, caused mainly by the economy produced by working on one system as well as by the greater rapidity of the service and the extra comfort to the passengers. By the immediate purchase of the lease, it is pointed out, the council would secure the additional profits of electrical working covering a period of four years, and also the economy of the addition to the load on the generating station which the new lines would create. The discussion upon these proposals has been deferred. Naturally enough, the company is in favor of the arrangement proposed, although it has not yet been placed before the shareholders. But for the action of the London County Council in placing itself in the hands of the borough councils on the question of the system to be adopted, I believe the company would have agreed to terms converting the lines to the trolley system several years ago, and thus a vast expenditure would have been saved the ratepayers.

The inquiry into the fires which occurred at the exchanges of the National Telephone Company through one of its cables coming into contact with the live third rail of the District Railway Company has now been concluded. One or two points raised by the expert witnesses were dealt with by the jury and satisfactorily disposed of. For instance, it was stated that there was danger to subscribers from such a current from a railway coming on to the telephone wires, but the decision was given that this was not so, provided efficient protective means were employed, practically upholding the view of the telephone company. Such a scare was raised by the daily press over this point that the jury was asked to express an opinion as to whether a government inquiry was needed into telephone risks, but the answer was in the negative. It was also found that there was not sufficient evidence to enable the responsibility for the fires to be fixed. Obviously, however, there was carelessness on the part of some one, and practically the net result of the inquiry is as stated above. The telephone company admitted that the exchange at which the fires occurred was not in the most fire-resisting condition.

While on the question of telephony it may be interesting to point out the present position with regard to the agreement between the National Telephone Company and the government. When the agreement was first published it was proposed to send it before a committee for examination and report. The postmaster-general proposed this in the House of Commons, and although it was generally agreed that this was the best course to adopt, the motion for the appointment of the committee was opposed and defeated on a technical point, owing to the lateness of the hour. This was many weeks ago, and it was then intimated that it might not be possible to bring the matter up again. Since then several alterations to the committee have been made, but it does not seem that the postmaster-general can now see his way to send the agreement before a select committee and that it will be discussed only in the House. If this course is adopted it will only be due to the obstructionist tactics of certain members of the House of Commons, the majority of whom would have treated the mere motion to send the agreement to a committee as a noncontroversial one. Should the agreement go before a committee after all, the nation will be distinctly the gainer, for any recommendations it might make would carry great weight in the House.

A further announcement has been made that although Lord Kelvin's progress is slow, it is all that can be anticipated. G.

## New York.

New York, May 6.—The New York state Assembly has voted by 94 to 51, over Mayor McClellan's veto, the bill to take away franchise-granting powers from the Board of Aldermen.

The Municipal Ownership League has sent W. R. Hearst, J. G. Phelps-Stokes and G. Augustus Haviland as a special commission to Europe for three months to prepare a report on municipal ownership, with the ultimate view on their return of framing legislation of a comprehensive character.

The legislation pending at Albany following the recent public-lighting investigation in this city may result in provision for commercial lighting at 10 cents a kilowatt-hour, except in the county of Kings, where 12 cents may be charged. Separate legislation provides for the charge for like consumers to be fixed at the same rates. An attempt to reduce the price of gas has not so far been successful.

The Rapid Transit Commissioners on Thursday decided tentatively upon a four-track subway across town on Thirty-fourth Street instead of the previously suggested moving platforms. This action really places the street route in the hands of the Metropolitan Company and is a blow at the plans of the Interborough.

The Interborough Rapid Transit Company will shortly make its first rental payment for the subway to the city, calculated on a basis of 3½ per cent. on the bond issue, less certain amounts deductible on account of unfinished work.

The committee on bridges and tunnels, referring to the "imperative condition" of electricity as a motive power for the New York Connecting Railway, enforces its opinion with the observation: "The argument against installing an electric system because of its cost is not sincere, because it would be far cheaper for the company to install an electric system at the outset of its operations than to furnish and maintain a steam-power system and be compelled after a very few years to go to the additional expense of installing an electric system."

A feeder cable on the lower Broadway surface line was burnt out last Sunday evening and delayed traffic for nearly two hours.

On Monday evening the state Senate passed a bill providing that all surface cars in Brooklyn shall be fitted with vestibules. This bill does not apply to Manhattan.

A 16-year-old Brooklyn boy is said to have devised an electrical signaling apparatus, which is being considered by the Brooklyn Rapid Transit Company as a means of dealing with the bridge traffic during the rush hours.

A recently published report shows that during 1904 286,413 feet of electrical conduit was laid in the city, as compared with 32,527 feet of new gas mains.

August Belmont was entertained on Thursday by Mr. and Mrs. Clarence Mackay at Harbor Hill, L. I. The entertainment included a dinner and a dance, and the occasion celebrated was the opening of the new race track at Belmont Park.

Two hundred delegates, with some of their womenfolk, who attended the International Railway Congress at Washington last week, visited New York on Monday. A strongly organized local committee took charge of them, and, among other sights, showed the visitors the subway and power houses. General Manager Frank Hedley represented the Interborough Company and President H. H. Vreeland the Metropolitan street railway.

On Friday at Albany several bills met their doom for the present session. These included the Niagara power bill, which failed to pass the rules committee; and the five bills which would have rehabilitated the "Steinway" Tunnel and enabled the Interborough company to connect Manhattan with Queens Borough.

The Hanover Light and Power Company, with a capital of $2,000,000, was incorporated yesterday, with head offices at Albany, and a large list of neighboring towns given as the sphere of the company's operations. The directors, mostly New Yorkers, include E. G. du Mazuel, Frederick K. Morris, Frank B. Pierce, Arnold L. Davis and William Brower.

A new million-dollar company has been incorporated under the title of the Northern Westchester Lighting Company, with headquarters at Ossining, N. Y., chartered for the purpose of supplying gas and electricity for light, heat and power. The first directors are William J. Bagnell, James H. Haggarty, Charles T. Lark and Alexander Keogh.

The Interinsular Heat, Light and Power Company is a new incorporation which purposes to operate in the boroughs of Richmond and Queens and in a few neighboring towns and villages. Its capital is $500,000 and the directors are John Eckhardt, E. D. McLean and Edward A. Kracke.

H. G. Villard and associates have incorporated the Marshall Light, Heat and Power Company of New York, with a capital of $150,000.

The Star Telephone Company is applying for a franchise to carry on a general telephone and telegraph business in the city. It asks for a 25-year privilege on a basis of five per cent. on the gross revenue.

The electrification of the western lines of the Long Island railroad is being pushed with all speed and the five sub-stations are so near completion that they will soon be ready for actual tests. A score of the new steel cars have been received and are being fitted out at the Locust Avenue shops. Seventy-four of the 200-horsepower motors have arrived for installation in the cars, and all the multiple-control air-brake equipment has arrived from the Westinghouse company. Some of the new cars are now ready for operation.

D. W. W.

## Southeastern States.

Charlotte, N. C., May 6.—One of the most extensive electrical developments in the South is now rumored, being the consolidating of all the numerous waterpowers on the Catawba River. Dr. Gil Wylie of New York, president of the Catawba Power Company of Fort Mill and Charlotte, N. C., is at the head of the interests concerned in the rumored developments. The Catawba people have recently secured control of another valuable power near Camden, S. C., for something like $125,000. The Catawba Power Company now possesses what might be termed a corner on the river, which passes near more cotton mills than any river in the South today.

A bill has been introduced in the Tennessee Legislature providing for a tax of $1,000 on plants of 10,000 lights or over, and $2,500 in cities of 100,000 inhabitants or more.

It is said that an issue of $750,000 bonds will shortly be placed on the market by the Asheville and Burnsville (N. C.) Electric Railway Company, of which George D. Mills of Warsaw, Ind., is president. This road will be built largely for freight purposes and will have located along the route more big lumber plants perhaps than any road of similar extent in the South.

The Kingston, Brighton and Northern Railroad Company of Northampton, Va., has been chartered and has the right to operate by electricity or steam, near Cape Charles, Va. W. E. Dickinson is president.

The town of Washington, N. C., has voted $15,000 additional bonds for an electric-light plant for the city.

Developments of considerable magnitude are being projected near Columbus, Ga. H. H. Hunt and Henry G. Bradlee of Stone & Webster, Boston, Mass., have expressed the opinion that to develop the Clapp's factory, waterpower will soon become a necessity, this being located two miles from Columbus, Ga. The syndicate has been deferring action until there was sufficient demand to warrant building a dam and installing a power plant. The Stone & Webster people will likely develop 10,000 horsepower on the Chattahoochee River.

The Knoxville (Tenn.) Traction Company has let the contracts for a car shed and shops to cost $75,000. Lines are being extended in all directions and half a million dollars has been expended already in improvements. L.

## Ohio.

Cleveland, May 6.—The local street-railway situation at Cleveland has caused quite a little comment for the last week or two. While the officers of the Cleveland Electric Railway Company have signified their willingness to present a fair proposition in exchange for a renewal of its franchises and the right to construct several new lines and extensions, they have not yet been able to do so. Mayor Johnson suggested that they lease the property to the city or to a holding company, with a guarantee of certain dividends, but the directors have expressed themselves, unofficially, it is said, to be in favor of operating the lines themselves. On the matter of valuation, if the company should agree to sell, President Andrews said the directors would insist on par value of stock. He suggested to the mayor at the last meeting that a commission made up of the mayor, a member of the council, one from the Chamber of Commerce and several other bodies, be appointed to settle the railway question.

The Board of Public Service and the City Council at Toledo have decided that the Cherry Street bridge is safe and that interurban cars may pass over it without further trouble. For a time they were barred and could not get into the city.

At the annual meeting of the stockholders of the Cincinnati Gas and Electric Company a few days ago the report of President Norman G. Kenan showed that there had been an increase in the electrical departments of 14.5 per cent. over 1903. Theodore Clauss was elected to succeed Henry W. Sage as secretary.

In all probability the Toledo and Indiana Railway Company will get its line into Bryan the latter part of this month. The track has all been completed and fires were started in the furnaces of the power house at Stryker a few days ago. When the overhead construction is completed the line will be ready for operation.

Thieves stole 1,500 feet of the trolley wire from the Shore line of the Cleveland, Painesville and Eastern a few days ago. It seems that this has become a good source of income for thieves, and the companies will have to police their tracks to save their property.

The Lake Shore electric has put on its summer half-hour service between Cleveland and Lorain.

The lease of the Cincinnati, Dayton and Toledo

to the Northern Traction Company has been signed. It is probable that the contemplated improvement on the road will be begun within a short time.

It is reported that the Cincinnati Trust Company has determined to foreclose on bonds of the Miami and Erie Canal Transportation Company. This company is trustee for the bondholders. President Schoepf of the Cincinnati Traction Company says that he has exhausted all efforts at a reorganization of the company. There is now $3,000,000 stock outstanding and the bonded indebtedness is $2,000,000. The outstanding indebtedness for general creditors is $100,000.

The people of Loveland by popular vote have ratified the contract with H. C. Hubble & Co. of Mt. Vernon, Ohio, for a 10-year franchise to furnish light, power and water. It is the intention to erect a plant that will cost about $100,000 and the company will furnish electric current both day and night.

It is reported that negotiations have been closed for the merging of the properties of the Pennsylvania and Mahoning Valley Railway Company, controlling local lines at Youngstown, Newcastle, Warren and Niles, and the Youngstown, Newcastle and Sharon, which controls interurban lines connecting several of the important towns in western Ohio and eastern Pennsylvania. The Pennsylvania and Mahoning Valley owns about 90 miles of track, while the other company has something like 40 miles. There is a tendency over the state to unite those roads into systems which will work well together. Both the freight and passenger traffic can be taken care of more satisfactorily in this way. O. M. C.

## Indiana.

Indianapolis, May 6.—The Evansville and Newberg electric railway was opened on May 1st. The management took a large delegation of the leading citizens over the 11 miles to Newberg and return. The new cars and equipment of the road are said to be equal to any in the West, and the roadbed is in fine condition. The road will be extended to Booneville.

J. A. Edson, general manager of the C., H. and D. steam road, announces that his road will follow the lead of the Southern Pacific and Chicago and Alton, and place gasoline-motor cars on its line, to meet interurban competition. He says the C., H. and D. now has in its shops an interurban motor car similar in construction to the car being tested by the Chicago and Alton. The C., H. and D. faces the prospect of having its line from Indianapolis to Cincinnati paralleled the entire distance by a fast electric railway.

The Valley Traction Company, headed by F. I. Barrows, J. B. Elliott and other citizens of Connersville is asking for franchises to enter Connersville, Brookville and other towns and cities along the proposed line.

The Marion, Bluffton and Eastern Traction Company has filed articles of incorporation. The initial capital stock is $30,000. The company will build and operate an electric line through Wells, Huntington and Grant Counties. Frank F. VanTuyle heads the incorporators.

The property of the Wabash and Rochester Traction Company in the city of Wabash has been levied on to satisfy a small claim of a Cleveland firm. The road was to be built by Pittsburg and Cleveland capital, and subsidies of $110,000 have been voted in aid of the road. About $30,000 has been spent in grading and supplies, but the work has stopped, and no one seems to know why.

That the Indianapolis and Eastern Railway Company's traction line is sought by the Widener-Elkins syndicate as a link in the proposed chain of electric lines from the East to the West, is acknowledged by President F. M. Fauvre. The latter says he and his associates have been approached flatteringly, but do not want to sell the road.

Final arrangements have been made for the sale of the Indianapolis and Western railway, the traction line now building between Indianapolis and Terre Haute by way of Danville and Greencastle, to the Tucker-Anthony syndicate of Boston. The former owners were principally the men connected with the Indianapolis and Eastern Railway Company, of which F. M. Fauvre is president and J. W. Chipman, secretary and general manager. The new owners have elected the following directors: P. L. Saltonstal of Boston, president; George L. Townsend of Indianapolis, vice-president; Piere Gray, Indianapolis, secretary; S. Reed Anthony of Boston, treasurer; Robert P. Wood of Indianapolis, chief engineer. The contract let for the completion of this line provides that cars shall be running by September 1st. The Tucker-Anthony syndicate now controls the Indianapolis and Northwestern lines to Lafayette and Crawfordsville, and by adding the new lines just purchased, makes one of the largest systems of electric lines in the state. S. S.

## Rocky Mountain States.

Salt Lake City, May 5.—The Western Power Company has been organized at Boise, Idaho. The officers are: President, J. B. Coate; vice-president, I. V. Howard; secretary and general manager, L. A. Coate; electrical engineer, A. J. Wilson; directors, Lee Bunch, J. R. Pritchet and [illegible]. The company plan the early [illegible] of a [illegible] horsepower plant.

Upon his return to Boise, Idaho, after an eastern trip, W. E. Pierce, who organized the company which plans the construction of an electric railroad from that city to Caldwell and Pearl, announced that everything had progressed [illegible], and that actual construction work would begin within the next few months. [illegible]

## Michigan.

Detroit, May 6.—The Detroit United Railway has installed special cars for service between Flint and Detroit. They will be put on a special fast schedule and will make the run between Detroit City Hall and Flint in two hours and 30 minutes. These cars will stop only at street crossings in Detroit and Flint and at eight towns between these cities.

The Detroit Edison Company will appear before the Detroit council committee, and Manager Dow of the company will answer charges made by one of the aldermen that it charges exorbitant rates and discriminates against some of its patrons. Representatives of the electrical workers will appear before the committee to protest against any reduction in rates, on the ground that it is likely to reduce their wages.

The Miami Avenue station of the Detroit Edison Company was the scene of an accident in the bursting of one of the large generators, which was running at the rate of 635 revolutions per minute. Pieces of the commutator were thrown in every direction, doing considerable damage. The manager's desk, which stood near by, was entirely demolished.

The Jackson and Battle Creek Traction Company's property has been sold to Myron W. Mills, James R. Elliot and George G. Moore. This syndicate now owns the Jackson city electric line and the Lansing and St. Johns electric line, which was purchased from Spitzer & Co., Toledo. The Jackson-Battle Creek line is a third-rail road and has been very popular. The earnings have been rapidly increasing and there is also an increase in the through travel from other lines. Close traffic arrangements will be made with the Detroit, Ypsilanti, Ann Arbor and Jackson railway. The same men are also building the new electric line from Jackson to Lansing. The Mills-Elliot-Moore syndicate will, upon the completion of the Lansing line, control 130 miles of electric line in this state.

An ordinance is now being prepared which proposes to make all motormen in the city of Detroit of possible assistance in giving alarms of fire. Each motorman will carry a fire-alarm key, so that in case of fire he can turn in the alarm or give the key to another to do it for him.

A new plan is now offered for the disposition of the Detroit United Railway to the municipality of Detroit by the scheme of an eastern banker, who has, it is said, acquired the controlling interest of the line, pending a demonstration of its success. The idea is for the men interested in the matter to turn over, for a fair cash consideration, to the city the entire property so far as it is affected by the lines lying within the city, retaining the interurban lines. An agreement is to be made with the city at the time of the transfer to the effect that the interurban shall have running rights over the city tracks, paying therefor a stipulated rental, the interurban company paying a proportion of the cost of the maintenance of the track.

The Detroit Engineering Society held its eleventh annual banquet at the Hotel St. Clair, this week, and the following-named officers were elected: President, J. D. Sanders; first vice-president, Benjamin Douglas; second vice-president, William R. Kales; secretary-treasurer, Clarence W. Hubbell.

A franchise for an electric road has been given through Brighton, Mich., to Charles Van Keuren, acting, it is said, in the interest of the Hawks-Angus syndicate. C. G. W.

## Pacific Slope.

San Francisco, May 5.—The meter department of the San Francisco Gas and Electric Company is being thoroughly overhauled. A new and more satisfactory system of testing meters on the consumers' premises has been inaugurated and a number of additional inspectors have been added.

R. E. Starkweather and C. E. Wishon of the California Gas and Electric Company have been at Angels, Cal., recently, planning an extension of the Standard company's electric line through Calaveras, Tuolumne and Merced Counties to furnish power to the mines and lights for the mining belt.

At the recent annual meeting of the stockholders of the American River Electric Company, held in San Francisco, plans were discussed for extending the company's electric transmission system, operating from the power house near Placerville, to Stockton, Cal., and intermediate points. The following directors were elected: M. Fleishhacker, F. H. Buck, H. Fleishhacker, W. Bell, A. Anderson, W. E. Gerber and S. C. Scheeline.

The management of the Citizens' Light and Traction Company of Salem, Ore., is making preparations for the proposed electric road from Salem to [illegible]

The Edison Electric Company will rebuild its distributing system at Whittier, Cal. The changes to be made at the central station will double the capacity of the present system.

It is expected that grading for the Yosemite Valley railroad will be commenced in Merced, Cal., at once. N. C. Ray, the chief engineer, is now in San Francisco in connection with the letting of contracts for construction.

The Field of Gold Mining Company of Masonic and Bodie, Cal., intends to install a large electric power plant on the Walker River several miles below Bridgeport, Cal. Power will be transmitted to Bodie through the new mining camp of Masonic, and on to Tonopah, Nev.

Work has been resumed on the proposed electric railway to connect Bakersfield with tide water at Hueneme, Cal. John Burson of Bakersfield, Cal., is interested in the project.

The Ventura Water, Light and Power Company announces its intention to rebuild and refit the lighting system at Ventura, Cal. Additional dynamos will be installed and new street lamps placed.

## PERSONAL.

Emile Guarini, a well-known technical writer, with headquarters in Brussels, Belgium, has been appointed for two years professor in the new school of engineering in l'Ecole des Arts et Métiers at Lima, Peru. He left Brussels for South America on April 15th.

Arthur Warren, manager of publicity for the Allis-Chalmers Company, was scheduled for an address at the Hollenden Hotel, Cleveland, Ohio, on Tuesday evening of this week, when the Manufacturers' Advertising Club was to entertain the Ad Club of that city.

T. S. Cornell, who has been engaged in electrical, mechanical and civil engineering work for the last 15 years, has lately opened an office at 136 South Burdick Street, Kalamazoo, Mich. Mr. Cornell has been retained as consulting engineer upon a number of large electrical undertakings in Michigan.

William Brewster, president of the Chagrin Falls (Ohio) Telephone Company and cashier of the Chagrin Falls Banking Company, died a few days ago from the effect of burns received while making a fire in a stove with coal oil. He was about 57 years of age and was one of the most prominent men in Chagrin Falls.

John Craig Hammond, advertising manager for the Denver Gas and Electric Company, was in Chicago on Monday of this week. He is as enthusiastic as ever over the coming electric-light convention in Denver and Colorado Springs, and is so cheerful and optimistic that he imbues everybody else with his confidence.

F. W. Judson has succeeded Harvey Pearce as superintendent of the Marquette County (Mich.) Gas, Light and Traction Company. Mr. Pearce has accepted the superintendency of the Board of Public Works at Negaunee. Mr. Judson has resigned the superintendency of the street-railway and lighting systems at Madison, Ind., to accept his new position.

A few days ago the Toledo (Ohio) Times contained a photograph and sketch of the career of Albert L. Lafferty, manager of the Postal Telegraph office in Toledo. Mr. Lafferty started in as a messenger boy and has been in the business for 24 years. He has been in charge of the Toledo branch for three years and has brought the service up in a very satisfactory manner.

William C. Hubbard, for several years with the Westinghouse Electric and Manufacturing Company, severed his connections on May 1st and has entered the sales department of the Cooper Hewitt Electric Company, New York city. Mr. Hubbard has had considerable experience in the lighting field, having been associated with Prof. L. B. Marks in the development and introduction of the first commercial enclosed-arc lamp in this country. For two years he was vice-president and general manager of the

Electric Arc Light Company, and afterward New York manager of the Manhattan General Construction Company, until both companies were absorbed by Westinghouse interests.

William Carroll has been appointed by Mayor Dunne of Chicago to the office of city electrician to fill the vacancy made by the retirement of Edward B. Ellicott, who recently resigned to become principal assistant engineer in charge of the hydro-electric development of the Chicago Sanitary District. Mr. Carroll has been connected with the electrical department of the city since 1874, when he started in the fire-alarm telegraph department. Since that time his progress has been steady and sure, he having been successively promoted as vacancies occurred, until in 1895 he was made superintendent of construction, which position he held until his present appointment. So intimate have been his relations with all things pertaining to the electrical department during the period of more than 30 years that he has been in the City Hall that he comes to his new office with a thorough knowledge of the details of the work, and, aside from the increased responsibility, there will probably be very little that is new to him in the position. He has seen the beginning and development of the city's electric-lighting plants, and in this department is especially well prepared to assume control. The fire-alarm and police-telegraph department is also perfectly understood by him to the minutest details, many years of the service which he has given to the city being spent in this branch of the work. Mr. Carroll is a man who makes friends at every hand through his kindly and courteous disposition, and none are more glad to congratulate him on his late success than his associates at the City Hall, many of whom have been connected with him for many years.

WILLIAM CARROLL.

## ELECTRIC LIGHTING.

At Oliver Springs, Tenn., Rich Bros. will install an electric-light plant.

Breckenridge, Mo., has voted $10,000 bonds for the construction of an electric-light plant.

The Sulphur Light and Power Company of Sulphur, I. T., has been incorporated with a capital stock of $100,000.

The Mutual Light and Heat Company of Seattle, Wash., has gone into new hands. N. H. Latimer is now the president.

Plans are being prepared by the Lee Electric Light Company of Clarinda, Iowa, for the erection of a new power house.

The Cramer Electric Company of Salt Lake City, with a capital of $50,000, has been incorporated. Lee Cramer is president.

It is proposed to build a concrete dam at Decorah, Iowa, for furnishing electric light and power at Decorah and Waukon.

A 10-year franchise has been granted to A. O'Donnell by the City Council of Howard City, Mich., to furnish electricity for all uses.

At a recent election on the question of issuing bonds for the erection of an electric-light plant, the citizens of Monroe, Ga., approved the plan.

A complete electric-light plant is included in the improvements to be made to the Central Presbyterian Church, Jefferson and Marcy avenues, Brooklyn, N. Y.

The Laurel Improvement Company has been granted a franchise by the City Council of Laurel, Miss., for the installation of a new $25,000 light and power plant.

The Tonopah Railroad Company of Tonopah, Nev., has let a contract to install an electric-light system of its own to illuminate the buildings and yards of the company.

The Kirkwood Electric Company, which has just been incorporated with a capital of $12,000, will operate an electric-light, heat and power plant in Kirkwood, Ill. J. F. White, J. F. Taylor and R. M. Houston are the incorporators.

J. C. Foster of Tallahassee, Fla., contemplates erecting and equipping an electric-light, heat and power plant in St. Augustine, Fla., at a total expenditure of $50,000. The proposed power house will be of brick, 100 by 60 feet.

The following-named are among recently incorporated electric-light companies. The capital stock and the name of one incorporator is given: Green Bay Gas and Electric Company, Green Bay, Wis., $750,000, William Mainland; Phœnix Fuel, Light and Power Company, Phœnix, N. Y., $100,000, J. A. Hawley; Henry Electric Light and Power Company, Nokomis, Ill., $20,000, J. H. Crickenberger; Wilmington Electric Light and Power Company, Wilmington, Del., $1,000,000, H. W. Ganse; Paterson Electric Light, Heat and Power Company, Paterson, N. J., $500,000, P. S. Van Kirk; Loveland Citizens' Electric Company, Loveland, Ohio, $100,000, H. C. Hubbell; General Light, Heat and Power Company, Kansas City, Mo., $100,000, Joseph F. Hein.

Sealed proposals will be received until May 20th for furnishing and installing complete an electric-lighting plant at the Washington filtration plant. Specifications and detailed information may be obtained upon application to Lieut. Col. S. S. Leach, U. S. Engineer's office, 1000 Twenty-second Street, Washington, D. C.

Representatives of New York, Chicago and St. Louis capitalists were in Paducah, Ky., a few days ago looking over the prospects for a large electric-light and power plant. It is said they expressed themselves as pleased with the location. If it is decided to build a plant, somewhere between $300,000 and $500,000 will probably be expended on it.

The City Council of Covington, Ga., has approved the proposition of the White Shoals Power Company to supply electricity for lighting the municipality, the terms including the loan of $45,000 in city bonds. An election will be called to vote on this bond issue. The White Shoals Power Company will have a capital stock of $150,000, and intends to develop waterpower on the Alcovey River, 10 miles southeast of Covington.

The Wisconsin Light and Power Company of La Crosse, Wis., has placed orders with the Westinghouse companies covering the entire equipment of a large light and power plant. Besides two alternating-current generators with an output of 400 kilowatts each, which will be driven by steam turbines, there are three vertical steam engines, one of which will be connected to a 25-kilowatt direct-current generator. In addition, there will be installed two motor-generator sets, each consisting of a 7½-kilowatt direct-current generator and a 15-horsepower induction motor, three 10-kilowatt and three 15-kilowatt transformers, one 6,600-volt 10-panel switchboard and one 220-volt arc-lamp panel, 15 low-equivalent lightning arresters and choke coils, and 25,000 incandescent lamps with Edison bases.

## ELECTRIC RAILWAYS.

The St. Paul council has granted the Twin City Rapid Transit Company a franchise for its proposed line to South St. Paul.

The receivership over the St. Louis, St. Charles and Western electric-railway line has been terminated and the property turned over to the stockholders. The receiver was R. W. Bailey of East St. Louis.

The Cincinnati, Milford and Loveland Traction Company will add to its equipment five complete car equipments, each consisting of four-50-horsepower 500-volt Bullock motors for double-end-control street cars, together with other auxiliary apparatus.

San Francisco's Board of Supervisors has passed an ordinance authorizing steps to convert the Geary Street railroad into a municipal electric line. The franchise of this line has elapsed and it is only necessary for the city to appropriate the money to take over the road.

The first steam turbine for street-railway service in the East has been installed at the South Framingham power station of the Boston and Worcester Street Railway Company. It was put in operation for the main-line service on April 23d. It has a capacity of 2,000 kilowatts, with a 50-per cent. overload.

The Chicago and Milwaukee Electric Railroad Company plans to extend its western branch, which now ends at Rockefeller, through Wauconda, McHenry and Woodstock to Belvidere, Ill. There it will connect with the Rockford interurban line. Surveys are already being made west from Wauconda.

The York County Traction Company will begin the construction of the Long Level extension within the next 30 days. A survey for the new line has been completed from Windsorville to Bittersville, and engineers have commenced driving stakes for the proposed route from Bittersville to the river.

South Water Street commission merchants in Chicago are receiving many consignments of berries and vegetables from country shippers over the interurban electric railways. Members of the commission drivers' union say that the suburban electric companies will take from the old express companies much of the business which they have always handled.

Perhaps the most important transaction in the business history of Bloomington, says the Champaign (Ill.) News, has been completed in the sale of the plant of the Consumers' Light, Power and Heating Company to the Illinois traction system, popularly known as the McKinley syndicate, which is to build interurban lines from Bloomington to Peoria and Champaign and from Decatur to Chicago through Bloomington.

The properties and surveys of the Eldon and St. Louis railroad, which was projected three years ago by J. E. Houghland of Eldon, Iowa, have been sold to Chicago men, who propose to build an electric railway over the route which extends through Central Missouri, north and south from Jefferson City, through Mexico and north to Eldon, Iowa, thence to Ottumwa, traversing in Missouri almost a direct north and south line.

The Queen City Electric Light and Power Company has been deeded to the Clarksville (Tenn.) Street Railway Company. The consolidated company proposes to issue bonds to pay all debts, improve the present systems and extend the street-car line and electric lights to New Providence, and also to Dunbar's Cave and Guthrie, Ky. Purchasers have been found for the bonds, and the proposed improvements will begin in a short time.

Stone & Webster of Boston are reported as having acquired control of the Galveston (Texas) street-railway system and will shortly take it over. The syndicate now controls the systems at Houston, San Antonio, El Paso, Waco, Beaumont and Dallas. It is the intention, it is said, to connect some of these systems with interurban lines and ultimately to put in a system of trolley cars covering a large part of the eastern half of Texas.

An opinion that the recent purchase by the New York, New Haven and Hartford railroad of street-railway companies in Massachusetts was illegal under the revised laws was sent to the Massachusetts Legislature by Attorney General Herbert Parker on May 1st. The opinion was asked recently in connection with a pending bill relative to the rights of steam railroads to purchase the stock of street railways, as petitioned for by the Boston and Maine railroad.

## PUBLICATIONS.

Those who have to contend with hard water in the operation of their boiler plants will be interested in the pamphlet published by the Booth Water Softening Company of New York city, entitled "Hard Water Made Soft," which presents a concise description of the various types of machines built by the company for the purpose of softening water. Much time and thought have been devoted to the preparation of the subject matter, which will be found of value to engineers and chemists.

Two catalogues of interest come from the Kinsman Block System Company of New York city. The Kinsman block-system apparatus is an equipment of the tracks and locomotives or cars of railroads for the automatic control and stoppage of trains in motion. The details of the apparatus as used in connection with electrically propelled trains on the Boston Elevated and as adopted for use in the Interborough Rapid Transit Tunnel in New York city are well known. The catalogues contain a thorough description of the system.

A very neat booklet from the Holophane Glass Company, New York, which is the fourth of a series of booklets on scientific lighting, is entitled "The Lighting of Hotels and Clubs." The booklet clearly points out the essential features in properly lighting all parts of the modern hotel and gives many valuable hints. Half-tones illustrate clubs, parlors, dining rooms, etc., which are considered properly lighted. The company states that its engineering staff will be pleased to receive blue prints, plans, etc., for the design of a proper scheme of illumination, whether the customer decides to use the Holophane system or not.

## SOCIETIES AND SCHOOLS.

Arrangements are being rapidly perfected for the joint convention of the Southern Hardware Jobbers' Association and the American Hardware Manufacturers' Association, which will be held at Hot Springs, Va., on the 6th to 9th of June. Secretary-treasurer C. B. Carter of Knoxville, Tenn., advises those who are going to attend the conventions and who have not already notified him, to do so at once.

Electrical engineering is given the prominence it deserves in the curriculum of the Michigan College of Mines at Houghton. This college held its class-day exercises on May 5th and the principal address was delivered by William G. Mather of Cleveland. There are 200 students, and in its 18 years' career the college has given degrees to 285 men, many of whom occupy high positions in their profession.

At a meeting of the alumni of the Massachusetts Institute of Technology in Boston on May 4th to discuss the proposed merger of the Institute with Harvard University, the discussion developed an overwhelming sentiment against the merger, although no vote was taken. The plan was advocated by President Pritchett, Eben S. Draper of Hopedale and J. R. Freeman. The speakers in opposition were Thomas L. Livermore, Dean A. E. Burton and J. S. Munroe. The faculty and executive committee of the school are said to be equally divided as to the wisdom of the merger.

## TELEGRAPH.

In a statement of its condition on December 31, 1904, filed with the Massachusetts commissioner of corporations, the Commercial Cable Company values its cables, land lines, etc., at $19,124,084. The total assets are $48,300,000, and the surplus and reserve funds are given as $11,666,169.

In the fourth annual report of the directors of the Philadelphia Bourse, submitted to the shareholders at the meeting held on May 9th, it is stated that a new time ball had been installed for the Bourse by the hydrographic office of the Navy Department. The outfit is of the latest type and compares favorably with those operated in other parts of the country.

## TRADE NEWS.

The Orrison-McMurtrey Company will engage in the electrical supply business in Walla Walla, Wash.

It is stated on excellent authority that the General Electric Company has become interested in incandescent-lamp manufacture in Japan.

The Chromatic Sign Company of Chicago, which has for its object the manufacture of electric-lighting appliances and signs, has been incorporated by G. E. Deming, R. J. Frank and F. P. Young. The capital is $12,000.

C. N. Michels, J. R. Oliver and W. C. Wieland have incorporated as the C. N. Michels Company, Chicago, and will deal in electrical supplies, automobiles, hardware and machinery. The company's capital is $30,000.

As the name of the old Rialto Building has been changed to Postal Telegraph Building, the home office of the Dearborn Drug and Chemical Works should now be addressed at 227-234 Postal Telegraph Building, Chicago.

The business of the Ashtabula (Ohio) Electrical Supply and Construction Company, of which F. Graves had been manager for several years, was sold recently to Burt L. Holme, who took possession, and will hereafter give the business his personal attention.

Schedules showing the liabilities and property belonging to the Barrett Electric Company of Cincinnati show that the liabilities are $15,851 and the assets $8,607. The assets include machinery and stock on hand valued at $5,442 and uncollected accounts amounting to $3,041.

The Electric Appliance Company is now located in its new Chicago building at 134 to 140 West Jackson Boulevard. The building is, the company says, the largest warehouse in the world devoted exclusively to electrical supplies. It gives added facilities for the prompt handling of increasing business.

Among the American firms which have engaged space at the international electric-tramway and railway exhibition, to be held in the Royal Agricultural Hall, London, on July 3d to 14th, are J. A. Roebling's Sons Company, United States Metallic Supply Company, Western Electric Company, Babcock and Wilcox, Blackwell & Co., Griffin Car Wheel Company, W. H. Coe Manufacturing Company, W. S. Laycock, Lorain Steel Company, Mountain & Gibson, Peckham Manufacturing Company, G. D. Peters & Co., Standard Varnish Company, Sturtevant Engineering Company and the Wallace Supply Company.

Speaking of the reported forming of a $50,000,000 combination of street-car builders, G. C. Kuhlman, former owner of the street-car manufacturing plant in Cleveland, does not believe it possible for the manufacturers to combine successfully, according to an interview printed a few days ago. Mr. Kuhlman said that he went all over the subject three years ago, and could see no advantage in it. At that time the plans fell through for that reason. On the other hand, George J. Kobusch, president of the St. Louis Car Company, is reported to have confirmed the statement that the deal was pending, but further than this would not discuss the matter.

[illegible] Navy Department [illegible] bids for furnishing an electric traveling crane. Intending bidders should call for schedule 245, which can be obtained at the navy pay office in New York or of the bureau.

## BUSINESS.

[illegible] sending out a card announcing their "silver" anniversary in the pole, post and tie business. The firm assures its customers prompt shipment from a well-assorted stock [illegible]

A. O. Garrison, president of the Columbia Incandescent Lamp Company, St. Louis, visited Chicago last week. Mr. Garrison's able administration of the affairs of the Columbia company has made the Columbia lamp more popular than ever, and the demand for it seems to be ever on the increase.

The Central Electric Company of Chicago is distributing a quantity of literature on fan motors, both direct and alternating current. The company, as general western agent for Diehl direct-current fan motors, carries in Chicago stock a large assortment of both desk and ceiling fans. In addition to this, it states that it is prepared to furnish General Electric and Westinghouse fan motors. The company will willingly furnish catalogues and quotations and will appreciate all inquiries on this subject.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued (United States Patent Office) May 2, 1905.*

788,506. Apparatus for Agitating the Contents of Electrolytic Cells. Edgar A. Ashcroft, Weston, via Runcorn, England. Application filed November 16, 1903.

A cell containing a fused electrolyte contains also a fused electrode beneath the electrolyte. Means for passing an electrolytic current through the cell in a radial direction are provided and an electromagnet is placed beneath the center of the cell to cause rotation of the contents.

788,513. Railway-signal System. Abram L. Bower, Boyertown, Pa. Application filed May 3, 1902.

Combined with a block system are signal rails arranged adjacent each end of a block and between track rails on opposite sides of the track. Batteries are arranged in each block and have their poles connected to opposite rails of a track, a connecting wire leading around each signal rail. Signal devices are arranged on the engine and in circuit with the track rails, the batteries and relays in circuit with the rails being adapted to control the display of the signals as the train passes over the signal rails.

788,518. Switch and Connection-controlling Electric Motors and Power Transmitters. Herbert B. Coho, Mount Vernon, N. Y., assignor of one-half to the Wheeler & Wilson Manufacturing Company and the Emerson Electric Manufacturing Company, St. Louis, Mo. Application filed September 17, 1903.

A type of motor-operated switch is described in which the motor acts to open or close the switch through the agency of a wheel mounted upon its shaft and a system of switch-operating levers.

788,526. Electric Trolley Wheel. Theophile Euphrat, Norwalk, Conn. Application filed August 25, 1904.

Associated with the trolley wheel is a normal grooved wheel having lateral perforations of the sides of the grooved part communicating with the groove. Latterly adjustable cutter-carrying disks, one on each side of the wheel, arranged with cutters entering the perforations, and means for setting the cutters inward for operative effect on the trolley wire and for retiring them for non-action are provided.

788,536. Pneumatic Railway Signaling System and Electropneumatic Valve Therefor. Ernest C. Irving, Westminster, England, assignor of one-half to John Patrick O'Donnell, Westminster, England. Application filed March 14, 1903.

Inlet and outlet ports in an electropneumatic valve mechanism for railway signaling are controlled by valves which are operated by the armature of an electromagnet according as the armature is attracted or released, the current through the magnet being controllable from a distance. (See cut on next page.)

788,540. Electric-light Bath Cabinet. Richard Kny, Brooklyn, N. Y. Application filed January 3, 1905.

A light-bath cabinet comprises separable bottom, top and side sections, one of the latter being provided with a closable aperture. Electric-lights of different colors are removably hung in the interior of the cabinet.

788,557. Electrical Ozonizer. Carl A. Sahlström, Ottawa, Canada. Application filed June 21, 1904.

Embodied in the ozonizer are a dielectric and a positive electrode held in resilient contact with the dieletric and consisting of a flexible sheet of metal having a number of tongues downwardly stamped out from the material. A negative electrode in contact with the inside of the cylinder consists of a sheet of wire netting and means for passing an electrical current from one electrode through the dielectric to the other electrode.

788,562. Electrical Railway Signal. James W. Tatum, Durham, N. C., assignor of one-half to Robert B. Boone and John W. Smith, Durham, N. C. Application filed October 19, 1903.

Duplicate electrical annunciating devices are arranged in the engine cab and wired to the engine-wheel axle and to a battery, while a pair of overhead trolley wires are arranged in blocks or sections. Insulated wire sections of the trolleys have their separating insulation pieces alternating each other. Trolley poles equipped with conductors connect with the electrical annunciating devices in the engine cab, whereby a single signal may be produced in each of two engine cabs when one trolley pole of each cab engages a common trolley wire section. A second signal may be likewise produced when the other trolley poles engage a common section of the other trolley wire.

788,563. Means for Establishing Electric Circuits. Guion Thompson, Duluth, Minn., assignor to the Thompson Safety Appliance Company. Application filed July 1, 1902.

Details are described.

788,566. Electric Motor and Power Transmitter. Orville R. Van Vechten, New York, N. Y., assignor to Herbert B. Coho, Mount Vernon, N. Y., the Wheeler & Wilson Manufacturing Company and the Emerson Electric Manufacturing Company, St. Louis, Mo. Application filed September 17, 1903.

The adaptation of a small electric motor to the driving of a sewing machine is described.

788,631. Manufacture of Chlorates and Perchlorates. Marcel Couleru, Geneva, Switzerland. Application filed November 12, 1904.

The method of simultaneously producing chlorates and acid peroxide consists in electrolyzing a chloride solution, neutralizing the formed alkali by the addition of chloride of lead and transforming the hydroxide of lead into peroxide of lead.

788,686. Resistance for Electrical Circuits. Hermon L. Van Valkenburg, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed August 6, 1904.

Combined with a frame or casing are a number of resistance elements each comprising a rod or bar. A sheath or covering of insulating, heat-resisting material is provided for the resistance rods, while a resistance coil surrounds the sheath.

788,704. Electric Striking Clock. Ulysses L. Collins, St. Louis, Mo., assignor to the Collins Electric Clock Company, St. Louis, Mo. Application filed February 23, 1904.

In an electric striking clock are an armature supporting shaft, an armature fixed upon the shaft, an electromagnet in position to operate the armature, a spring for moving the armature away from the magnet, means for locking the armature against the magnet, a suitable clock mechanism, and a connection with the clock mechanism, whereby the armature is unlocked.

788,728. Apparatus for Electromagnetically Receiving, Recording, Reproducing and Distributing Articulate Speech, etc. Valdemar Poulsen, Copenhagen, Denmark. Application filed August 14, 1901.

Magnetically recording speech or other signals represented by electrical impulses is accomplished by a device consisting of an endless band or wire of steel or other paramagnetic material and an electromagnet through which such impulses flow. A second electromagnet is provided in which the impulses are reproduced and a third magnet of constant strength adapted to uniformly magnetize the band or wire. (See cut on next page.)

788,732. Electric Sparking Igniter for Gas or Gasoline Engines. Joseph P. Seaton, North Birmingham, Ala. Application filed September 10, 1903.

An insulating plug is provided on its inner end with a shaft head carrying an ignition point.

788,747. Electric Display Apparatus. Edmund L. Zalinski, New York, N. Y. Application filed October 6, 1904.

In an electric display apparatus is a letter or other design outlined by electric lamps showing inside view, in combination with a base composed of divergent lamp sockets with suitable electric connections.

788,762. Electromagnetic Device. Albert Favarger, Neuchâtel, Switzerland. Application filed November 25, 1902.

Electromagnet mechanism for producing a rotary movement by means of alternating currents comprise a polarized armature in the form of a toothed dissymmetrical wheel and an electromagnet provided with pole pieces having positions which differ among themselves by one-half division of tooth with regard to the set of teeth of the wheel. By this means under the effect of the alternating current the pole pieces may cause the wheel to turn always in the same direction, by intermissions of one-half division of tooth after the magnetic alternating attractions and repulsions.

788,792. Clock-synchronizing System. Harry W. Pidgeon, Chicago, Ill., assignor to the American Clock Company, Chicago, Ill. Application filed July 29, 1904.

Combined with a master clock are two pairs of electrical contact devices carried thereby, one pair effecting a time contact and the other pair an instantaneous contact.

788,800. Telegraphy and Telegraph Apparatus. Wesley Trafford, New York, N. Y. Application filed March 15, 1897.

The principal features of the invention are a printing-telegraph receiver having a rotary type wheel and means for positioning the type wheel according to the impulses sent by the transmitter. The transmitter for sending successive impulses to the receiver is controlled for the sending of such impulses by the movement of a member of the receiver.

788,819. Electric Motor-starting and Stopping Device. John H. B. Bryan, Buffalo, N. Y. Application filed March 14, 1904.

An induction motor has its armature provided with a resistance and a switch is provided for controlling the resistance rotating with the armature. A piston connected with the switch compels it to move axially together but permits the switch to rotate with the armature independently of the piston.

788,868. Sparker for Explosive Engines. George A. West, Buffalo, N. Y., assignor of one-half to Austin M. West, Buffalo, N. Y. Application filed November 13, 1903.

A cylinder having one end in communication with the explosion chamber of the engine contains a piston disposed in the cylinder. An electrode is carried by the piston, and a second electrode is movable transversely of the first and adapted to be engaged and moved thereby as the piston is reciprocated. The electrodes have rounded or cam-shaped contact faces to permit the wiping of one past the other.

788,871. Automatic Stopping Device for Engines or the Like. Daniel B. Adams, Summitville, N. Y. Application filed August 29, 1902.

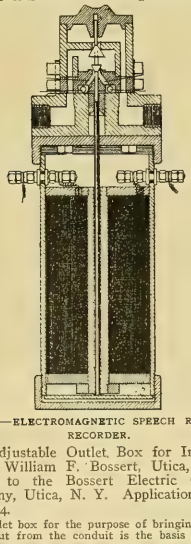
In a stopping device for engines there is combined with the engine cylinder electrical igniting means therefor. A thermostat, located in proximity to the cylinder, controlls the igniter circuit and is arranged to interrupt it when the temperature of the cylinder exceeds a predetermined degree. (See cut.)

788,872. Automatic Electric-light Connection for Automatic Railway Block Signals. William Alloway, Caledonia, N. Y. Application filed March 22, 1904.

In an automatic railway block signal are a track battery and a relay. Incandescent lamps are attached to the signal posts, the signal blades having a lens movable in the path of the incandescent lights. A lamp battery and wires leading from the battery through the post to the lamps and connected to the relay are the remaining parts.

788,875. Electrical Stop Mechanism for Looms. Frederick M. Armstrong, Pawtucket, R. I., assignor to the Kip-Armstrong Company. Application filed July 26, 1902.

Electric stop mechanism for looms embodies an electric circuit including a generator, a portion of which circuit is composed of the metal of the loom frame. The circuit has in it a normally open break and a magnet adapted to be energized by the circuit to operate loom-controlling devices. Devices adapted to close the normally open break are provided, and a switch insulated from the loom frame breaks the circuit a moment after the normally open break has been closed, that part of the circuit between the switch and the normally open break in the circuit being insulated from the loom frame and containing the coils of the electromagnet.



NO. 788,728.—ELECTROMAGNETIC SPEECH RECEIVER AND RECORDER.

788,880. Adjustable Outlet Box for Interior Conduits. William F. Bossert, Utica, N. Y., assignor to the Bossert Electric Construction Company, Utica, N. Y. Application filed April 26, 1904.

An outlet box for the purpose of bringing electric conductors out from the conduit is the basis of the patent.

788,905. Electric Heater. Harry M. Hill, St. Louis, Mo., assignor to the Hill Electric Manufacturing Company, St. Louis, Mo. Application filed April 25, 1904.

An electric heater comprises a manifold, and tubes communicating with the manifold at its respective ends, two heating electrodes being placed within the manifold A circulation of water in the intervening space formed between the two electrodes is maintained for heating of cars and the like.

788,916. Electrical Switch Mechanism. Hubert Krantz, New York, N. Y. Application filed December 6, 1904.

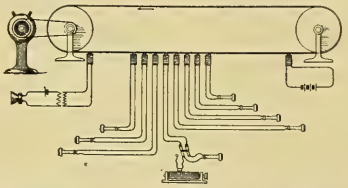
Electrical switch mechanism contains bus bars, with a crossbar formed from a substantially rectangular flat blank. The blank is slit to provide a tongue, the tongue being bent in one direction from the plane of the blank. A portion of the blank, constituting the crossbar proper, is bent in the opposite direction, the tongue adapted to make electrical connection with a bus bar and support the crossbar edgewise to the bus bars.

788,917. Electrical Device. Hubert Krantz, New York, N. Y. Application filed December 6, 1904.

In electrical switch mechanism are a metallic device having a base, a connection plate above the base, and an upright switch contact blade, all in one piece.

788,924. Telephone Switchboard Annunciator. Charles T. Mason, Sumter, S. C., assignor to the Sumter Telephone Manufacturing Company, Sumter, S. C. Application filed June 10, 1904.

A switchboard annunciator combines a pivoted signal drop and plug, and a drop-restoring ball between and independent of the parts and adapted to have direct-pressure contact with both.



NO. 788,536.—ELECTROPNEUMATIC SIGNALLING DEVICE.

788,959. Electric Circuit and Apparatus for Railway Signaling. Henry W. Spang, New York, N. Y., assignor to Charles H. Ketchum, Yonkers, N. Y. Application filed August 21, 1902.

Embodied in an electric railway-signal apparatus are a normally closed guard circuit, normally charged, a signal-controlling magnet in the circuit, but normally inoperative, a resistance in the circuit, a track circuit closer for completing a normally open connection of the electromagnet before reaching the section of track embraced in the guard circuit and connections for simultaneously removing the resistance from the circuit.

788,990. System of Electric Car Lighting. Richard D. Apperson and Albert J. Kohler, Lynchburg, Va. Application filed March 24, 1904.

For electric car lighting there are in the system a number of lighting circuits, and terminals in the circuits. A self-adjustable contact shoe is mounted upon the trolley-pole support in position to make the connection between a predetermined pair of the terminals.

789,014. Trolley. Charles M. Feist, Sioux City, Iowa. Application filed August 24, 1904.

The trolley axle has a slot, and a segmental plate constitutes a contact-shoe in the slot. A wheel is rotative on the axle and surrounds the plate, a coiled spring in the axle, bearing at its outer end against the plate. A fixed bearing is placed in the axle for the inner end of the spring.

789,030. Electric Signal System. Robert O. Johnston, Brooklyn, N. Y. Application filed March 30, 1904.

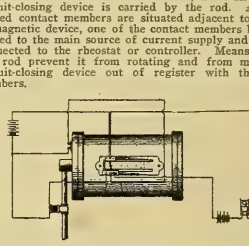
A series of circuit closers are spaced along the track, a series of electromagnets corresponding to the circuit closers being in circuit therewith. An index is movable from one to another of the electromagnets successively as they are successively energized. Means including a lever operates a semaphore and an electrically operated lock for the lever is in circuit with the source of electricity and with all of the circuit closers.

789,040. Electrotherapeutic Apparatus. Charles F. Marsh, Pensacola, Fla. Application filed December 3, 1903.

An electrotherapeutic apparatus combines a static machine, a resonator, conductors between the accumulators of the machine and opposite sides of the center of the resonator coil and electrodes connected to the terminals of the coil.

789,082. Safety Device for Electric Currents. McKelvey Crites, Cleveland, Ohio, assignor of two-thirds to William S. Rogers and Oscar Textor, Cleveland, Ohio. Application filed September 22, 1904.

An electromagnetic device has a movable member and a rod attached to the movable member, while an elongated circuit-closing device is carried by the rod. A pair of spaced contact members are situated adjacent to the electromagnetic device, one of the contact members being connected to the main source of current supply and the other connected to the rheostat or controller. Means engaging the rod prevent it from rotating and from moving the circuit-closing device out of register with the contact members.



NO. 788,871.—AUTOMATIC ENGINE STOP.

789,083. Safety Device for Electric Currents. McKelvey Crites, Cleveland, Ohio, assignor of two-thirds to William S. Rogers and Oscar Textor, Cleveland, Ohio. Application filed December 27, 1904.

A rheostat or controller is described, having an electromagnetic device adapted when energized to hold the switch lever in full current position, with means for moving the lever to its initial position when the device is de-energized.

789,087. Art of Electrical-wave Transmission. Cornelius D. Ehret, Washington, D. C. Application filed December 3, 1901.

A method of transmitting signals consists in impressing an alternating or fluctuating current upon a circuit, modifying the current to form a signal, permitting leakage of the current, reinforcing the current, and passing the modified current through a receiver to reproduce the signal.

789,124. Electrical-wave Transmission. Cornelius D. Ehret, Rosemont, Pa. Original application filed December 3, 1901. Divided and this application filed June 12, 1902.

In a telephone system are means for impressing upon a circuit an alternating or fluctuating current, a transmitter for modifying the current by and in accordance with speech, means permitting leakage of the current, means for reinforcing the current, and a receiver for reproducing speech.

## EXPIRING PATENTS.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on May 8, 1905:

382,299. Electric Railway Signal. B. H. Gedge, Covington, Ky.
382,332. Switch for Electric Circuits. C. C. Stirling, Hartford, Conn.
382,335. Alternating-current Dynamo-electric Machine. E. Thomson, Lynn, Mass.
382,336. Alternating-current Regulator. E. Thomson, Lynn, Mass.
382,358. Plate for Storage Batteries. C. D. P. Gibson, New York, N. Y.
382,415. System of Electrical Distribution. T. A. Edison, Llewellyn Park, N. J.
382,420. Secondary Battery. L. Epstein, Martinkenfelde, near Berlin, Germany.
382,421. Electric Arc Lamp. R. E. Fenner, Chicago, Ill.
382,439. Electric Burglar Alarm. H. C. Roome, Jersey City, N. J.
382,444. Electric Burglar Alarm. G. F. Taft, Boston, Mass.
382,461. Telephone System. R. N. Dyer, New York, N. Y.
382,474, 382,475, 382,476, 382,477. Multiple Switchboard. M. G. Kellogg, Hyde Park, Ill.
382,483. Electric Motor for Railway Cars. William M. McDougal, East Orange, N. J.
382,515. Electric Railway Signal. C. F. de Redon, New York, N. Y.
382,560. Electric-lamp Filament. C. Seel, Berlin, Germany.
382,589. Electric Motor. G. F Card, Covington, Ky.
382,593. Electric Stop Motion for Knitting Machines. C. Draper, Springfield, Mass.
382,599. Automatic Switch for Secondary Batteries. C. A. Faure, New York, N. Y.
382,625. Automatic Electrical Switch. F. Stitzel, Louisville, Ky.

## SPECIAL MENTION.

"What do you get when you ask for a Paiste socket?" asks the H. T. Paiste Company of Philadelphia. "Something more than a mere 'socket.' You get the product of more thought, more attention to details, more testing of brass and phosphor-bronze than you ever thought possible. You get a perfect-working, smooth-running, everlasting, attractive-looking socket that keeps both you and your customers thoroughly pleased."

The Tuolumne Electric Company of San Jose, Cal., has ordered from the Allis-Chalmers Company one 600-kilowatt alternating-current generator, two 35-kilowatt generators and three 200-kilowatt transformers to be installed on the Tuolumne River, where a new hydro-electric power plant is nearly completed. The current to be developed will be used both for lighting and power, principally in neighboring mines, and an extension to the present plant will probably be made later on.

Users of electrical supplies will be interested in the announcement of the Chicago House Wrecking Company, which has placed on the market all the electrical material secured through its purchase of the St. Louis World's Fair. The company says that it has 200,000 incandescent lamps, used only a short time, as well as 150,000 new incandescent lamps and 20,000 colored lamps, which it is prepared to sell cheaply. The company is also able to furnish 100,000 feet of wooden conduit, as well as miscellaneous electrical material.

"Through to the East on the Keystone Express" implies a solid train of sleeping cars and vestibuled coaches from Chicago to New York over the Pennsylvania lines—Pan Handle Route, the low-rate-fare route. This train leaves Chicago daily at 10:05 a. m., arriving in New York at three p. m. on the next day. For information about going via Washington to Philadelphia and New York at the same fares as by direct route travelers are requested to inquire of C. L. Kimball, assistant general passenger agent, No. 2 Sherman Street, Chicago.

The metaphone, which is offered to the trade by Anderson & Nachman, 356 Dearborn Street, Chicago, is made for all interior installations where communication from one floor or office to another is essential. A bell installation is all that is necessary for the metaphone, and connecting one instrument to the push button and the other to the bell will give satisfactory results. The instrument itself comprises a transmitter and receiver on opposite ends of a handle, by means of which the receiver is held to the ear, the transmitter then being in a position near the mouth and ready for talking.

Activity in the application of motors to cranes, hoists and machine tools of every description is reported by the Westinghouse Electric and Manufacturing Company as indicated by several orders entered recently as follows: The Morgan Engineering Company of Alliance, Ohio, eight railway-type crane motors with a total of 250 horsepower; the Pond Machine Tool Company of Plainfield, N. J., 28 type C induction motors; Niles Tool Works, Cincinnati, Ohio, five type S direct-current motors; the Long & Allstatter Company of Hamilton, Ohio, 13 type S motors; the Delaware, Lackawanna and Western Railway, 20 type CC induction motors; the U. S. Hoe and Tool Company of Columbus, Ohio, eight type S motors; the Austin Powder Company, 10 type C induction motors.

# WESTERN ELECTRICIAN

EVERY SATURDAY

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## Late Developments in Italian Electric Railways.

By Frank C. Perkins

While Italy has an abundance of waterpower which is being utilized for generating current for lighting, power and railway purposes, still there are a number of electric railway systems in various cities which are operated by steam. This is true in spite of the fact that coal is high in price, and largely has to be imported from England. There is a large number of extensive railway systems throughout the country which are of great value to its inhabitants, who are engaged in agricultural pursuits probably to a much greater extent than in commercial work. It is stated that the government has pursued a liberal policy toward the changing of the steam railways to electrically operated roads, and also toward the development of the immense waterpower available in the mountains of Italy. On the street-railway and suburban lines steam railroads of Italy will be operated [illegible]. In Palermo there are 31 miles of urban track operated by the Societa Tramway Elettrici, and an extensive interurban railway connects Palermo with Rocca and Monreale, which is of more than passing interest.

Palermo central station is equipped with three 550-horsepower horizontal tandem-compound engines of the condensing type operating at a steam pressure of nine atmospheres with a speed of 115 revolutions per minute. Each of these engines is directly connected to a 330-kilowatt multipolar railway direct-current generator supplying current to the railway feeders at a pressure of 600 volts. The electrical equipment was installed by the Elektricitäts Actien Gesellschaft. Figs. 3 and 4 represent, respectively, a map of the lines and an example of track construction of the Palermo-Rocca-Monreale system. On the map the solid lines represent the actual roads and the dotted lines those contemplated. An electric locomotive is used on the high-grade [illegible] traffic, with express trains, local passenger trains and freight trains running on regular schedules, the time tables being prepared for high-speed service for the express passenger trains. Nearly 70 miles of railway north of Lecco are operated by electrical energy generated by the utilization of the waterpowers in the vicinity of [illegible].

This line may well be considered as one in which electric motive power has entered the field of steam-railway practice, as the road is 116 miles long, and the trains, both freight and passenger, consist of locomotive and a number of cars, making a speed of 30 to 60 kilometers per hour. The freight trains have a capacity of about 200 tons

FIG. 1. LATE DEVELOPMENTS IN ITALIAN ELECTRIC RAILWAYS.—LATEST TYPE OF ELECTRIC LOCOMOTIVE ON VALTELLINA LINES.

entering Naples at Aversa, Porte de Naples, and Casoria, as well as Capodichino, Afragola (Fig. 2) and Place Belvedere the underrunning trolley is utilized similar to American railways, with the single pole, although the cars, it will be noted, are constructed on somewhat different lines.

The trains of the Naples suburban electric railways are usually made up of one motor car or electric locomotive and two trailers. The power house of the electric railways of Naples is constructed of brick and stone and is equipped with direct and alternating-current apparatus. There are three horizontal tandem-compound engines, each directly connected to electric generators, additional flywheels being provided for aiding the regulation at full load and no load. The units include a six-pole direct-current generator and two alternators of the revolving-field type. The engine and generator room is served by an overhead traveling crane of 10,000 kilograms capacity.

The suburban traffic on the electric railways, as well as the longer electric lines operated by waterpower, are competing successfully in the steam-railway field, and there is little question but that within a decade a large proportion of the present section of this line, with rope haulage. The locomotive operates on a narrow gauge between the tracks of the standard line, and is disconnected from the regular trolley cars at the top and bottom of the incline, and disappears in a pit below the level of the standard track. Nearly 100 cars are employed, two motors being connected to the trucks of each car. The total length of the tracks of the Palermo system is 32 kilometers, the grade being about 12 per cent. on that section using rope haulage with the narrow-gauge locomotive, which weighs 7.9 tons.

The Valtellina line in Italy is one of the newer electric railways now in operation. It utilizes a polyphase current of 3,000 volts upon the overhead-trolley lines and 20,000 volts from the power station to the sub-stations along the electric railroad. Both freight and passenger trains run regularly now upon the Valtellina lines between Lecco, Sondrio, Colico and Chiavenna by electric energy generated at a waterpower plant at Morbegno, about 15 kilometers from Colico.

In the Valtellina region, as well as that bordering on Lake Como, there is a large freight traffic, and the electric railway installed was required to and are handled by electric locomotives, the speed being 15 to 30 kilometers per hour, according to the grades, which are exceedingly steep in many places.

The railway is divided into sections about 10 kilometers long, and each section is supplied from a sub-station which receives the current from the power house at 20,000 volts and, by step-up transformers, the current is reduced in pressure to 3,000 volts for use upon the trolley wires. This division into sections gives great safety in working, for when a block signal indicates "stop" the next part of the line is not supplied with current from the sub-station next beyond it. The electric locomotives are also arranged so that in case of an interruption of current the Westinghouse brakes are applied automatically, bringing the train to a stop without any action on the part of the operator.

There are two trolley wires, spaced about a yard apart, and the rails act as a common return for the polyphase alternating current used.

The power plant is located at Morbegno. There are four 2,000-horsepower turbines directly connected to polyphase alternators generating a 20,000-

volt three-phase current directly in the windings of the armature, thus doing away with the necessity of using step-up transformers for the high-tension transmission line.

Three of these alternators were constructed by the Elektricitäts Actien Gesellschaft, and the turbines were supplied by Ganz & Co. of Budapest. The alternators have a frequency of 15 cycles a second, and each has a capacity of 1,500 kilowatts as a maximum and a normal output of 1,050 kilowatts.

The Schuckert 20,000-volt alternators are each

FIG. 2. TYPE OF ELECTRIC CAR USED ON AFRAGOLA RAILWAY IN ITALY.

equipped with a safety governor, which automatically introduces a high resistance into the field circuit in case the turbine governor ceases to act for any reason, and the speed of the generator exceeds 170 revolutions per minute, although these dynamos are tested to run at a 50 per cent. increase of voltage without injury, which would equal 30,000 volts.

On account of the high-tension alternating current used on all the cars the metal on the cars, including the metal roof, is carefully grounded to provide perfect safety for the passengers and employes, and all the electrical apparatus is entirely metal clad. The cables for conducting the current from the trolley poles to the motors on the cars are rubber covered and highly insulated, supported in cylindrical porcelain insulators placed every 10 centimeters inside of brass tubes, which are carefully connected metallically to the wheels and the roof to insure immediate blowing of fuses in case of leakage.

The district served by the high-tension three-phase Valtellina line is essentially a manufacturing one, although there is a very large tourist element, and during the summer months this is an important feature. The total passenger traffic during this season furnishes nearly two-thirds of the revenues, a large proportion being tourists and first-class travelers.

Fig. 1 illustrates one of the latest 1905 Ganz locomotives hauling a train of express and passenger coaches on the Valtellina line. Locomotives of this type haul passenger trains of 250 tons and freight trains of 400 tons. These locomotives are controlled entirely by compressed air carried in tanks on top of the car and kept charged by electrically operated compressors. A diagram of the pneumatic arrangement is shown in Fig. 5. The trolley poles are also controlled in the same manner as the electric switches, being drawn down and raised into contact with the overhead high-tension conductors by means of compressed air.

There are a number of first-class motor cars for hauling local trains and for express service on the Valtellina lines, each of which is more than 60 feet long and weighs more than 50 tons. The Ganz polyphase four-wheel motor trucks are mounted about 36 feet apart and the motors have a special coupling device and special electrical connections. The cars are heated, lighted and ventilated by electric energy and the stations are also lighted from the power-service wires, although the low frequency of 15 cycles per second would make a poor flickering light were it not for the fact that three filament lamps are employed which overcomes this trouble to a large extent, while ground-glass globes also help to maintain a more uniform light. The storage-battery current may be employed where a perfectly steady light is desired. As will be noted from Fig. 1, the current for the locomotives is taken from the 3,000-volt trolley wires by rollers having ends of truncated cones, the cylindrical part being about 1.5 feet long. The rollers are constructed of aluminum and are mounted on insulated shafts, ball bearings being used, as the rollers have speed of several hundred turns a minute, being only about three inches in diameter.

A cast-iron base is placed on the top of the motor cars and electric locomotives, which carries a frame supporting the trolley, roller poles and a system of springs, as well as the pneumatic controlling apparatus, which is supplied with compressed air from the electric compressor driven by a 100-volt three-phase five-horsepower motor.

Another and special form of double trolley has also been used for taking the current at 3,000 volts from the overhead conductors. This consists of two copper rollers separated by an insulating block of wood, and the rollers make contact with carbon brushes connected with the flexible cables leading directly to the motor primary windings.

Both the electric locomotives and the motor cars have two double trolleys, one at each end; in the latter the distance between the trolleys is 12 meters, so that the dead sections are always bridged, as they are never more than seven meters in length.

From the trolleys the three-phase 3,000-volt current is conducted through well-insulated cables within metallic pipes which are grounded to the stator windings of the main induction motors. The rotors of the main motors are connected through slip rings and brushes and flexible cables to the controlling switches and then to the primary windings of two other induction motors which are necessary for the cascade method of control devised by Ganz & Co. Fig. 6 shows diagrammatically the type of induction motor used. The secondary or rotor circuits of these motors are connected with liquid rheostats.

The only operation required in connection with the high-tension 3,000-volt circuit is the closing of a switch connecting the trolleys with the primary windings of the main motors. The entire control of the car or locomotive is effected by the manipulation of the controller regulating the low-tension induced current, which puts the motors in cascade or direct connection as desired. An air valve is used which regulates the height of liquid in the rheostat, the latter consisting of a series of sheet-iron plates, which are gradually immersed in an alkaline solution, which is forced into the rheostat.

When the solution reaches the top of the resistance box a float manipulates an air valve, and the three armature windings are short-circuited by special switches operated by compressed air. Two rheostats are provided for each car, and work only in

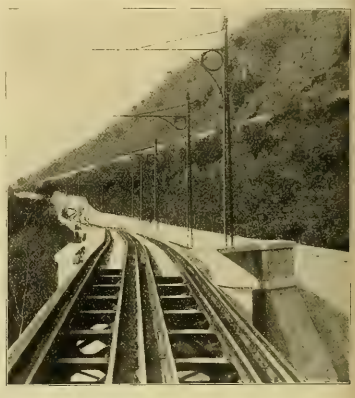


FIG. 4. EXAMPLE OF TRACK OF PALERMO-ROCCA-MONREALE SYSTEM IN ITALY.

the secondary 300-volt circuit. There are three divisions in the iron rheostat case, and four plates of various lengths are employed in each chamber, the plates being connected alternately, the current entering by one couple and out from the other couple. The plates do not move in the solution of sodium carbonate which is employed, but when it is desired to insert resistance the solution is forced out of the iron case gradually, while to cut out the resistance it is only necessary to pass the liquid into the rheostat, submerging one plate after the other.

Each of the trucks has a high-tension motor connected to one axle and a small secondary low-tension motor on the other axle, a special elastic coupling being used. In starting, the large 150-horsepower motors are connected in tandem with the small induction motors, or in cascade, as it is termed. The primary of the large motor is connected with the three-phase line and all of the high-tension apparatus is in a locked case, the key of which cannot be obtained as long as the trolley poles are in a raised position.

The secondary of the large motor in starting, and for a low speed, is connected to the primary of the small motor and the variable resistance of the liquid rheostat is included in the secondary circuit of this small motor, which really takes the place of a large rheostat. Instead, however, of wasting the energy in a heavy rheostat directly in the secondary of the large motor the useful work of the second motor is employed for acceleration in starting.

The two small motors are only employed in starting and stopping and on grades, in which case they are connected in cascade with the high-tension 150-horsepower induction motors. The ratio of transformation in the large motor is 10 to 1, which gives 300 volts in the secondary or rotor winding, and the current induced in the armature is led into the field of the low-tension motor, which is in turn connected to the resistance starting box. The second motor is cut out when the acceleration has reached an angular speed corresponding to 0.5 of the frequency of the alternating polyphase current. For normal speed, which

FIG. 3. MAP SHOWING LOCATION OF LINES OF PALERMO-ROCCA-MONREALE SYSTEM IN ITALY.

is about 60 kilometers per hour, the two large motors alone are in the circuit, and the controller is arranged so that the liquid resistance may be connected to the secondary winding of the large motors at the moment that the small motors are disconnected, remaining in circuit and being gradually cut out until full normal speed is reached, when the secondaries of the large motors are short-circuited by the rheostat automatically.

Each motor car carries the four motors directly connected to the axles, but flexibly, and they are coupled two and two in tandem, which provides a

train, being normally cut out of circuit. In the air-brake apparatus [illegible] is impossible for current to be taken from the trolleys, as a proper air pressure must always be maintained in the air-brake cylinder to allow the trolley poles to ascend to the conductors overhead.

At Milan, Italy, the electric-lighting and railway service of the city is supplied by the Societe Generale Italiana Edison di Elettricita, and the current is generated by a hydro-electric plant at Paderno by a steam-turbine electric plant and by a steam-engine installation driving three-phase generators

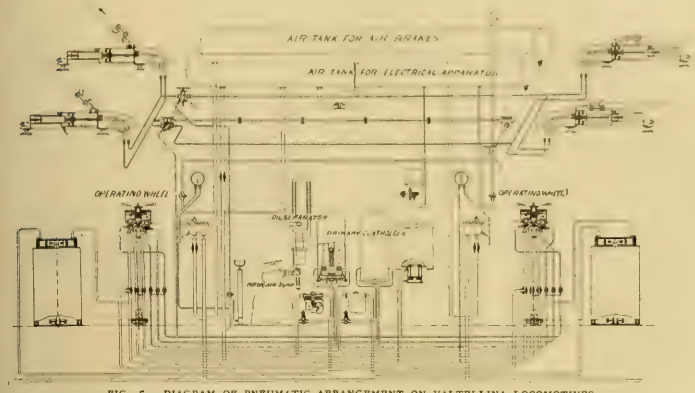



FIG. 5. DIAGRAM OF PNEUMATIC ARRANGEMENT ON VALTELLINA LOCOMOTIVES.

speed for the rotors which is half of that of the rotating field of the primary so that two speeds are possible. The locomotives or motor cars may run at 30 kilometers per hour, or 60 kilometers per hour, with a correspondingly heavier tractive effort at lower speed. The motor cars are 18.1 meters long and 2.7 meters wide, and the wheel base of each truck is 2.5 meters, the truck itself being 4.1 meters long. Two groups of three double springs support the frame for the body and pivots, which are 11.5 meters apart, which are further supported by plate springs from the axle boxes.

The controlling apparatus in the operating com-

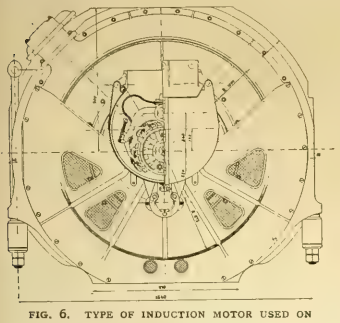


FIG. 6. TYPE OF INDUCTION MOTOR USED ON VALTELLINA LOCOMOTIVES.

partment includes the trolley valve, air-compressor switch for the five-horsepower motor, the starting switch, the main switch and the controller for the low-tension circuit. An eight-kilowatt transformer is connected to the distribution box in the motorman's cab, and this transformer reduces the tension of 3,000 volts from the trolley to 100 volts for operating the lights, ventilators, heating apparatus and motor driving the air compressor.

A special device is provided which grounds the 3,000-volt trolley wires at once if the tension falls, owing to a breaking of the line, and as the line is divided into sections each train is arranged to cut out the current from the section behind it and re-establishing it when it has just passed the next block. It will thus be seen that as each train leaves the section behind it dead, it is never possible for a following train to overtake it, and no train can be moved into any section before its right-of-way is properly signaled from ahead, as the signaling devices are so constructed that they do not allow the current to pass to the train except when it has the right-of-way.

Another interesting feature of the track and line construction of the Valtellina system is that the overhead 3,000-volt working trolley wires are absolutely dead, except at the time of a passage of a

by horizontal compound engines of the Tosi and Sulzer types.

The capacity of the Paderno hydro-electric power house which supplies current for Milan is 15,400 horsepower and includes seven polyphase machines of 1,500 kilowatts, each directly connected to seven 2,200-horsepower turbines.

The central station in Milan is equipped with two high-power steam-turbine generators. One was constructed by Messrs. Parsons in England and has a capacity of 2,000 kilowatts, while the other was constructed recently at Baden, Switzerland, by Brown, Boveri & Co., and develops 4,500 horsepower, being directly connected to a 3,000-kilowatt three-phase alternator.

The Porta Volta station at Milan has a total capacity of 13,000 horsepower, of which 3,600 horsepower is developed by twin horizontal compound steam engines directly coupled to three-phase alternators.

## Indiana Electric Railway Association.

"Repairs of Car Equipments" was the principal topic discussed at the May meeting of the Indiana Electric Railway Association in the Traction Terminal Building on May 11th. The subject was presented in a very interesting and practical paper by M. M. Nash, master mechanic of the Terre Haute Traction Company. He said that the successful operation of a city or interurban road depends, to no small extent, upon a repair department, the very best labor and material proves cheapest in the long run. Though this may seem costly at first, the expense is surely justified by the knowledge that on heavy days, when a company is obliged to put all its cars into service, the schedule will be uninterrupted by breakdowns. On such occasions as this the manager, who is prone to criticize the expense account of the repair department, is the first to congratulate himself and boast to others on the excellent condition of his equipment.

Mr. Nash said that in the shops of the first company with which he was connected the material used was the cheapest that could be bought, and the repair men had not been instructed how to systematize the work. He proceeded to procure better material and better assistants, all of which costs more money, but in three months' time, with the repair work systematized, and with good material, the cars were always ready for service, and 14 men instead of 39 accomplished the work, and subsequently reduced the expense of the shop fully 50 per cent. Mr. Nash advocated a thorough periodical inspection of cars for the discovery of apparently latent defects, which, if not caught in time, might seriously disable the car. A complete record should be kept of all work done upon a car and its equipment. He described the best method of dismantling a car for making the inspection, and this proved very interesting to the mechanics present. It is essential that special men be detailed to examine special parts, and these men should be held responsible for the condition of these parts. The speaker took up the subject of bearing metal and lubrication, which proved interesting, and nu-

[illegible] and

and it was decided that where steam lines had re-[illegible] superior service rather than reduce the present rate to meet the reductions made by the steam lines.

Following the business meeting, the members of the association were the guests of the Indianapolis, Columbus and Southern Traction Company in a ride on the "Flat Rock Flyer" to Columbus, and an inspection of the company's power plant at Edinburg. The party was under the escort of Mr. George S. Saylor, superintendent, and Mr. Robert O. Boyer, special agent of the company. Will G. Irwin, general manager, joined the party on the return trip and pointed out the waiting stations along the line where he had offered prizes of $2[illegible] for flower and vine decorations.

The subject for the next monthly meeting will be "Train Dispatching."

## New Power Station in Jersey City.

The increasing demand for industrial light and power in the territory served by the Public Service Corporation of New Jersey was the incentive which induced that company to undertake the building of what will be one of the largest electric power stations in this country. The new central station, which is now being built, and a view of which as it will appear when completed is shown here, is located on the east bank of the Hackensack River in Marion, a suburb of Jersey City. The river is navigable at this point for deep-draft vessels, giving excellent water supply, and as the plant is placed between the main lines of the Lackawanna

NEW POWER STATION IN JERSEY CITY.

and Erie railroads, the location is most advantageous.

When fully completed the new station will have a capacity of 64,000 kilowatts. The engineers laid out the plant so that it could be erected in sections of individual units and increased as required. At present there are under construction two sections of 8,000 kilowatts each. Steam turbines of the Curtis vertical type will drive the big generators. The first and third of these generators, of 5,000 kilowatts, will deliver current at 25 cycles, while the second and fourth, of 3,000 kilowatts capacity, will be of 60 cycles.

Each individual steam plant, which will supply one of the 8,000-kilowatt sections, will embrace 10 600-horsepower Babcock & Wilcox boilers of the horizontal water-tube type, fitted with Babcock & Wilcox superheaters. The boilers will be operated under natural draft, 225-foot Custodis stacks being provided between each double row of boilers. Ordinarily each stack will serve 10 boilers. Elevated coal hoppers are provided above the boilers, from which coal will be delivered directly to the boiler-room floor by chutes. Coal will be delivered to the bunkers by a belt conveyor, while ashes will be removed from the ash bins beneath the furnaces by cars upon a narrow-gauge industrial railroad operated by a trolley locomotive. No economizers or stokers will be used.

It was decided to locate the new station upon the Hackensack, so that it could serve the entire Hudson County district adjacent to the Hudson River, as well as, by means of tie lines with the other station, aid in carrying any overload that might occur in the Newark district.

## What Public Ownership of Telegraphs Costs in Great Britain.

[From the London correspondent of the Western Electrician.]

The postoffice has just issued the annual statement concerning the telegraph system. This account deals with the year ended March 31, 1904, and shows that the loss for the year was no less than $4,788,950, nearly one-third greater than the deficit of the previous 12 months. The actual loss upon the telegraph system of the United Kingdom since the government took it over in 1870 is now $60,000,000.

## Moving Platform Subway for New York City.

Some details of the proposed moving-platform scheme to provide crosstown connection in New York city in a subway below Thirty-fourth Street will be of interest. The idea of such a moving-platform subway was brought before the Board of Rapid Transit Railroad Commissioners of the city by prominent railroad officials and engineers. The commission, after thorough investigation, voted against the installation, not, however, on account of objection to the moving platform as such, but on account of the appropriation of Thirty-fourth Street, the first level below the surface of which street, it is declared, should be reserved for a system of transportation identical with that under which the greater part of the future subway system will be operated. It is said that the suggestion of the commissioners to install the platform below Twenty-third Street may be adopted.

The following details of the scheme are taken from the Scientific American: The subway is planned to be divided into two equal halves, the whole section of the tunnel to be 30 feet wide by 14 feet in height. The moving platform proper consists of three continuous lines of steel plate, covered with rubber to insure a safe footing. The plates overlap laterally at their edges. The fourth platform is an auxiliary, which will be run at a speed of three miles an hour, and used only for a few hours after midnight, when travel is lightest, at which time the main moving platform will be stationary. The first moving platform will run at a constant speed of three miles an hour; the second at six miles, and the third platform at nine miles an hour. The first two platforms will be known as stepping platforms, and the third, which is considerably wider, will be provided with transverse seats. To assist passengers in moving from one platform to another, the two stepping platforms will be provided with lines of vertical posts, placed at frequent intervals.

The platforms will be built in sections, each of which will be about six feet long, and the abutting ends of the sections will be struck to a radius which will permit of the platform curving around the terminal loops at First and Ninth avenues. Extending longitudinally beneath each platform is a pair of I-beams, the upper flanges of which are riveted to the bottom of the platform, while the lower flanges serve to support the weight of the platform upon pairs of wheels which are carried upon transverse shafts mounted at intervals of two feet nine inches, upon concrete piers. Between each pair of longitudinal I-beams is carried a pair of horizontal guide wheels, which engage a guide rail that serves to keep the platform in proper alignment. At every 75 feet, 10-horsepower motors are mounted on the floor of the subway, and are connected by a chain drive with the transverse shafts, which carry what might be called the driving wheels of the platform. The gradation in the rate of speed of the sections of the platform is secured by varying the diameter of these driving wheels, which are eight inches in diameter for the three-mile, 16 inches in diameter for the six-mile and 24 inches in diameter for the nine-mile platform. The driving wheels are covered with rubber, as are the horizontal central guide wheels, and consequently the motion of the platform will be both smooth and silent. The successive sections of the platform are coupled together by means of long links, 46 inches in length, and the coupling pins are placed at the center from which the curves of the abutting ends of the platform sections are struck; consequently, the opening between the joints may be reduced to a minimum, and a smooth and continuous surface presented for walking, with no open spaces to bewilder or trip the passenger.

## Receiver for National Electric Company.

The affairs of the National Electric Company of Milwaukee, Wis., have been placed in the hands of a receiver. John I. Beggs, one of the directors of the company, has been named by the court as receiver. From information obtained at the Chicago office of the company just before going to press it is learned that the action was voluntary, for the purpose of reorganization, and properly adjusting the claims. The defalcation by Frank G. Bigelow of the funds of the First National Bank of Milwaukee, of which he was president, brought about the trouble, he having also been a leading stockholder and financial backer of the National Electric Company.

The Hillside Water and Power Company and the Susquehanna Water and Power Company have been merged into the McCall Ferry Water and Power Company. An electric power plant will probably be installed at McCall Ferry, York County, Pa. These two companies have invested thousands of dollars in lands adjoining the river. The location of the proposed plant will make it possible to supply Baltimore, Wilmington, York, Havre de Grace and Philadelphia with electric power.

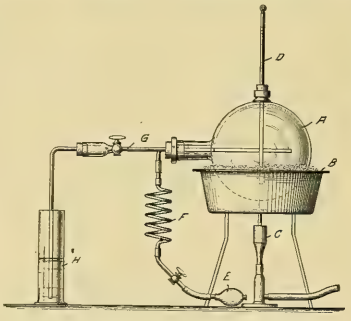
## Process of Manufacturing Radio-active Matter.

Substances rendered secondarily radio-active through impregnation with thorium emanations have been used, with more or less success, in the treatment of disease and the preservation of food. Water and other liquids, salve, paste, etc., have been made radio-active in this manner and applied, either internally or externally, for various diseases, and, according to some authorities with beneficial results. For the purpose of manufacturing such secondarily radio-active substances Hugo Lieber of New York city has devised a method by which the emanations from thorium are made to permeate certain substances, thereby making the substances themselves radio-active for the purposes above specified. The accompanying diagram shows the apparatus used by Mr. Lieber.

In the figure, (A) is a glass vessel containing thorium oxide, and resting in a bath of sand (B), (C) being a Bunsen burner by means of which heat may be applied to the bath of sand, in order to facilitate the thorium emanations.

A bulb (E) is used for blowing a current of air through the tube (F) into the glass vessel, thereby causing the emanations to pass out of the vessel and through the tube (G) into the vessel (H). The vessel (H) contains the water or other liquid or substance to be impregnated with the emanations and rendered radio-active. The thorium emanations being blown with a current of air from the glass vessel through the tube into the substance contained in the vessel (H) come into intimate contact therewith.

Thorium is a radio-active substance, and it emits and radiates rays called Becquerel rays. In addition to the emission of Becquerel rays, thorium




PROCESS OF MANUFACTURING RADIO-ACTIVE MATTER.

gives off emanations of gaseous particles. These thorium emanations of gaseous particles are characterized and defined, first, by their radio-activity, shown by their power to discharge an electroscope and by other phenomena of radio-activity; second, by their capability of being transferred, as when blown by a current of air, from one vessel into another, where they produce the same effects as they previously produced in the first vessel; third, by their capability of being reduced at a low temperature, like other gases, to a liquid, too small in quantity, however, to admit of measurement, and, fourth, by various other phenomena.

The radio-activity of the thorium emanations is capable of measurement. The thorium emanations possess the quality of ionizing the air or other gas, rendering it a conductor of electricity. If the gaseous particles constituting the thorium emanations are left in a closed vessel, a radio-active substance is soon deposited upon the inner surface of the vessel, being shown by its radio-activity. As electricity is definitely known by its qualities and effects, so the thorium emanations are definitely characterized and defined by their qualities and effects produced by their presence.

The emanations from thorium can be utilized to render other substances radio-active. Other substances rendered radio-active by means of thorium emanations may be said to be secondarily radio-active. Mr. Lieber discovered that other substances can be impregnated with thorium emanations, according to the process of the invention and can thereby be rendered persistently radio-active or radio-active in such degree that they retain their radio-activity for a considerable length of time.

A satisfactory manner of obtaining the emanations from thoriuim and of utilizing them in carrying out the invention is by heating thorium oxide below red heat and then by means of the air current blowing the emanations into the matter to be impregnated.

Instead of thorium oxide there can be used in like manner for the obtaining of emanations other forms of thorium—for example, thorium nitrate—perferably in solution with water. Should thorium nitrate be used, the use for which the impregnated radio-active substance may be intended may require the neutralization of any free nitric acid present.

## Windmill Electric Plant at Askov, Denmark.

In Europe the windmill has been developed to a considerable degree as a source of motive power for small electric plants. Among the notable installations of this kind is one at Askov, Denmark,

FIG. 1. NEW AND OLD WINDMILL ELECTRIC PLANTS AT ASKOV, DENMARK.

which town is supplied with electric light supplied by an electrical generator operated by a windmill. The installation is said to have given excellent satisfaction for a number of years. Fig. 1 shows a windmill electric plant, with wings 11.6 meters in diameter, constructed a number of years ago under the direction of Prof. P. LaCour of the Askov Popular Academy. This Danish windmill is shown at the right in Fig. 1. At the left in the same view may be seen a much larger installation constructed more recently with wings of the windmill measuring nearly 23 meters in diameter. The wings of these windmills were so arranged as to be placed automatically against the wind, the screen flaps of the wings closing or opening automatically with the strength of the wind to supply the necessary regulation. Figs. 2, 3 and 4 show the details of construction and arrangement of the apparatus as well as the electrical connections of the storage battery, dynamo and regulating devices designed in order that the dynamo might yield practically a constant current regardless of the strength of the wind in charging the storage battery.

Professor LaCour designed two automatic devices for transforming the wind power to electric energy and storing it automatically without continual supervision. The storage battery acts as a regulator, being charged and discharged simultaneously if desired, the current being utilized for lighting or power purposes. The wind-driven electric generator automatically supplies current to the accumulators when operating at the proper speed. As soon as the voltage of the generator

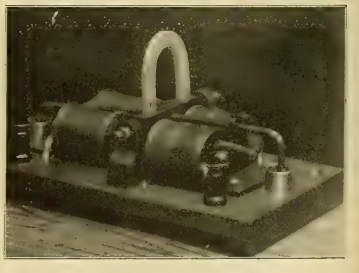


FIG. 2. AUTOMATIC REGULATOR FOR CHARGING STORAGE BATTERIES IN WINDMILL PLANT.

driven by the windmill exceeds the voltage of the storage battery the connection is automatically made and the current charges the storage cells. In case the speed of the dynamo is too low to supply the necessary voltage the circuit from the dynamo to the storage battery is automatically broken.

The automatic switch utilized for this purpose is shown in Fig. 2, its connections being shown in Fig. 3. It consists of two mercury cups ($K_1$) and ($K_2$), together with the horseshoe magnet (M)

arranged to rotate about (O), with its poles approaching those of two electromagnets, which are wound with a heavy wire (SS) and fine wire (ss), the latter being connected at each end to the terminals (A) and (B). The current is conducted from (A) to (B) continually through the fine wire (ss), the connection through the heavy wire (SS) being made only when the right hand end of the copper rod dips in the mercury cup ($K_3$). While the voltage of the dynamo is lower than the voltage of the storage battery a current passes through the fine wire sufficient to draw the magnetic poles to the right so that the mercury contact is broken at ($K_3$). If the dynamo attains the necessary speed so that its voltage is higher than that of the accumulator cells the mercury contact is closed at ($K_3$), as the magnetic poles will be drawn to the left, and the current will then be charging the storage battery through the heavy

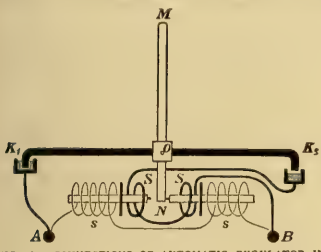



FIG. 3. CONNECTIONS OF AUTOMATIC REGULATOR IN WINDMILL PLANT.

winding of the electromagnet. In case the wind dies down to such a point that the dynamo is not supplying a sufficient voltage the mercury contact is again broken at ($K_3$) and remains broken until there is sufficient pressure at the dynamo terminals to again charge the storage battery.

In order to maintain the current constant regardless of the strength of the wind another device is provided, as indicated in Fig. 4. The dynamo (M) is driven by the belt (rr), the pulley (C) of the intermediate shaft being mounted on a movable arm having a counterweight (L) hinged at (D). This pulley is driven by vertical belt ($R_1$ $R_2$), driven from pulley (A), which is operated by the windmill. The belt tension controls the maximum pull which can be transmitted by the belt. As soon as the resistance has reached the value of the driving force the belt will begin slipping and the driving force will remain practically constant. This arrangement is utilized not only with windmill electric plants but also for dynamos driven from car axles, the belt slipping as soon as the speed of the train exceeds a given amount.

In a test by Professor LaCour to ascertain the efficiency of this device it was found that as the speed increased from 837 revolutions to 950, 992 and 1,060 revolutions the current in amperes remain practically constant at from 40 to 41 amperes. It is claimed that this double regulation allows electricity to be generated and stored automatically, utilizing the wind as a source of power with reliability, as shown by the last two years' operation at the experimental plant at Askov.

Experiments were made with four types of

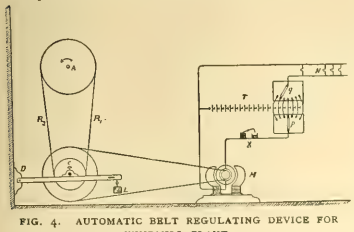



FIG. 4. AUTOMATIC BELT REGULATING DEVICE FOR WINDMILL PLANT.

windmills, including a Ventotrat, Windrose and Sorensen old-type motors as well as a conical wind motor of recent design, these wheels having an area of 7,440 square centimeters, 2,976 square centimeters, 1,116 square centimeters and 1,188 square centimeters, respectively. The output was found to be 1.59 kilograms per second, 1.77 kilograms per second, 1.81 kilograms per second and 2.34 kilograms per second, respectively. This shows that the conical wind motor has an output of 50 per cent more than the Ventotrat, the latter being higher than the Windrose and higher than the original Sorensen motor. It is stated that the main force of the wind is applied to the paddle-shaped extremities, which are the parts most effected in producing torque and this accounts for the extraordinary power of the conical wind motors, while they are further said to be safe during severe storms. These conical wind motors are constructed at Kiel, Germany, by Thomas Reuter & Schumann. A special pendulum governing device is provided for driving the electrical generators by the conical wind motors at a constant speed, very little variation, it is claimed, being noted, regardless of the velocity of the wind.

An arrangement has also been designed so that these wind motors are operated successfully in connection with steam engines, resulting in a great saving of fuel when there is sufficient wind. The steam engine supplies the necessary additional power during a light wind and acts as a regulator as to speed, while it never has to turn the windmill when the latter is not operated by a sufficient wind.

It is held that the automatic regulation of the conical wind motor is of great value, this regulating being provided by swiveling boards on the wings opened automatically by their centrifugal force as the speed of rotation reaches a certain maximum desired.

The opening of these flaps allows the surplus wind to pass through at the higher speed, the boards closing as the motor rotates at a slower speed when the wind decreases in strength. A windmill of 15 horsepower capacity designed on these lines is capable of supplying the necessary power for a dynamo for 150 incandescent lamps continuously, or a larger number in case the storage battery is installed with a capacity sufficiently large for storing the entire output of the mill and generator for several hours during the daytime.

At Askov the electric plant run by the windmill supplies the residences of the town with electric current, the constant normal current being 60 amperes at a pressure of 220 volts. A petroleum engine has been installed for use as a reserve in case of several days' calm weather. The plant has given excellent satisfaction, requiring little care or attention. It is stated that the man in charge has been away from the plant for days at a time when the petroleum engine was not required.

The storage battery has a sufficient capacity for supplying the maximum amount of energy required during 48 hours. The cost of the Askov plant was less than $4,500, of which over $800 was paid for the petroleum-motor equipment. The current is supplied from this windmill plant at four cents per kilowatt-hour for motors and 13.5 cents per kilowatt-hour for lighting purposes, the same rate as is paid by the consumers in Copenhagen. P.

## Hertzian-wave Apparatus for Igniting Frost Preventives.

Within the frost belt in various sections of the country, during cold weather, it is customary to light fires in orchards for the purpose of preventing damage by frost, and for this purpose briquets, oil pots or other devices are common, which are usually lighted by hand. As it is a well-known fact that frost occurs early in the morning, it is a difficult matter to get persons out to ignite the smudge apparatus at the proper time. In order to light these "smudge pots," as they are called, an ingenious apparatus, utilizing the Hertzian-wave principle, has been patented by Henry H. Lyon of Riverside, Cal., the apparatus being directly set in operation by the use of a thermostat, which may be so adjusted as to operate at any degree of temperature. If preferred, an electrical switch apparatus may be employed, whereby an electric circuit may be closed for the purpose of causing the igniting wires to be heated or rendered incandescent.

Referring to the accompanying diagram, (A) designates a thermostat carrying a contact point, and (C) a metallic strip with which the pointer is adapted to contact to close the circuit. The contact point is connected by the wire (D) with the primary (E) of an induction coil through the battery (F), so that, on closing the circuit, a current is sent through the primary. A suitable switch (G) is provided whereby the circuit may be closed, if desired, when the apparatus is actuated without the employment of the thermostat.

The secondary of the induction coil is shown at (K), both poles of which are connected to suitable terminals within the metallic reflector (N) through the wires (N'), which may be so arranged as to cause the Hertzian waves developed to fall upon a given area of ground. It is well known that the Hertzian wave can be reflected or refracted as

[illegible]

lic casing

(Q), which may be provided with an earth con-

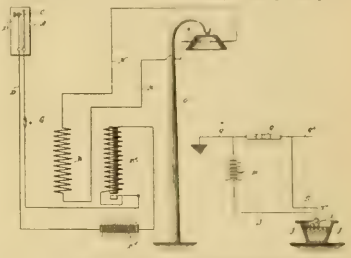
[illegible]

to travel any great distance, these are not absolutely necessary.

The coherer is in circuit with a local battery (R), and [illegible] (S') is prolonged so as to include a short piece of wire [illegible] the form of a loop, as at (T), which is adapted to be brought to incandescence by the local battery (R) when the circuit is completed through the coherer. Surrounding the metallic loop (T) is an inflammable substance (L), which creates the smudge.

The fuse (L) is to be suitably attached by pins to the briquets or floated on the surface of the oil (J), held in the receptacle (J'). By any mechanical arrangement a resistance wire without a covering may cause the ignition of the smudge, in which case it will be necessary to heat the wire to incandescence.

The operation of the apparatus is as follows: On completing the circuit through the primary of



HERTZIAN-WAVE APPARATUS FOR IGNITING FROST PREVENTIVES.

the transmitter as the pointer (B) comes in contact with the metallic strip (C), or when the switch (G) closes the circuit, Hertzian waves are developed within the reflector (N) and are caused to impinge upon the receivers within the area controlled by the reflector, and by their action cause the circuit to be completed through the coherer, the battery (R) and the wire loop (T). The current developed through the battery (R) raises the loop (T) to incandescence, thus firing the inflammable compound (L), which in turn ignites the oil in the smudge pot or receptacle.

By the provision of an apparatus embodying the features described a simple and practical apparatus is provided for automatically igniting smudges, which may be set to be actuated at any degree of temperature or by the manipulation of the thermostat for closing the circuit.

## Chicago Strike Situation.

Readers of the Western Electrician no doubt are aware of the existence of a strike by union teamsters in Chicago. The strike has been in progress for several weeks and has not been without some violence, and, also, some inconvenience, however, it is a pleasure to make room for the following announcement, dated May 5th, written by a conservative and well-known electrical man of business, Mr. George A. McKinlock, president of the Central Electric Company:

"We are informed that exaggerated reports are being circulated throughout the country, to the effect that the commercial facilities of Chicago are handicapped by reason of a strike by union teamsters.

"We desire most emphatically to denounce these reports to be untrue and circulated for the purpose of injuring Chicago as the great central market. Such reports are in line with unsuccessful efforts which have been made from time to time in the past by Chicago's envious competitors to injure its trade and secure a portion of its business by misrepresentations.

"We have good grounds for claiming that orders are being received and filled promptly, and that shipments are being made as usual.

"Please do not, therefore, hesitate to send your orders to Chicago, as they shall receive prompt attention."

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## DATES AHEAD.

Association of Railway Telegraph Superintendents (annual meeting), Read Hotel, Chattanooga, Tenn., May 17th and 18th.

National Electric Light Association (annual convention), Denver, June 6th, 7th and 8th, and Colorado Springs, June 9th, 10th and 11th.

American Institute of Electrical Engineers (annual convention), Battery Park Hotel, Asheville, N. C., June 19th to 23d.

National-Interstate Telephone Association (first convention of consolidated telephone associations), Chicago, June 20th and 21st.

Canadian Electrical Association (annual convention), Montreal, June 21st, 22d and 23d.

National Electrical Contractors' Association (fifth annual convention) and Electrical Exhibition, Mechanics Hall, Boston, Mass., July 15th to 22d.

Ohio Electric Light Association (annual convention), Hotel Victory, Put-in-Bay, August 16th to 18th.

International Association of Municipal Electricians (annual convention), Erie, Pa., August 29th, 30th and 31st.

IN THE litigation between the Chicago Telephone Company and the Illinois Glass Company, in which the latter seeks to recover $50 a year per telephone for a period of five years, during which, it avers, the telephone company has been charging more than the original contract price, the whole question hinges upon the matter of grounded and metallic lines. Metallic lines, as is well known, give better and more quiet service, especially in a city like Chicago, in which the sources of disturbance are many. But even in Chicago there are still a large number of subscribers by grounded circuits. The very interesting question therefore arises, whether an operating company shall be obliged to furnish its subscribers with the very best line construction at the original contract price or whether it may be allowed to ask an increased price for these betterments.

THE QUESTION of the amount of current which an electric conductor is able to carry necessarily depends upon the temperature limitations, the limiting temperature being reached sooner in confined spaces. Though this fact is evident to anyone, it is not readily understood that the form of the cable determines to some extent the temperature rise. A committee of experts was appointed at one time by the leading German wire manufacturers to ascertain the maximum load which a cable will take without overheating. It was found by this committee that a bundle of wires or cable heated according to a different curve from that showing the heating of a single cable, the shapes of the curves being entirely different. This led to the supposition that a longer time would be required for a large cable to arrive at the maximum temperature, with the same amount of current per square centimeter of the cross-section, than would be required for a small cable. But further experiment proved that this was not the case, due probably to the greater radiating surface. Further tests were made, using cables buried in the soil, to ascertain the temperature rise. Here it was found that the moisture in the soil was the principal determining element. At Munich it was found that, with a bundle of nine cables buried in the ground, the temperature was 11.5 per cent. higher in dry earth than in earth containing 16 to 22 per cent. of moisture. These results point to the fact that too much confidence may be placed in established rules for the current-carrying capacity of electric cables, and that the conditions under which the cables are to operate, and their surroundings, should be considered carefully when calculating the amount of copper.

ELECTRIC RAILROADING in Italy has reached an advanced stage, not only in the direction of light railways, but also in the operation of heavier lines for both freight and passenger traffic. Prominent among these is the Valtellina system, which has attracted the attention of engineers ever since the building of the road, a few years ago. The leading article in the Western Electrician this week, by Mr. Frank C. Perkins upon the "Late Developments in Italian Electric Railways" contains some interesting facts concerning this important system, including a description of the latest type of electric locomotive used on the Valtellina lines. These locomotives, like those of the New York Central, are designed for the hauling of heavy trains. One of the illustrations shows a locomotive coupled to a train of 10 passenger cars and one baggage car. When it is known that these trains are often from 250 to 400 tons, the power of the locomotives can be readily realized. The locomotives are controlled entirely by compressed air, not only in the operation of the switches, but also the raising and lowering of the trolley poles being accomplished by pneumatic devices. The trolley poles on each locomotive are four in number, arranged in pairs, and each pair carrying a horizontal roller contacting with the trolley. The cascade form of connecting the motors is employed. The entire control of the locomotive is effected by the manipulation of the controller, which regulates the low-pressure induced current, putting the motors either in cascade or direct connection. Each of the trucks has a high-tension motor connected to one axle and a small secondary low-tension motor connected to the other. In starting, the larger motors are connected in tandem or cascade, the primaries of the larger motors being connected with the three-phase line, and the secondaries at the same time to the primaries of the small motors, which add their torque to the axles only during starting or slow running, being cut out when higher speeds are attained. The smaller motors take the place of rheostatic control, and by adding their power to that of the larger motors accomplish an economy in operation.

THE FEELING of respect and interest which has begun to manifest itself among steam-railroad engineers for the possibilities which lie in electric traction was strongly emphasized at the International Railway Congress, just held in Washington, much time being given up to the discussion of points bearing upon the electrification of steam railroads. In a report presented by Mr. Victor Tremontani, manager of the electric department of the Italian Mediterranean Railway, some strong sentiments were expressed in favor of electrical operation. "In order to obtain greater speed for existing trains," said Mr. Tremontani, "the steam locomotive cannot be used, as it has nearly reached its limits of economy and power, and we must turn to the electric motor, which can easily give the extreme speeds at present in demand for express trains." To multiply steam trains, to comply with the ever-increasing traffic demands, he believes to be impracticable for economical reasons. In adopting electric traction on railways a new service should be commenced, with frequent fast trains of smaller size, the ideal electric train consisting of a single car. The reporter prophesied that, in the future, trains of great length will no longer be run, except for long distances, and short trains at frequent intervals will be the established custom. This result will in a great measure depend upon advances made in electric technology.

ELECTRIC WELDING by the well-known Thomson process is an American invention that is attracting renewed attention in England, to judge by a recent article in the London Times. The writer notes that in many industries the system has caused a complete modification of existing methods of manufacture, and in some cases electric welding has created entirely new manufactures. The process is used for welding tramway rails, in the manufacture of steel chains, in the production of wire fencing and in the making of bolts, printers' chases, steel tubing, tires, hoops for casks, vehicle frames and many other articles. Electric welding has advantages which render practicable many operations which are impossible by the ordinary forge or gas blowpipe. Finished work may be welded and repaired without damage. The welding operation can be closely watched as it proceeds and faulty welds prevented. Welds are made with great rapidity, occupying only a few seconds, and in small work they are performed almost instantaneously. Impurities are excluded from the joint and a perfectly homogeneous weld is obtained. The results of tests of the comparative strength of electric and hand welds, carried out for the late Sir Frederick Bramwell, show that whereas in the case of hand-welded iron bars the ratio of weld to solid was 89.3 per cent., in the case of electrically welded bars the ratio was 91.9 per cent. The cost of fuel is, generally speaking, about the same for hand and electric welding, but with the electric process the labor is greatly reduced. When the large power stations now being projected in Great Britain come into operation for the supply of electric energy at cheap rates the application of electric welding in that country will doubtless be greatly extended to the mutual advantage of manufacturer and consumer; and in the United States, too, there are many iron-working industries which might avail themselves of electric welding to a greater extent than they now do. The process does not in this country attract as much attention among electrical men as it did a few years ago, or as other branches of the art in process of development do now; but it is one of the valuable applications of electric power, and it is only when one stops to review what it has accomplished that one realizes its importance.

## International Railway Congress.

A brief outline of the earlier work of the International Railway Congress, held in Washington, D. C., May 4th to 13th, was given in the Western Electrician last week. A more detailed account of the proceedings is here given, touching upon the work of the sections and also upon that other phase of the congress, the manufacturers' exhibits, which formed a valuable and interesting feature. So voluminous were the reports made to the congress and the other business transacted relating to the advancement of railroad affairs in general that only an outline of the proceedings is here possible, paying special attention to those features more directly bearing on the electrical aspects of railroading.

As stated last week, May 3d was devoted to registration of the members, the actual work being taken up on the 4th, when the congress was duly opened. After the opening addresses the section announcements were made, the sections beginning the regular work of hearing and discussing the various reports on May 5th.

Section 1, meeting on May 5th, took up the general subject of cross-ties, with special reference to the selection and kinds of wood and the processes of preservation. The section was under the presidency of Mr. Stuyvesant Fish and met at the Ebbitt House. The opinion expressed at the meeting was to the effect that pickling of the sleepers to increase their life is to be recommended.

Section 3 on this day discussed the subject of baggage and express parcels. The reporters on this subject were George H. Daniels, general passenger agent of the New York Central and Hudson River Railroad Company, and J. H. Bradley, general traffic manager of the American Express Company.

Two subjects were discussed at section meetings on May 6th—"Suburban Traffic, Section 3, and "Locomotives and Rolling Stock," Section 2. Upon suburban traffic the reporters were A. W. Sullivan, general manager of the Missouri Pacific railway, and H. G. Drury, superintendent of line of the Great Eastern railway of London. W. H. Hyde, assistant general manager of the Great Eastern railway, presented an abstract of Mr. Drury's report. The characteristic feature of this service is the necessity of handling a very heavy traffic and making the necessary arrangements during a very short period of time every morning and evening. The type of car is a prime factor, and new lines constructed should be adapted to the very latest types of cars. All necessary measures should be taken to accelerate the movement of the passengers and the prompt starting and stopping of the trains.

Mr. Brisse, assistant chief of operation of the Compagnie de l'Est (France), explained why the majority of the French railroad companies are still in a waiting state as to the electrification of their lines. He showed how the mixture of express and local trains on the same line does not necessarily reduce the capacity of this line, compared with lines where local trains only are operated.

J. E. Muhlfeld, general superintendent of motive power on the Baltimore and Ohio railroad, and Edouard Sauvage, chief consulting engineer of the Western railway of France, were the reporters on the subject of "Locomotives and Rolling Stock."

Section 4, general, met on May 8th and discussed the subject of slow-freight rates. The reporters were M. C. Markham, assistant traffic manager of the Illinois Central railroad; Mr. Smart, secretary of the Railway Clearing House, London; Mr. Mange, assistant general superintendent of the Paris and Orleans Railway Company, and W. J. Van Overbeek de Meyer, chief of the division of tariffs of the Holland state railways.

Section 1 on this day took up the question of wooden cross-ties. Mr. Lum (Southern railway, United States), stated that in his section of country white oak is used in preference to any other wood. Some experiments have also been made on a limited scale with cross-ties of red oak or black oak, and others of long-leaf yellow pine. Mr. Lum also gave some information regarding the life of ties of each of these varieties; under some climatic conditions those of yellow pine last only two years.

Another subject taken up at this date was that of the lighting, heating and ventilation of trains. Mr. Anderson (government railroads of India) said that lighting by electricity has been considered as a great improvement in Europe and in America, and it is almost a necessity in the Oriental countries, because it absolutely avoids heat, and, still better, permits the use of fans by the same current. On the main lines of India about 95 per cent. of the cars are lighted by electricity, and it is certain that the use of gas will completely disappear. The only question is to decide which of the various systems should be used. Until the present time three methods are in use, viz.:

First—The use of a dynamo placed at the end of the train. This system has been used for years past with good results.

Second—Lighting by means of a storage battery which is being used at the present time on one system operating 1,600 miles of track. It was at first feared that the replacing of the storage batteries would involve much cost, but these fears have not been realized. On the above distance there are six stations where storage batteries are recharged.

Hind. The Stone system, which is used between Bombay and Calcutta, on the [illegible]. This system, however, does not give the best results, because it is very difficult to keep the apparatus in good order, partly on account of the scarcity of electricians in India and to the [illegible] capacity of the ordinary train staff.

May 9th was given up principally to an interchange of opinion regarding the subject of the quality of steel for fish plates, the subject of pooling locomotives and other subjects bearing directly on steam-railroad practice.

Automatic block signaling was one of the subjects taken up on May 11th. Among the conclusions arrived at was that automatic signaling, properly designed and installed, be recognized as a suitable means of protecting train and switching movements. The congress noted that there has been much improvement and extension of the automatic signaling since the last congress, and that those who have used it have found it effective for their purpose. The congress was not prepared, however, to recommend automatic block signaling for general adoption to supersede existing system, but considered there are cases where this system may present special advantages.

"Light Railways" was another topic discussed on this day by Section 5. The conclusion arrived at was that light railways merit in the highest degree the attention of public authorities. Their construction makes it possible to encourage the progress and development of districts which previously have remained in the background, and it is accordingly not only the interest, but the duty, of the governments to assist them. It is desirable, therefore, not to adhere to old types and old methods of construction, operation and regulation, but to introduce every facility possible, adaptable to local needs and available resources. It is also desirable that state governments and local authorities should accord to light railways, either under the form of subsidies, relaxation of requirements or other methods of assistance, the support which they need, both for construction and for operation, so that all parts of the country may be adequately served. When the authorities of a country do not themselves construct or operate light railways, and turn them over to private companies, it is indispensable that the terms of the concession should be so defined as to harmonize the interests of the working company with those of the public.

Mr. Wilson (assistant general manager Northeastern railway) stated that the greatest difficulties encountered in England by light railways have been the higher cost of construction and the requirements imposed on the operating companies, especially as to signal systems. The traffic has in several cases proved insufficient to pay fixed charges and cost of operation, and it has become necessary to replace the railroads with an automobile service on highways. As to the question of reducing the station service, excellent results have been obtained by utilizing lower salaried employes, doing without individual station accounts and entrusting the central accounting department with the work of the whole line. Finally, the English companies have suffered because of the requirements of the public in matters of safety. A plan of electrifying a line by means of a third rail had to be abandoned because of complaints of the public, who claimed that grade crossings were too dangerous for the passage of cattle and the general traffic of the highway. The difficulty was met by arranging a car with a motor, so that it was capable of running in either direction without turning.

The subject of automobile cars was taken up conjointly by Sections 4 and 5, and further allusion to this topic will be made in a future issue. The conclusions arrived at regarding these motors was that it is desirable that railway managements should continue their experiments in this direction, and more especially investigate the classes of service to which this new motor is suitable and the advantages it offers the public and the railway managements, particularly in the matter of cost.

An important report presented to the congress was that of M. F. Paul-Dubois on "Present State of the Question of Electric Traction on Railways," a summary of which is given elsewhere in this issue.

Another valuable report, given May 11th, was that of W. D. Young, electrical engineer of the Baltimore and Ohio Railroad Company, on the question of "Electric Traction." In order to obtain the information required Mr. Young prepared a set of 209 questions, which were sent to 222 railroad companies, 171 replies being received. Of the 171 roads, eight were using electricity and were in a position to furnish information. These were: The Baltimore and Ohio; Boston and Maine; Chicago, Burlington and Quincy; Hocking Valley; Long Island, New York, New Haven and Hartford railroad; North Shore railroad, and the Pennsylvania Railroad.

Comparing the tabulated information thus obtained with that of Mr. N. H. Heft in a report read before the congress in 1900, it is found that the number of roads using electric traction in some manner has increased from three to eight. The miles of track thus operated has increased from 81.2 miles to about 172 miles. There is a special instance where the speed has increased from a maximum of 40 miles per hour on the level to [illegible] locomotives.

[illegible] in the Western Electrician.

In [illegible] the questions already alluded to and the answers [illegible] from this appendix will be found interesting. Regarding the number of miles of lines electrically operated, the Baltimore and Ohio operates four, the Boston and Maine, 47.34; the Chicago, Burlington and Quincy, 3.73; the Hocking Valley, about 14; the Long [illegible] New York, New Haven and Hartford, 58.48; North Shore railroad, 30, and the Pennsylvania, 8.31. The rated kilowatts capacity of the generating stations of these roads are, respectively, 2,500, 800, 200, [illegible].

The Baltimore and Ohio experiences on its lines a maximum drop of 60 volts, the Boston and Maine 200, the Hocking Valley 200 volts at the end of 10 miles when heavily loaded, Long Island railroad 10 per cent., North Shore railroad 200 volts at starting train, and the Pennsylvania Railroad 125 volts.

All these roads use direct current entirely, with the exception of the New York, New Haven and Hartford, which uses direct current and three-phase alternating current.

Many were the features of entertainment and opportunities for social intercourse during the two weeks the delegates were in Washington. Among the places visited were the new Union Station, the arsenal and gun shops, public buildings, including the Patent Office and National Museum, excursions to Fort Meyer and Arlington, etc. Receptions were given at the various embassies; Mrs. Roosevelt entertained many of the delegates at tea May 12th; a banquet was tendered by the American Railway Association May 11th, and a reception was given May 10th by George Westinghouse.

Altogether the congress, which was the first to be held on American soil, was a success and will be remembered with gratification by those whose good fortune it was to attend.

### American Railway Appliance Exhibition at the Congress.

The several thousand visitors from home and abroad in attendance to the International Railway Congress not only gained a large and valuable fund of useful railway information from the carefully prepared papers they heard read at the meetings of the congress, but they saw practical demonstrations of all the latest inventions in actual every-day service on American railways, and gained much additional knowledge, a knowledge that is not easily forgotten and something that can be taken away and used to advantage.

The "White City" on the grounds of the Washington Monument proved attractive not only to the visitors but to almost the entire population of Washington as well. So attractive was the exhibition that the holders of complimentary tickets had to be limited to certain hours so as not to crowd the railway men from viewing the exhibits, and indeed getting into the grounds. The exhibit was divided, the locomotives and cars of every description being placed on temporary tracks along Maryland Avenue from Ninth Street to Fourteenth Street, the mechanical exhibits and railway accessories being housed in an enclosure covering about four city blocks. About 70 houses and booths were in use.

The first impression on visiting the exhibition whether during the day or at night was that electricity was the dominant feature. There were 300 exhibits covering the entire wide range of railway equipment—steam and electric—ties, rails, switches, bridges, interlocking signals of every class, electrical, pneumatic and mechanical; locomotives and cars for electric or steam roads for freight or passenger service; car-lighting apparatus, electric and gas. Several well-known makes of air brakes were shown and demonstrated, showing the operation of brakes when air is applied slowly and when applied instantly in emergency cases. A very large variety of automatic car couplers was also demonstrated and proved attractive and instructive to the large crowds which were constantly gathered about them, whether railway men or laymen.

Several well-known manufacturers of pneumatic tools showed a great variety of tools and gave practical demonstrations of the varied uses to which compressed air can be put.

Over 60 exhibitors had separate buildings, leaving the others to take up the spaces in the large building, which accommodated over 300 exhibits. This building was devoted to parts and accessories of every description and to machine-shop tools. It is not an exaggeration to say that everything that enters into the manufacture and maintenance of railway equipments was displayed in this building.

The Westinghouse Companies' exhibit was at all times densely packed with visitors. The European delegates manifested particular interest in

the operative exhibits of the latest types of electric-traction systems in this big pavilion. The Westinghouse alternating-current railway system was new and interesting. The single-phase exhibit showed the complete equipment of a 50-foot double-truck car, with four 100-horsepower motors, and a form of electropneumatic control through auto-transformers and an induction regulator, the wheels of the trucks resting on greased rails to provide sufficient frictional load on the motors to permit demonstration of variable voltage operation. Alternating current from a 400-kilowatt Westinghouse rotary converter, running inverted, was received at 1,100 volts through two oil-insulated step-up transformers set up near the car platform. The Westinghouse straight air-brake equipment, with motor-driven air compressor, formed a part of the operating exhibit, the motors and brakes being controlled by master controllers and operating air valves at each end of the car frame.

The operating exhibit of the Westinghouse direct-current multiple-control system were of interest not only because of the various new features embodied in the design of the master controller, the reverser, the unit-switch group and other important details of the control apparatus, but also in that the truck in operation (Fig. 1) was one soon to be placed in service on the Long Island railroad, probably the heaviest type constructed to

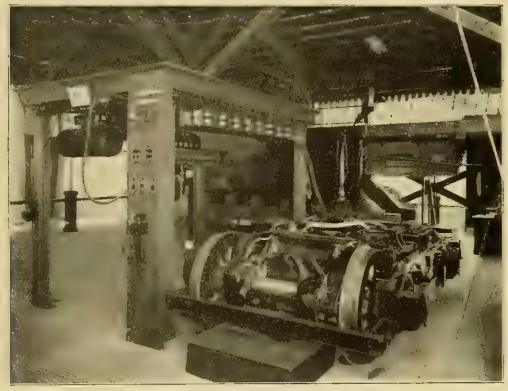

Fig. 1. Operating Exhibit of Westinghouse Company.

Fig. 2. View in General Eelctric Company's Exhibit.

RAILWAY APPLIANCE EXHIBITS AT THE CONGRESS.

date, the total weight, exclusive of the motors, being 13,860 pounds.

An interesting collection of heavy machine-shop tools was exhibited, driven by Westinghouse motors. One Niles 90-inch locomotive-driver lathe was shown, operated by a 40-horsepower direct-current motor, and near by was a Niles axle lathe operated by a 20-horsepower direct-current motor. The Putnam lathe was driven by a 50-horsepower motor. A Sellers tool grinder was operated by a 7½-horsepower motor.

A Westinghouse-Parsons 600-horsepower steam turbine, identical in size and type with the Westinghouse turbine that ran continuously for 3,962 hours at the St. Louis Fair, was shown open for inspection. This turbine was direct connected to a 400-kilowatt alternating-current generator.

Nernst lamps, peculiarly adapted for decorative passenger-station and train illumination, or for economical terminal-shed and tool-shop lighting, were used very liberally throughout the pavilion.

The exhibit of the General Electric Company consisted of a railway truck equipped with two 200-horsepower motors, the Sprague-General Electric system of multiple-unit control, a Curtis steam turbine and General Electric generator for train lighting, and a miniature track and car used to demonstrate the full-sized General Electric automatic track-signal system. This part of the exhibition also attracted a great deal of attention. On a short section of track alongside of the building was a small mining locomotive and reel. The 30-ampere mercury arc rectifier, changing alternating current into direct current, and the General Electric air-brake exhibits completed the display. The building was brilliantly lighted, and to add to the attractiveness of its surroundings the trees about the buildings were profusely decorated with various colored miniature electric lights. The accompanying illustration (Fig. 2) is an interior view of the General Electric exhibit building.

Train-lighting systems seemed to be the next in importance among the electrical exhibits, and the two companies showing systems in actual operation on the cars had a full corps of demonstrators busy all the time explaining the merits of their respective systems to the visiting delegates and the large numbers of men from the mechanical and operative departments of the railroads entering Washington.

The Consolidated Railway and Electric Lighting and Equipment Company of New York had a passenger car out on the road making scheduled trips, while the Newbold Company had a loaned car containing its equipment, located on the temporary track on Maryland Avenue, operating the truck dynamo by a motor set on the ground under the car, taking current from the local light and power company's service lines.

The Gould Storage Battery Company, in addition to its battery exhibits, showed its train-lighting system, using an improvised truck with axle-driven dynamo, the drive from the car axle to dynamo being by Morse chain.

The U. S. Lighting and Heating Company also showed a railway truck equipped with a dynamo operated by the car axle. This was an exhibit which proved a feature of interest to the delegates. In a measure this was due to the great simplicity of the dynamo and the automatic control for cutting in the storage battery when the car was stopped, and for cutting out the battery when the car attained a certain speed.

The Electric Storage Battery Company of Philadelphia, Pa., had a very extensive exhibit housed in its own building.

The National Battery Company also exhibited storage batteries.

The Fairbanks-Morse Company of Three Rivers, Mich., covered a very wide range of railway appliances and included a large exhibit of its dynamos, showing one complete lighting plant operated by a gas engine adapted to the use of either gas or gasoline.

A similar lighting plant was shown by the Otto Gas Engine Company, along with many other exhibits.

Inter-pole motors for operating machine-shop tools requiring variable or constant speeds were shown in operation by the Electro-Dynamic Company of Bayonne, N. J.

The largest display of railway signals was shown by the General Railway Signal Company of Buffalo, N. Y. Two lines of regulation railway tracks with a cross-over were completely equipped with necessary switches and track signals. The switches and signals were operated from the large signal tower built directly over the tracks. In the tower there were three sets of automatic-signaling apparatus for operating the signals and switches—electric, pneumatic and mechanical. All the systems were of the interlocking type. In addition to showing the operation by the towerman, a section car was run up and down the tracks and over the cross-over, demonstrating the automatic operation of the signals by the electric circuits made by the passage of the car over the different sections.

Several sets of automatic signals were shown by the Hall Signal Company. These were of the electropneumatic type, the operating current for each signal being supplied by eight cells of primary battery.

The telegraph men all showed considerable interest in the exhibit of the Morse Code Signal Company of Milwaukee, Wis. Here was shown some things new in the way of telegraph instruments. The novelty consisted in the instruments responding automatically to the particular call for which they were set and ringing an electric bell. Another electric novelty was a typewriter for sending Morse signals and which could be used for recording in the usual manner the messages as received by sound.

Electric hoists were shown by Yale & Towne of New York.

A Robins belt conveyor was shown handling coal. Power was supplied by electric motor.

The illumination of the grounds was a special feature of the exhibition. Electric signs were very numerous and would have sufficed to light the buildings and grounds without the hundreds of additional lamps which were used.

## Present State of the Question of Electric Traction on Railways.[1]

By M. F. Paul-Dubois.

If we may attempt to summarize the situation, we would say that the use of electric traction on railways is already practicable in all cases where its use would be considered advisable from the economic point of view.

We do not intend to assert by this that all the technical difficulties are by now completely overcome, but only that their solution would not involve any obstacle too great for the present resources of industry; existing processes and appliances have shown their capabilities in applications sufficiently different to make it certain that the elements necessary for the solution of any practical problem are to be found in them.

It is certainly desirable to improve them still further, and we have tried to show in what direction, in our opinion, progress can be made; the principal object to be aimed at is the reduction of the cost of installation and of working.

It may indeed be said that, under present conditions, apart from the cases where electricity must necessarily be used (e. g., for operating lines which are chiefly underground), electric traction can only find economical application where there are special conditions.

Without here wishing to enter into the question of first cost, which is much too complicated, and about which we have at present too few data to make it possible to treat it with any accuracy, it is interesting to consider in this connection what are the conditions favorable to the use of electric traction.

This system of traction is characterized by the fact that the motive power is generated not on the locomotive, but at permanent generating stations, from which it is transmitted over a distance to the motors of the train. The principal advantage of this system consists in being able to generate power on a large scale, and under the best economic conditions. But the advantage which results from this concentration is not net gain; we have to deduct the cost and the loss which the transmission involves.

Now these latter are the greater the more variation there is in the total power consumed by the trains at any given moment, because the capacity of the installations which serve for the transmission and transformation of the energy, as well as that of the generating stations, must necessarily be proportioned to the maximum consumption. The more this maximum differs from the mean power required, the greater is the capital outlay and also the cost of working, particularly in the case of central stations where steam is used, owing to the bad utilization of the plant and of the staff and to the low efficiency of the appliances working at a low mean load.

With an irregular timetable, when the trains are few in number, but heavy, the relative amplitude of these variations may be considerable and the economy seriously affected thereby. It is, therefore, a priori evidence that electric traction is more particularly advantageous when there are comparatively light trains succeeding each other at short and regular intervals.

Now, although the multiplication of passenger trains is a justifiable desideratum, at least as regards short-distance traffic, there are other classes of traffic, particularly goods traffic, in the case of which it is the tendency for railway companies to reduce the number of trains by increasing their tonnage.

Short-distance passenger traffic thus seems to

1. Summary of a report made to the International Railway Congress in Washington. Mr. Paul-Dubois is the engineer of the central rolling-stock and locomotive department of the Orleans Railway in France.

offer the most favorable field for electric traction. Moreover, it is almost exclusively to the class that the application already made on railways belong. Electric traction of goods trains exists only as an exception justified by peculiar local conditions. It may be said in a general way that in services of this kind the economy of the system increases with the reduction in the weight of the trains and with the increase in their number.

Leaving out of consideration metropolitan railways, which form a special class for which electric traction is now a necessity, then, from the point of view which we have been considering, the suburban lines of some large towns may offer conditions favorable to the use of electricity.

The latter, moreover, in the case of services with many stops, has the great advantage that it makes it possible to increase the average speed materially, owing to the rapidity of starting electric motors. The absence of smoke, the better lighting of carriages and stations are other advantages, which, although only of a secondary character, yet also contribute considerably to the general improvement of the service.

Similar conditions will be found to occur on sundry busy lines connecting large centers, not very far apart, in industrial districts, where the service must assume as nearly as possible the character of a tramway service. On lines of this kind, and even on certain secondary railways, the increased facilities of transport made possible by electric traction may lead to important increases in the traffic and in the receipts.

Another case where the adoption of electric traction is worthy of consideration is that of lines which are worked up to their full capacity. For electric traction indeed makes it possible, under certain conditions, to increase the capacity for traffic, while avoiding more costly measures, such as quadrupling the track or enlarging the terminal stations. This possibility is due in the first place to the greater speed of the trains, resulting from quicker starting and less loss of speed up gradients, and, secondly, to the reduced blocking up of the terminus stations, owing to the smaller number of operations necessary to receive a train and then clear the siding for the next train.

Doing away with smoke and steam in long tunnels will of itself make it possible, in the case of some very important lines, to subdivide them into very short block sections, thus enabling them to carry more traffic than with steam traction. In both cases the increase of traffic would extend to the branches of the main line.

The great specific power of electric motors is specially in favor of their use on mountain railways, whether adhesion or rack railways. We know that an electric locomotive need not weigh more than 40 to 50 kilograms per horsepower (89 to 112 pounds per British horsepower) and the equipment of a motor car not weigh more than 20 to 25 kilograms per horsepower (45 to 56 pounds per British horsepower). Electric traction, moreover, makes it possible to obtain the maximum adhesion, by making all the carriage wheels driving wheels.

It therefore makes it possible to plan lines with sharper curves and steeper gradients (for instance, the Fayet-Chamonix line, Paris-Lyons-Mediterranean railway), which are cheaper to build. The saving effected may in some cases be so large as to cover, or even more than cover, all the additional expenditure for the installation of power stations and lines of transmission.

The same applies to rack railways, where the weight of the locomotive proper forms an item in the total weight of the train, which is the more important the steeper the gradients, since with the power remaining constant the weight moved is reduced.

The use of electricity is, as a rule, specially advantageous in mountain districts, where coal is generally expensive, and waterpower cheap, if there are no special difficulties in storing and utilizing the water.

The relative lightness of electric vehicles also makes them suitable for obtaining very high speeds. The large amount of power which is necessary to run a train at from 150 to 200 kilometers (93 to 124 miles) per hour can more easily be furnished by electric motors fed from outside than by a steam locomotive, the weight of which increases rapidly with the speed to be attained; the recent experiments made in Germany have proved (if indeed it was necessary) the superiority of electricity from this point of view.

No doubt, before definite application, there are still numerous practical problems to be solved, in connection with the safety, the brakes, the signals, etc. But the most serious obstacle to such a great increase in speed is the considerable expense which would be entailed.

In the first place, if we consider very busy lines, which alone could serve as a motive for the use of high speeds, it would not be possible to think of running trains at 200 kilometers (124 miles) per hour, in between ordinary trains, without disturbing the whole timetable and making the ordinary traffic impossible.

It would, therefore, be necessary to build new lines, either by adding new tracks to the existing ones, or, better, by building entirely new lines with curves of large radius and a wider formation level so as to make it possible to have a safer way. As for the track, the experiments referred to seem to [illegible] track now in use would have to be [illegible] materially. In the interest of safety, [illegible] it would be necessary to absolutely [illegible] crossings, junction and other [illegible]. Thus, taking it altogether, such a line would cost much more than the existing [illegible] from the electric equipment. As a [illegible] would also be of considerable length, for it would scarcely be worth while to incur such a large expenditure merely in order to save one-quarter or half an hour on a journey, it follows that the capital required for construction would be enormous.

Now, in order to earn dividends on such a capital and to meet the working expenses, which also would be very high, were it only on account of the great increase in tractive effort at higher speeds, one could only reckon on passenger traffic and perhaps on some additional receipts from parcels traffic.

No doubt cases will occur, sooner or later, where the development of the communication between two large centers may justify, from the economical point of view, the building of such a line. But in France at least, this case does not seem to be likely in the immediate future.

On the whole, it seems to us that electric traction should at present be looked upon as a useful auxiliary to steam traction, capable of operating certain parts of railway traffic with advantage and economy. The principal cases in which its adoption may at present be feasible are: First, on lines which are chiefly underground; then on metropolitan and on suburban lines; on interurban lines of limited length and with much traffic; on railways with steep gradients, and on lines which are worked up to their full capacity.

It is impossible to indicate in a general report in any more definite a way the cases in which the system of working may lend itself to the application of electricity; it is essentially a question of degree, and each individual case requires special examination. In this examination special consideration must be given to the cost of the electric equipment, the principal factors of which are, in the first place, the conditions of working, the number and weight of the trains, and, second, the conditions under which the line is built, its length, profile and plan; then the charges for interest and sinking fund of the capital outlay required must be compared with the economy which electric traction will give as compared with steam traction.

If it is a question of a new line, the adoption of electric traction may in certain cases result in a lower cost of construction, whereas in the case of existing lines the value of the rolling stock which will be rendered useless by the introduction of electricity has to be taken into consideration and written off.

Among the conditions in favor of electric traction are naturally the proximity of easily utilizable waterpower or of other cheap sources of energy, such as coal pits and blast furnaces.

In comparing the cost of traction we must allow, in the case of electricity, in addition to the eventual economy realized in the production of energy, for the reduction of dead weight resulting from the smaller weight of electric locomotives, the reduction in the cost of driving and of maintenance, as well as for the accessory economies capable of being effected in shunting operations at stations, in lighting the stations and trains, etc. Finally, if so happens, the increased receipts which may result from the improved service have also to be taken into consideration. In any case, the problem becomes in the end a financial and economic one.

## Schedule for "Official" Burlington Special Train, Chicago to Denver-Colorado Springs Convention.

It is now definitely confirmed that the official electric-light special over the Burlington railroad to Denver, with which the Pennsylvania railroad limited special combines at Chicago, the entire train going West as a big combination train, will leave Chicago Sunday, June 4th, at 11:15 a. m. for the convention.

The special from New York will arrive at Chicago at 8:25 a. m. Sunday, June 4th. This will give the New York party, which already lists over 90 persons, a chance for a small breathing space before the combined special starts for Denver, that train leaving from the Union station at 11:15 a. m., central time. The convention train will arrive in Denver Monday at 2:30 p. m., mountain time.

A representative of the Western Electrician has been over the ground to a large extent west of Buffalo and finds the greatest enthusiasm for a phenomenally large gathering at Denver.

The two railroads, too, are showing commendable enthusiasm in their expressed determination together to produce a combination convention train equal if not better than any that has ever made the trip from the eastern coast to Denver and the Rockies. Both the Pennsylvania railroad and the Burlington Route promise the very finest equipment in their possession. Both these roads are vying with each other to see which will be the

## Chicago Edison and Commonwealth Electric Reports.

[illegible] the last previous year. Earnings on the stock of the Edison company figures about 10.78 per cent., while that of the Commonwealth company is about 4.2 per cent. The Edison company's total surplus [illegible] to the depreciation reserve. The Commonwealth company added $102,000 to the depreciation reserve and about $180,000 to the surplus, making the total surplus $750,164.

The income account of the Edison company for [illegible] the previous year is as follows:

| | | | |
|---|---|---|---|
| Gross income | $ [illegible] | $ [illegible] | $ [illegible] |
| Operating and general expenses | [illegible] | [illegible] | [illegible] |
| Net income | $ [illegible] | $ [illegible] | $ [illegible] |
| Interest | [illegible] | [illegible] | [illegible] |
| Dividend paid | [illegible] | [illegible] | [illegible] |
| Balance | $ [illegible] | $ [illegible] | $ [illegible] |
| * Decrease. | | | |

Owing to additions to the capital stock and bond accounts, dividend and interest payments were larger and the balance shows a small reduction as compared with that of the year 1903-4.

Following is the income account of the Commonwealth company for the last two years:

| | | | |
|---|---|---|---|
| Gross income | $ [illegible] | $ [illegible] | $ [illegible] |
| Operating and general expenses | [illegible] | [illegible] | [illegible] |
| Net income | $ [illegible] | $ [illegible] | $ [illegible] |
| Interest | [illegible] | [illegible] | [illegible] |
| Balance | $ [illegible] | $ [illegible] | $ [illegible] |

## Chicago Street-railway Situation.

At the suggestion of Mayor Dunne the advertisements for the building of a municipal street railway in the streets covered by the Chicago Passenger franchise have been changed on account of Judge Grosscup's recent decision, to show the fact that the city can give possession at once. J. J. Cummings of the McGuire-Cummings Manufacturing Company has offered to build and equip the proposed city line, taking Mueller certificates in payment, and work on a short lease from the city. In speaking of Mr. Cumming's offer Mayor Dunne's remarks would indicate that he hopes to make terms with the Chicago Union Traction and Chicago City companies for the acquiring of all the surface lines. The mayor said: "It would be better first to see what terms we can make with the Union Traction and Chicago City companies, and ascertain if we can acquire their properties at a reasonable cost. If we cannot, then it will be necessary to build independent lines around them, but the time for deciding that has not yet come."

Recently Mayor Dunne extended an invitation to B. A. Crawford of Glasgow, said to be the leading authority on municipal ownership in Great Britain, to accompany James Dalrymple to Chicago, and it is said the two will start for the United States soon.

## Improvement of the Union Loop.

It is being urged by the local transportation committee of the Chicago City Council that the plans suggested by Bion J. Arnold for deadening the noise on elevated railways and for increasing the facilities of the Union Loop (see Western Electrician of March 18 and 25, 1905) be tested by Mr. Arnold and General Superintendent E. C. Noe of the Northwestern Elevated Railway Company, which controls the loop. President Clarence Buckingham of the Northwestern company prophesied, however, that no method for an elimination of noise can be devised by the city's experts. His company is willing to make a test of the suggestions made by Mr. Arnold if the expense is not too great. Attorney Clarence S. Knight attacked Mr. Arnold's sound-deadening plans and through-routing proposals. The best plan to relieve the Loop congestion, he said, was extension of the platforms. Mr. Noe declared that if the Chicago and Oak Park road was compelled to take the inner track the Loop question would be solved for 10 years to come.

At a recent meeting of the International Psychological Congress in Rome Miss Louise Robinovitch, an American, delivered a lecture on electric sleep-making experiments on a rabbit, in which she endeavored to prove that sleep obtained by this means is natural and not epileptic.

## Anniversary Dinner to Indiana Independent Telephone Companies.

Nearly 400 Independent telephone men, representing as many exchanges in Indiana, were present at a dinner given at the German House in Indianapolis on May 10th by the New Telephone Company, the New Long-distance Telephone Company and the Indianapolis Telephone Company. The dinner was to celebrate the sixth anniversary of the opening of the Independent local and long-distance lines.

Mr. S. P. Sheerin, president of the Indianapolis Telephone Company and the New Long-distance Company, as toastmaster extended a hearty welcome to the guests and gave a brief review of the growth of the Independent lines in Indiana. He said that he and his associates took up the work because they believed the field offered opportunity for a good business investment, and stated that the Independent companies of Indiana now have six active telephones for every one of the Central Union.

Mayor Holtzman welcomed the guests to "Indianapolis the Beautiful," and a letter was read from Col. J. D. Powers of Louisville, who was to have spoken on "How We Do Things in Kentucky." Jesse W. Weik, president of the Greencastle Telephone Company, amused the audience by a series of humorous remarks.

Samuel W. Foster of Fort Wayne spoke on "Why Our Own People Buy and Hold Our Telephone Stocks and Bonds." He said it is a matter of gratification to know that 85 to 95 per cent. of the capital for the Independent lines of the state was furnished by residents of the state. The fact that the Independent lines are owned at home and managed by their owners had much, he declared, to do with the wonderful growth of the systems in this and other states. He said that the Independent system had saved the citizens of Fort Wayne at least $50,000 a year.

Hon. John W. Kern spoke on what the Independent telephone movement had done for Indianapolis, and A. B. Ware spoke of the Independent movement as a commercial factor.

James B. Hoge of Cleveland, Ohio, made a plea as to the necessity for state and national organization. He said the inauguration of the Independent movement has increased the number of telephone users fifteenfold and reduced the proportion in Indiana to one to every 12 residents.

As a "Message from New York," B. G. Hubbell of Buffalo, president of the Consolidated Telephone Company, told of the success of the Independent movement in his state and of the stiff fight that made success possible. More than $15,000,000, he said, had been invested in New York by Independent telephone companies during the last four years. A letter was then read from M. F. Mahoney of Logansport, who was to have spoken on "How a City Can Get a Good Telephone Exchange if It Wants One—A Sketch from Life."

E. B. Fisher, secretary of the Citizens' Telephone Company of Grand Rapids, Mich., paid a high tribute to the fighting qualities of S. P. Sheerin, R. S. Taylor and Hugh Daugherty of Indiana, and said had it not been for the conspicuous part they took in the great legal fight his company would not be present to celebrate the anniversary dinner.

Thomas D. Sheerin of the senior class of Purdue University told of the opportunities that the Independent telephone companies offered for the inventor and the student in electrical technology. He said the college-trained engineer cannot fail to be pleased at the prospects which present themselves on every hand because of the great Independent movement. Energy and ambition have been put at a premium and investigation and invention have alike been encouraged. No one has profited more by the Independent movement than have the student and inventor.

Before dismissing the banqueters S. P. Sheerin said that he regretted that a special toast, acknowledging the indebtedness of the Independent telephone interests to the press for its assistance in the general movement in the state ever since the movement was started, had not been offered. He assured the representatives present that the press would not be overlooked next time.

## Telephone Association for West Virginia.

Reports from Parkersburg, W. Va., are to the effect that the West Virginia Independent Telephone Association was formed there a few days ago. It includes 20 of the larger companies of the state and is modeled after the Ohio association in many ways. The statement is made that there will be no merging of capital, but that better long-distance facilities will be arranged and improvements made in other ways. The companies at Huntington, Parkersburg, Fairmont, Grafton, Wheeling, Clarksburg, Martinsburg and other points are members. The officers are as follows: President, J. Walter Barnes of Fairmont; vice-presidents, W. C. Handlan of Wheeling, W. C. Caiton of Parsons, G. W. Downs of Buchhannon, W. L. Rector of Ravenswood and Hon. H. Hutchinson of Huntington; secretary, A. C. Davis of Parkersburg; treasurer, Lloyd Beegley of Weston.

## Chicago Telephone Rate Litigation.

As the Western Electrician goes to press testimony is being taken in Judge Holdom's court in a test rebate suit in which the Illinois Glass Company seeks to recover $50 a year per telephone for about five years from the Chicago Telephone Company. The most interesting testimony, on a question of much importance in the outcome of the case, was on the comparative efficiency of the grounded and all-metallic systems, both of which are used by the Chicago Telephone Company.

To state the case in a general way, the telephone company's ordinance provides a rate of $125 a year. When the ordinance went into effect the company was operating on the ground-return system. As the art of telephoning developed the all-metallic system was brought out. This system gave more efficient service although at a greater cost of installing and maintenance. Especially for long-distance use is the later system considered almost indispensable. Today many of the company's local subscribers are using the metallic system, having contracted for such service at the rate of $175 a year, although a large part of the local telephones are still on grounded circuits.

Witnesses for the plaintiff testified that the grounded telephone system is as efficient as the metallic, and one witness stated that extension telephones could be efficiently used on the former system. On this testimony is where considerable confusion arose in the hearing. The question of hearing foreign sounds in the telephone came up and Edward B. Ellicott, former city electrician, testified that it was impossible to use any system of telephones without at times hearing these noises. By proving that the grounded system was as efficient as the metallic the attorney for the plaintiff sought to establish that the rate should be the same for both systems.

On the other hand, Mr. A. S. Hibbard, general manager of the Chicago Telephone Company, testified that good service could and is being given by the grounded system, but that for long-distance use and also for local use there was an improvement in the metallic system. Mr. Hibbard says that no system is perfect, and cites a case in a suburb of Chicago where fault is found with the system, which is exclusively metallic, on account of foreign noises; this condition being due, it is believed, to the close proximity of electric-light wires and high-voltage trolley wires.

The telephone company, maintaining that its grounded system is efficient, believes it has a right, under its ordinance, to charge a higher rate to those who wish to avail themselves of the more expensive, and, especially for long-distance use, more efficient system.

There are said to be 2,000 subscribers having similar suits pending, involving more than $2,000,000, and the outcome of the present test suit means much to the company.

## Telephone Gives First News of Tornado.

About 100 persons were killed and 150 injured in a tornado which centered at Snyder, Okla., on May 11th. The first intimation the outside world is said to have had of the disaster was when the long-distance operator at Hobart, Okla., heard the long-distance operator in the Snyder exchange scream. The cause of the scream was the destruction of the Snyder telephone building, which was a long, narrow wood building, and which was split half in two by the wind, the break occurring where the switchboard was fastened to the wall. As the wind whipped off the front end of this building a heavy piece of wood was driven into the side of the manager's head, who was sitting at his desk. The telegraph and telephone wires went down with the storm, and for several hours no word of the disaster reached the outside world. A telephone operator walked through the darkness and the storm to Mountain Grove, a neighboring village, and from there telephoned bare facts of the disaster.

## Proposed Telephone Rates for St. Paul.

The draft of an ordinance for regulating telephone charges in St. Paul, Minn., as proposed by City Attorney Michael, suggests the following rates: Business telephones within two miles of old postoffice building—Individual lines, $48 a year; two-party lines, $30; three-party lines, $24; four-party lines, $18. Residence telephones, limit of distance two miles—Individual lines, $30 a year; two-party lines, $24; three-party lines, $18; four-party lines, $15. For districts lying beyond the two-mile limit an additional charge of 25 cents for each half-mile may be made on the individual lines. Where two or more are on the same wire the additional charge shall also be 25 cents for each half-mile, the charge to be divided equally among the whole number on the line. An additional charge not to exceed $6 may be made for desk extensions.

Speaking to the Common Council of St. Paul, Mr. C. P. Wainman, manager of the Northwestern Telephone Exchange Company of Minneapolis, said that telephone rates in the Twin Cities are lower than in other cities of the same class. He stated that the unit of value on the telephone is the call, and the unit of expense for furnishing service is the call. In 1890 the average rate per hundred calls was $3.33; in 1895 it was $2.08, and in 1904 it was reduced to $1.40. He declared it a mistake in the companies to change to a flat rate, saying that the heavy user should bear the heavier portion of the expense. The reduction in rates proposed, he said, would reduce revenues $90,000, while the profits are but $80,000.

## Bell Telephone Output.

The American Telephone and Telegraph Company's report again makes a record, the April comparative exhibit of instrument output showing a gross total of 174,207, and exceeding that reported for March by 5,000, while the April net gain exceeds the March net gain by 7,712. The expansion in the telephone business has been very marked thus far in the current year. Comparative exhibits for April and four months follow:

| Month of April: | 1905. | 1904. |
|---|---|---|
| Gross | 174,207 | 102,007 |
| Returned | 44,981 | 42,335 |
| Net | 129,226 | 60,572 |
| Since January 1: | | |
| Gross | 608,301 | 404,475 |
| Returned | 177,903 | 151,325 |
| Net | 430,368 | 253,150 |
| Total outstanding | 4,910,362 | 4,052,667 |

## Proposed Independent Telephone Merger.

A recent dispatch from Nebraska City, Neb., published in the St. Louis Globe-Democrat, says: "A company has been organized and is preparing to float bonds to the amount of more than $500,000 to control all the Independent telephone lines in Southeast Nebraska, Northeast Kansas, Northwest Missouri and Southwest Iowa. All the companies have agreed to the terms of the merger, but the promoters decline to make public any of the particulars for the present. The combination will include all the Independent lines between Omaha and Kansas City, as far west as Lincoln and as far east as Red Oak, Iowa."

## Canadian Telephone News.

The company which is being formed to establish a local telephone system in Russel, Man., and neighborhood is meeting with success and will, it is said, purchase its plant in a short time.

Poles have been delivered for the long-distance telephone line between Lumsden and Regina and from Regina to Indian Head, N. W. T. The Bell Telephone Company expects to be in Lumsden early this summer.

The Bell Telephone Company is building a line between Winnipeg and Boissevain and cars of poles are arriving at Boissevain for the company's long-distance line, work on which is being vigorously pushed from the eastward.

A local telephone system is being formed in Manitou, Man., and a plant will be shortly installed. G. W. Ulyott is mayor.

Seven hundred new subscribers have been added to the Bell Telephone Company's list since the last issue of the local directory in Winnipeg. During the last year 1,400 new circuits have been added, making at present a total of 5,000. The new addition to the building is finished and the removal to the two upper stories will take place at once, when the old building will be remodeled and enlarged. The new switchboard now in course of construction will contain 10,000 circuits and will be in the new portion of the building. Winnipeg has now the third largest telephone exchange in Canada. H.

## Indiana Telephone Items.

The Citizens' Telephone Company of St. Bernice has filed articles of incorporation with a capital stock of $4,000. The company will establish an exchange in St. Bernice, and extend the lines throughout Vermillion County. J. T. Newton, J. P. Hartsock and A. L. Reed are the directors.

The Needmore Telephone Company of Needmore, Brown County, has increased its capital stock from $2,000 to $10,000, to extend the line and to install new apparatus.

In the appeal in the case of the city of Evansville against the Cumberland Telephone Company, set for a hearing May 10th, the case was again continued to October. This is the third continuance. It has been three years since the city obtained a judgment of ouster in the lower courts against the company, but it continues to use the streets and alleys of the city without a franchise.

Rain and electric storms were so severe and general throughout the state during the last week as to occasion great damage to telegraph and telephone property. S.

## Ohio Telephone Notes.

Garney R. Johnson of New York will accept the position of manager of the Citizens' Telephone Company at Columbus, succeeding Frank L. Beam, who resigned to become manager of the Ohio Independent Telephone Association. Mr. Johnson will take charge of the business at once. He is now secretary of the American District Telegraph Company, a position which he has held for some time. Having once lived in Columbus, he is acquainted with the conditions. Mr. Beam will take charge of the work of the association at once and will push forward the organization as rapidly as possible.

C. L. Norton, general toll accountant of the United States Telephone Company, was a passenger on the train that was wrecked on the Pennsylvania road at Harrisburg last Thursday morning. He received a number of injuries, but is not badly hurt.

Farmers in Butler County are erecting telephone lines along Hill, Cameron, Banklick, Springfield and Pippin Roads, the commissioners having granted Paul A. Huston, Edwin Huston and E. M. Barnes franchises for that purpose. It is said that they will connect with the Home Telephone Company's plant at Hamilton.

During the coming season the United States Telephone Company will spend $225,000 in extension of its lines into new territory. Several new wires will be strung out of Columbus, through Circleville and Chillicothe, to Portsmouth, thence to Catlettsburg and Huntington, W. Va. At Huntington connection will be made with lines passing through Southern West Virginia and all the mining region in that section of the state. A heavy wire is now being put up between Cleveland and Erie, Pa., which will give connections to Albany, N. Y. A line will be built direct from Cleveland to Toledo. In the past connections have been made by way of Kent, but the business has grown too heavy for this. The Kent line will be extended to Youngstown, where it will make connection with the Pittsburg line. The business from Albany and Buffalo will be handled over the new Cleveland-Toledo line. Nothing will be done toward getting into Cincinnati, it is said, until the local companies arrange for a plant there.
C.

## Telephone News from the Northwest.

The Wisconsin Telephone Company has completed the installation of a complete new local system at Ashland, Wis., costing $40,000.

The Citizens' Telephone Exchange in Waupaca, Wis., has arranged with the Bell company for long-distance service.

E. C. Kast seeks a franchise at Litchfield, Minn., on behalf of the Twin City Telephone Company, for a local exchange.

W. J. Dwyer seeks a franchise at Medina, N. D., for a local exchange.

Extensive improvements are projected to the telephone-supply manufacturing plant of the Vought-Berger Company at La Crosse, Wis.

The Dakota Telephone Company has been formed at Dickinson, N. D., with $20,000 capital. The company proposes to build a line to Oakdale and other points.

The Walker Telephone Company of Walker, Minn., has been incorporated with $50,000 capital. The incorporators are E. I. P. Staede of Mankato, Minn., Charles Kinkele and others of Walker.

The Northwestern Telephone Exchange Company of Minneapolis has secured a site in North Minneapolis for the erection of a new branch-exchange office building. This will relieve the Main exchange materially and will be the third sub-exchange to be constructed.

The Comfrey Rural Telephone Company of Comfrey, Minn., has been formed.

The Rockham (S. D.) Telephone Company will extend its line to Hand City.

The Mutual Electric Construction Company of Wahpeton, N. D., has been awarded the contract for erecting poles for the Sleepy Eye (Minn.) Telephone Company.

The Great Eastern Telephone Company has been incorporated at Pierre, S. D., with nominal headquarters at Huron, S. D., and a branch for business in New York city. The capital is $30,000,000.

The local telephone exchange at Chisholm, Minn., is to be improved and a new switchboard installed.

The Duluth (Minn.) Telephone Company will install a new switchboard for its office at West Duluth, to accommodate 600 connections.

J. R. Eddy has purchased the Eldon (Iowa) Home telephone system.

The Cedar Valley Telephone Company has sold the line from Jubilee and LaPorte City, Iowa, to the Wettstein Telephone Company.
R.

## The Telephone in Texas.

F. B. McElroy and associates have applied to the City Council for a franchise to establish an Independent long-distance telephone system for Dallas. Fort Worth and other cities will be connected with the system.

The Southwestern Telephone and Telegraph Company has bought the rural telephone system of [illegible] and will [illegible] Lines will [illegible] The company [illegible] system in Galveston. [illegible] will be [illegible] the proposed [illegible] $30,000.

It is probable that the Southern Independent Telephone Company will establish a telephone system in El Paso. The company secured a franchise [illegible] four years ago for the proposed system and considerable work was done on its construction, when it was temporarily abandoned.

The Reeves County Telephone Company is extending its lines from Pecos to Dixieland, a distance of 20 miles, and has also begun a line from Pecos to Tayohvale, a distance of 45 miles.

The Amarillo Telephone Company, of Amarillo, has applied to the City Council to extend its franchise to 20 years. If this is granted the company will make improvements to cost $10,000.
H.

## GENERAL TELEPHONE NEWS.

The Stark County Telephone Company, Toulon, Ill., has increased its capital stock from $6,000 to $20,000.

The Osage Valley Telephone Company of Fulton, Kan., will put in an exchange at Devon and extend the line into the Glendale district.

An application for a franchise for a telephone and telegraph system has been made to the City Council of Reno, Nev., by H. E. Reid and associates.

The young women employed in the operating department of the Home Telephone Company at Kansas City have organized a mutual-benefit association.

A modern fireproof structure, to be equipped on an elaborate scale, will be built at Logan, Utah, during the summer months by the Rocky Mountain Bell Telephone Company.

The Pioneer Telephone Company of Oklahoma City has made arrangements with the farmers in the southeast part of the county to furnish telephones and maintain the lines for $1 a month.

By a tie vote the Assembly of the state of Wisconsin refused passage to the Ekern bill to compel rival telephone companies to make connection for the transmission of messages. The bill had been fought by the Bell company.

The Home Telephone Company of Los Angeles, Cal., has secured rights-of-way between San Diego and Santa Ana for a long-distance service. Application for franchise rights in Oceanside, Cal., will be made at the next meeting of the trustees of that place.

The dates of the coming Chicago convention of the National-Interstate Telephone Association are June 20th and 21st. There has been some misunderstanding about the exact time of the meeting and various dates have been published, but the ones here given—June 20th and 21st—are correct.

The telephone administration in Paris has just introduced a register with a clock face, on the circumference whereof figures indicate 12 minutes, divided into the units of conversation—namely, three, six and nine minutes. When the machine is set a-going the speaker can see precisely how long he has been talking.

The Southern New England Telephone Company, operating in Connecticut, is perfecting plans for an extensive rural service in that state, each subscriber to pay $9 a year. The plan contemplates the construction of the lines by the farmers in the rural districts served, and the ownership thereof, the company making connections from designated central exchanges.

It is given out that a movement is on foot looking to a combination of six telephone companies in Virginia, Maryland and Delaware. The scheme will be presented to the stockholders at the coming annual meetings, and it is believed that arrangements will be perfected for the merger early in June, the new concern to be known as the Diamond State Telephone Company.

## MANUFACTURERS AND DEALERS.

Estimate blanks for telephone exchanges have been often printed, but the one now issued by the F. Bissell Company of Toledo, Ohio, is very complete. It covers four pages, each of two columns, and may be had free for the asking.

The Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., reports that it has closed contracts for switchboards for the following places: Quimby, Ohio; Rice Lake, Wis.; Roosevelt, Ariz.; Essex, Iowa; Breeds, Ill.; Linn Grove, Iowa; Buffalo Hart, Ill.; Baldwin, Wis.; Ostrander, Minn.; Litchfield, Mich.; Lawnridge, Ill.; Louisville, Ky.; Columbus, Ohio; Adena, Ohio; Nome, N. D.; Plymouth, Neb.; Conotton, Ohio; Kernersville, N. C.; Clatonia, Neb.; Willshire, Ohio; and Trivoli, Ill.

## Additional Papers and Reports for National Electric Light Association.

[illegible] Blood, Jr.; [illegible]

## New Mercury-arc Rectifier.

The demand for [illegible] outfit for electric automobiles, launches and for similar service, has been met by the General Electric Company, in its new mercury-arc rectifier, illustrated herewith.

The [illegible] into direct current without rotating machinery is flexible and can be supplied to meet a wide range of conditions. A [illegible] are illustrated herewith.

The mercury-arc rectifier has the advantages, over

FIG. 1. LATEST FORM OF RECTIFIER TUBE.

any motor-generator set of the same output, of higher efficiency, lower first cost, lower maintenance cost and greater reliability and convenience in the hands of non-technical users. Its noiseless operation and freedom from need of expert handling make it especially valuable for the use of physicians and surgeons, who have hitherto been obliged to have their storage batteries for surgical use carted to and from a charging station. It requires practically no attention beyond starting, and may be operated by any man of ordinary intelligence, such as a coachman, general mechanic or man of all

FIG. 2. DIAGRAM OF MERCURY-ARC RECTIFIER CONNECTIONS.

work—a feature which is building up a demand for the apparatus in private installations and in small and medium-sized automobile repair shops and garages.

The rectifier outfit may also be adapted for use in small telephone offices, where the amount of business does not warrant the constant attendance of an inspector, but where the growing use of the "common-battery system" requires a storage battery as part of the equipment.

Fig. 1 is a view of the latest form of rectifier

tube for converting single-phase alternating current to direct current, with the terminals lettered to correspond with the diagram of connections shown in Fig. 2. The alternating-current mains are connected to the terminals (A) (A) through an adjustable reactance, and the direct current is taken off at terminal (B) and the middle of the reactance.

Fig. 2 is a complete diagram of the rectifier-outfit wiring, by which it is possible for varying the connections to obtain any direct-current voltage between 16 and 46 volts when operated on a 110-volt alternating-current circuit, and any direct-current voltage between 46 and 115 volts when operated on a 220-volt alternating-current circuit.

Fig. 3 is a front view of a complete rectifier

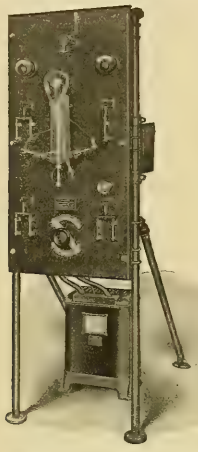

FIG. 3. FRONT VIEW OF COMPLETE RECTIFIER OUTFIT.

outfit of 20 amperes or 30 amperes direct-current capacity, with the compensating reactance for controlling the direct-current voltage placed on the floor back of the panel.

## Single-phase Integrating Induction Wattmeter.

A new type of single-phase, integrating-induction wattmeter embodying many new features of merit has been developed by the Fort Wayne Electric Works of Fort Wayne, Ind., and is known as the type W. Of the accompanying illustrations Fig. 1 shows a front view of the wattmeter with the cover removed; Fig. 2 is a side view also, with the cover removed, while Fig. 3 shows the gauge-adjusted magnet, which is an important feature.

All connections with the line are made inside

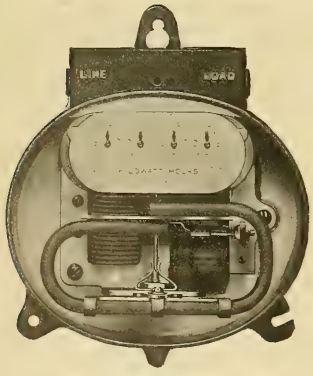


FIG. 1. FRONT VIEW OF WATTMETER WITH COVER REMOVED.

a separately sealed terminal box on top of the meter to binding posts effectually protected from accidental short circuits. No shunt-circuit wires need be extended and no soldered connections need be made outside the meter. Both sides of a two-wire circuit or the outside wires of a three-wire circuit pass through the terminal box.

The meter is provided with four dials, which are easily read at a distance, the smallest readings being given in kilowatt-hours.

The upper bearing for the rotating shaft is inverted, the end of the shaft being hollow and rotating about a stationary flexible-tempered steel needle mounted in the top-bearing stud. This flexible feature eliminates noise of vibration and the hollow top of the shaft permits lubrication if desired, without the possibility of oil being drawn to the wormwheel by capillary attraction.

The rotating element is a small lightweight aluminum disk mounted on a short phosphor-bronze shaft and held in place on the shaft by a set-screw in a collar in the disk. It can be adjusted vertically very readily to permit adjustment with the air gap of the magnet.

A novel feature is the permanent or drag magnet in front of the shaft, as shown plainly in the side view and in detail in Fig. 3. It is at-

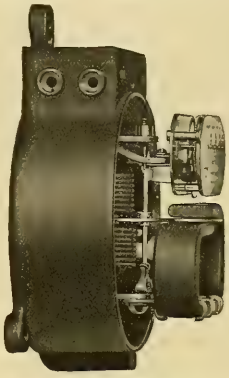

FIG. 2. SIDE VIEW OF WATTMETER WITH COVER REMOVED.

tached to the lower bearing bracket by two screws engaging with slotted lugs on the magnet clamp. Its position with relation to the center of the disk is maintained by a sliding gauge, which can be locked. After the gauge is set the magnet may be removed and replaced freely without further adjustment, as the gauge is a part of the magnet clamp and is not changed by the removal of the magnet.

Two series coils are fitted to spiders, each attached to the main frame with a single screw and located opposite the shunt coils in the back of the meter. For three-wires curcuits they are double-wound to avoid the effects of unbalanced loads.

The shunt coils are mounted on the upper and lower arms of the magnetic circuit. The meter, for 60-cycle circuits, has a lagging connection on the outside of the lower shunt coil for 60 cycles only. The 140-cycle meter has a 140-cycle lagging connection on the upper shunt coil, in addition to the 60-cycle connection below, and can be altered for use on the lower frequency.

Light-load adjustment is made by shifting a copper plate in the magnetic path or air gap of

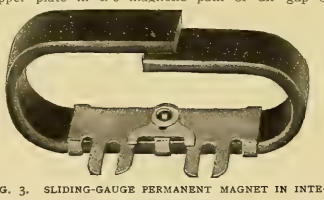

FIG. 3. SLIDING-GAUGE PERMANENT MAGNET IN INTEGRATING WATTMETER.

the motor magnet in which the disk revolves. The movement is made by a micrometer screw, in combination with a guide bar. A small setscrew locks this adjustment.

The meters are wound for 110 and 220-volt two and three-wire service. It is made also for four different amperages, five, 10, 20 and 40 amperes, without transformer.

## Comparative Cost of the Gas Engine.

In a paper which came recently before the attention of the Glasgow University Engineering Society the author, Mr. A. Marshall Downie, instituted some interesting comparisons, from a commercial standpoint, of the efficiency of the reciprocating steam turbine and gas type of engines. Mr. Downie proceeded on the basis of the production of electrical energy on an assumed output of 14,200,000 units per annum, with a load factor of 30 per cent. The author took for the steam engine the figure of 3.3 pounds of coal per kilowatt-hour, for the steam turbine four pounds, and for the gas engine the consumption of coal per kilowatt-hour, with the load factor stated, was taken at 1.75. The conclusion arrived at by the author on these figures was that the gas engine is the prime mover of the future from the commercial standpoint. The author pointed out that the question of gas residuals was not taken into account in his figures; but that if recovery plants were installed the by-products realized would in some cases be almost sufficient to pay the coal bill.

## Nernst Street Lighting in New England.

West Hartford, a beautiful suburb of Hartford, Conn., serves as the location for the residences of the business men of the latter city, there being very little commercialism and no manufacturing in this immediate vicinity. While its streets are of generous width, they are for the most part lined with large shade trees, so that in the consideration of a proper system for lighting the streets, it was deemed advisable to place the source of illumination as much below the foliage as practicable. For this reason it was decided to use a system of small units, placing them well under the foliage and somewhat closer together than usual. The choice lay between the single-burner gas lamp and the single-glower Nernst lamp, the final decision being in favor of the electric system as having a higher practical efficiency and lower running cost.

The Hartford Electric Light Company is now supplying the Nernst single-glower units to the

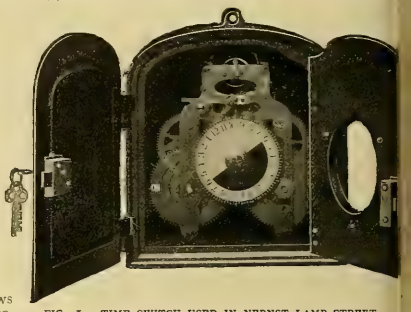

FIG. 1. TIME SWITCH USED IN NERNST LAMP STREET LIGHTING.

borough of West Hartford for $18 a lamp-year on an all-night schedule of 3,750 hours, whereas the 60-candlepower gas unit would not be furnished under $27 a year, using artificial gas at $1 a thousand.

The 60-cycle current, supplied both for the house and street lighting of West Hartford, is generated at the main power plant of the Hartford Electric Light Company at Tariffville, 14 miles away. From there it is transmitted at a pressure of 11,000 volts, three-phase, to the sub-station in Hartford. Here it is stepped down to 2,400 volts, single-phase, and is carried over two-wire mains to West Hartford, four miles distant. Then the current is again lowered to 230-115 volts pressure for the Nernst and incandescent lamps, respectively, by means of five-kilowatt transformers with three-wire secondaries, the neutrals of which are grounded.

One of the outside wires supplying the Nernst lamp is led through a time switch, which may be set to throw the lamps on or off at any desired time. This switch is similar to the one shown in Fig. 1.

The primaries of the transformers are fed through single-pole high-tension fuses, lightning arresters being used on the mains only at the Hartford sub-station.

With the exception of one six-glower unit, located in the center of the district, the installation at present consists of 224 one-glower lamps. These are grouped on 13 separate circuits, the number of lamps on each varying from 10 to 28, and each circuit being supplied from a five-kilowatt transformer, centrally located.

The lamps are mounted, as shown in Fig. 2, at an elevation of about 20 feet on standard goose-neck brackets, such as are used in series incandescent systems. The illustration also shows the mounting of the high-tension fuses, transformers and automatic time switch, the latter being placed on the pole within easy reach from the ground. The lamps are placed on alternate poles, with a regular spacing of 200 feet.

While the lamps were originally equipped with clear globes, these are gradually being replaced as they become broken with opalescent globes, as the latter seem to give the best results.

The system is regularly patroled each day before 8 a. m. and after 4:30 p. m. by three boys mounted on bicycles. Each boy carries in a suitable case a number of repaired holders with which he replaces any burnt-out holders he may discover. The latter are returned to the maintenance department for repairs. In addition to this repair work, all the inspection and repairing necessary in connection with the Nernst installations in the city of Hartford, amounting to a total of about 2,500 glowers, are done by a young man located at the lighting station.

The records kept by the company indicate that the total average cost for maintenance of the commercial and street-lighting system amounted to $1.26 per glower for the first six months of last year. This represents the most recent data available. The exact cost of the street-lighting maintenance cannot be determined, as this was not kept separate from the commercial-lighting records.

The regulation is said to be within five per cent.,

that is, 2½ per cent. either side of normal, and the life of the glowers is found to be slightly in excess of 800 hours on an average. Inasmuch as No. 6 wires are used for the secondaries, there is no appreciable drop between any transformer and the most distant lamp on the circuit.

That the system is giving excellent satisfaction to all concerned is evidenced by the fact that the company has been asked to install 18 additional street units in the near future.

The villages of Unionville and Farmington, distant 13 and nine miles, respectively, from the city of Hartford, both have Nernst street-lighting systems similar to that in West Hartford, and are supplied with current from the power plant located at Unionville.

FIG. 2. VIEW SHOWING LAMP BRACKET AND SWITCH BOX IN NERNST STREET-LIGHTING INSTALLATION.

Although not over 200 horsepower in capacity, this plant is strictly up to date in its design and equipment. The normal lighting load of 80 horsepower is supplied from a 75-kilowatt three-phase generator driven by a water turbine. An extra steam-generating unit with sufficient capacity to carry the normal load of the station is held in reserve. The three-phase 60-cycle current is transmitted at 2,300 volts pressure from the station to the step-down transformers in both villages, over three No. 4 main conductors. The transformers, which are mostly of 10-kilowatt capacity, are connected to these mains through General Electric high-tension cut-outs and Wurts lightning arresters. The line has also the usual lightning protection at the station.

Both the Nernst street lights and the commercial Nernst and incandescent lighting are supplied from these transformers through three-wire 112-224-volt secondaries of No. 8 gauge, giving a maximum drop of eight volts from the transformer to the most distant street lamp, with a regulation of three per cent. above normal.

The system, with a total of 188 single-glower lamps, is divided up into six circuits of approximately 28 lamps each; of the total, 77 lamps are used for street lighting in Unionville, 86 for street service and 25 for commercial service in Farmington. The street lamps are mounted similar to those in West Hartford on standard goose-neck brackets at an average elevation of about 30 feet, with a spacing of from 125 to 375 feet between lamps, depending upon the location.

All the lamps are inspected and the necessary renewals made by a boy once every two days. The glowers are allowed to burn out their natural life, and the complete records show an average life of 803 hours, with a total cost of maintenance a lamp-year, including labor, interest and depreciation, of $2.80, or 8½ mills a kilowatt-hour.

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Information has been given out of the trial recently held at Schenectady, of one of the General Electric Company's new electric locomotives intended for the express-passenger traffic on the New York Central railroad. The electrical engine was haced against a steam locomotive of the powerful Pacific type, each drawing a six-car train. Both trains started together, and the electrical locomotive gained an acceleration of 50 miles an hour in two minutes and seven seconds, as against three minutes and 23 seconds for the other. At 500 yards from the starting point the electrically propelled train was a full length ahead. Scientific and highly exhaustive tests are in progress at Schenectady as to the theoretical and practical efficiency of the electric trains.

## New Automatic Starters for Induction Motors.

Induction motors may be started by connecting them directly to the supply circuit, and usually however, being only used with [illegible] power or under. Under these conditions the current at starting draws a great [illegible] causing a heavy drop in the supply [illegible] and throwing heavy [illegible] on the winding of the motor. For these reasons it is necessary to provide some form of auto-starter. Two new types of [illegible] starters have recently been developed, one by the Westinghouse Electric and Manufacturing Company of Pittsburg and the other by the American Electric and Controller Company of New York. Descriptions of these interesting devices follow.

The Westinghouse company's starter is of the oil-immersed type for use with all sizes of constant-speed induction motors from five to 2,000 horsepower of various voltages, frequencies, and two and three phase. The one shown with covers removed in Fig. 1 was constructed for the control of a 1,400-horsepower, 2,200-volt motor. The switches, circuit breakers and operating devices only are mounted in the case, and, since the auto-transformers are standard, they are not shown.

This controller, known as type 197, has eight starting points and one running point. At the first starting notch a low voltage is impressed on the motor, and, as each succeeding notch is passed, the voltage is increased until the full line potential is reached and the motor attains its running speed. The motor circuit is never opened in passing from one starting point to another, as preventive resistances are inserted between the different notches. Destructive arcing and wear on the contacts are thus prevented, as are also the fluctuations in the line due to starting the motor. Two auto-transformers mounted outside the case, in connection with the preventive resistances, furnish the necessary reductions in voltage for starting.

The controller is equipped with two automatic line circuit breakers and two non-automatic breakers upon which the circuit is broken when changes in voltage are made, thereby saving the current-carrying contacts of the drum switches. By the first turn of the hand-wheel the circuit breakers are closed and the motor is connected to the first point of each auto-transformer, both direct and through the preventive resistances. The next step connects the motor through another set of resistances to the next higher voltage, disconnects the motor from the lower voltage and finally short-circuits the resistance on the higher voltage step. This is continued with each of the eight steps until the motor is connected to full-line voltage.

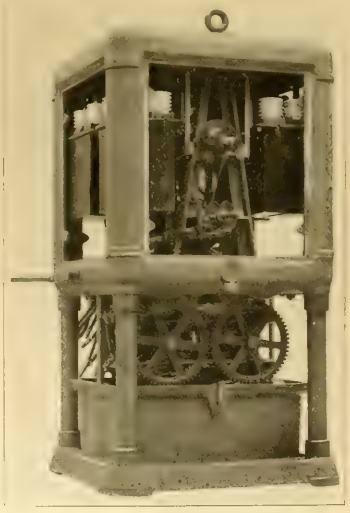

FIG. 1. WESTINGHOUSE OIL-IMMERSED TYPE OF INDUCTION-MOTOR STARTER.

Two non-automatic circuit-breakers are actuated by cams connected to the shaft, beneath the words "off" and "on," and operated by a hand-wheel not shown. This shaft is turned through 180° for each notch of the controller, the change from point to point being shown on the indicator below the wheel. At any position a slight backward turn of the hand-wheel will cause the main-line circuit-breaker to open, and the word "off" to replace the word "on," and seen through a hole in the front cover when the latter is in place. An overload on the motor will also cause this breaker to open. In either case it is necessary to return the wheel to the initial starting position before the circuit-breaker

[illegible] starting, thus increasing [illegible]

[illegible]

[illegible] tion for the motor running. A float-switch is shown in the upper [illegible]

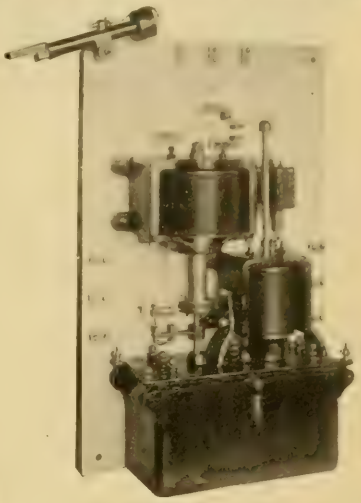

FIG. 2. AMERICAN ELECTRIC AND CONTROLLER COMPANY'S INDUCTION-MOTOR STARTER.

or thermostat, having electrical contacts, or any suitable device, acts at the proper time through a small relay at the right of the large upper solenoid, trips a latch and causes the main switch to open at the same time, leaving the circuits ready for starting again.

To start the motor, the large upper solenoid is first energized, which lifts the plunger and rod. The latter throws the auto-transformer switch, at the same time cutting off the current in the solenoid and allowing the plunger to fall very slowly by gravity against the retardation of the dashpot. The transformer switch in the meantime remains closed long enough to permit the motor to reach full speed. The plunger has then fallen to its lowest point and makes the connection which energizes the lower solenoid and closes the main switch across the line, throwing out the transformer switch by the same movement and completing the cycle.

The starter for the slip-ring type of motor is similar in principle, but the plunger of the large upper solenoid carries a cross-arm which makes sliding contact with a straight-line set of contacts connected to grid resistance in the circuit of the motor secondary. The lower solenoid shown in Fig. 2 is dispensed with altogether.

A device may be added to the slip-ring type of resistance starter, making it possible to hold the cross-arm and plunger at any desired point along the row of contacts, thus making it serve as an automatic speed regulator as well as starter.

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One of the large contracts let for power machinery during the month of April was that for the extension of the hydraulic and electrical equipment of the San Joaquin Power Company of Fresco, Cal., where 3,000 horsepower will be installed. In addition to the hydraulic turbine for producing this power the machinery will consist of two 1,000-kilowatt Bullock waterwheel-type alternating-current generators, seven 350-kilowatt and four 500-kilowatt transformers, with exciters and other apparatus. The transformers will be oil-filled and water-cooled. The generators will produce a three-phase, 60-cycle alternating current. A voltage of 33,000 will be used over the 76 miles of transmission. This current will be used for general power purposes and particularly to drive pumps to irrigate the San Joaquin Valley.

## Light-balancing Selective Diffuser Ceiling.

One of the latest achievements in scientific diffusion of light for interior illumination is the light-balancing selective diffuser ceiling system of the General Electric Company. This system, which possesses many valuable qualities, was described quite thoroughly by Mr. W. D'A Ryan at the meeting of the Chicago branch of the American Institute of Electrical Engineers, held March 28th. While the enclosed arc light furnishes, in many respects, ideal features for interior lighting of stores, etc., it has the fault of failing to distribute the light uniformly,

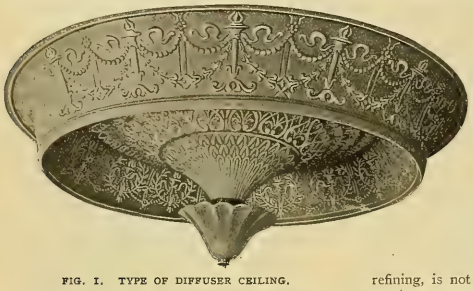

FIG. 1. TYPE OF DIFFUSER CEILING.

due largely to the moving about of the crater on the upper carbon tip. The diffuser system here described is intended to do away with this fault and to produce a steady and uniform light in all parts of the room.

The diffusers consist of a circular ceiling, as shown in Fig. 1, of pleasing design, in the center of which, and somewhat below, is hung the arc lamp. The lamp itself is not visible from below, as a reflector is hung beneath the lamp, shaped like

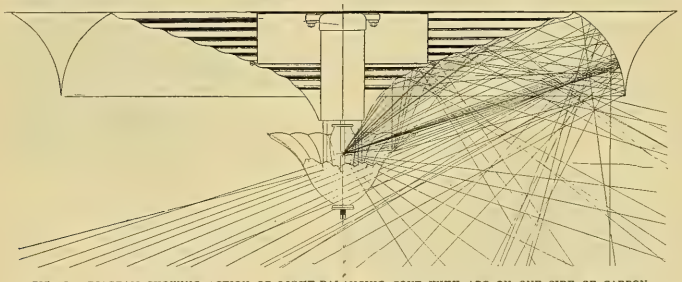

FIG. 2. DIAGRAM SHOWING ACTION OF LIGHT-BALANCING COVE WITH ARC ON ONE SIDE OF CARBON.

an inverted bell, which reflects the light upward to the ceiling, from whence it is again reflected in a downward direction to the lower parts of the room. Fig. 3 shows the method of hanging the lamp and the bell-shaped reflector. The light in the immediate vicinity of the lamp is greatly softened and the intensity at points midway between the lamps is increased, while dark shadows are dispersed, and the general effect is an even intensity of light in all parts of the area illuminated.

The lamps are placed as high as the ceilings will permit, and are out of the direct line of vision. The intrinsic brilliancy is reduced by the lower shade, so that the light is not trying to the eyes; moreover, the change in intensity of the light in different parts of the room, due to the wander-

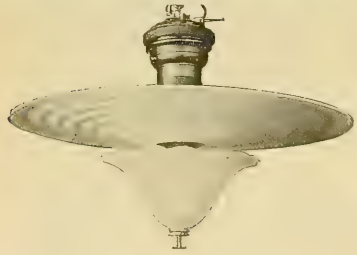

FIG. 3. METHOD OF HANGING LAMP AND DIFFUSER.

ing of the arc, is counteracted by the "light-balancing cove," which maintains a relatively steady light in all directions, independent of the position of the arc. This balancing cove or corona is particularly useful where ceilings are high and in small rooms where there are one or two lamps. In large areas, where a number of lamps are used, even illumination is produced by the accumulated light from the different lamps, so that the corona is not so essential. In such rooms, especially if the ceiling is low, an appropriate molding is substituted for the corona.

In cases where it is not desirable to install a complete ceiling, the diffuser section, either with corona or molding can be used with excellent results esthetically as well as from a lighting point of view.

Fig. 2 is a diagram showing the action of the light-balancing cove when the position of the arc crater is at one side of the carbon tip. It is to be observed in this case that the arc is on the right side, and ordinarily the light would be much brighter on this side than on the other. Following the lines of reflection, however, it is seen that the distribution of light at the lower levels is nearly uniform, which is practically true whatever the position of the luminous point on the arc.

## Temperatures of Copper-refining Solutions.

In a paper read before the American Electro-chemical Society, at the convention held in Boston this month, by Prof. Charles F. Burgess of the University of Wisconsin, the author gives the results of experiments which go to show that the lowering of the voltage in an electrolytic cell, such as is used in copper refining, is not proportional to the increase of temperature, regardless of the distance between the plates. On the other hand, the temperature effect is far more marked when the electrodes are close together than when they are far apart. In other words, the apparent temperature coefficient is dependent upon the distance between electrodes, being greatest when the electrodes are close together.

It is not warrantable, therefore, to say that the most economical temperature in a cell with the plates one centimeter apart is the most economical for a cell with the plates one-half inch or 1¼ inches apart, as in the series and multiple refining systems, respectively.

The pressure between the two electrodes of a copper-refining tank is the sum of two quantities, the polarization pressure and the drop caused by the current flowing through the electrolyte. The former is small and may be considered as practically constant for a given solution, being influenced very slightly by the temperature. The IR drop through the electrolyte varies, however, in a marked degree with change of temperature, and it is this variation which causes the falling off in applied pressure necessary to pass a given current through the cell as the temperature rises.

An explanation for the marked variation in temperature coefficient with various distances between electrodes is afforded in that phenomenon which Gore chose to call "transfer resistance," defined by him as "a species of electric resistance distinct from that of polarization and ordinary conductive resistance, varying greatly in amount in different cases, which exists at the surfaces of mutual contacts of metals and liquids in electrolytic and voltaic cells," and "this resistance varies largely in amount with different metals in the same solution, and with the same metal in different solutions." Gore measured the effect of this "transfer resistance" by means of the heating effect on the air enclosed in a thin platinum electrode.

If there exists a resistance at the electrode surface apart from the resistance of the electrolyte itself, of such nature that it has a great temperature coefficient, in that fact rests an explanation of the dependence of the apparent temperature coefficient of an electrolyte upon the distance between the electrodes, the reduction of the "transfer resistance" producing a greater proportion of the total change when the electrodes are close together than when farther separated.

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Experts who have been examining the Grand River dam proposition say, according to news from Muskogee, I. T., that power can be furnished to Muskogee cheaper than it is now furnished to any other city in the United States.

# CORRESPONDENCE.

## Great Britain.

London, May 3.—Once again the question of municipal trading is occupying attention, and one or two notabilities have been theorizing upon its evils. What may be called the practical side, however, received a good dal of notice during the inquiry into the large electric-power scheme for London, when it was the boast of the promoters of the scheme that they could supply the London borough councils cheaper than they themselves could generate. The position of the London councils in the matter of electric supply is a peculiarly unequal one, for, whereas several are distinctly paying undertakings, the remainder are in various stages of financial instability. The case of the Southwark Borough Council is a case in point, which, if anything, should give support to the contentions of the promoters of the scheme above referred to. As it happens, in the district of the Southwark Borough Council, an important district bordering on the city on the south side of the Thames, there are several companies in competition over a large portion, while in a small portion the local authority has a monopoly. Curiously enough, in the area served by one of the companies, but not touched by the local authority, the street lighting is by gas, whereas in the area served by the local authority the street lighting is by electricity. Some time ago the company in question offered to supply electricity to the local authority in its district, for public lighting, at a price below cost price at the council's own works, but, although the council could not itself supply in the portion of the district in question, the offer was refused. Such are the relations here between private and municipal trading.

So much for the past history at Southwark. This matter has been further brought to a head recently by another offer by the same company at a still lower figure, which, however, has been referred to a committee. An inquiry has also been made as to the amount of the deficit upon the electricity undertaking of the council, but the information is withheld, owing to the fact that opposition is being made to the big power scheme. One member of the council has now given notice to move that, in view of its heavy cost to the ratepayers, the undertaking should be sold as a going concern. Such bad management naturally tends to have an evil influence upon the electrical industry, a fact which has been often pointed out, but in this case the evil effect will be the more by reason of the local authority in question being a leading London borough, and not an insignificant provincial town council.

The license to erect a municipal telephone exchange which the postmaster-general granted to the Huddersfield corporation in 1901 has been withdrawn, owing to the corporation, after having received the license, displaying a want of unanimity as to whether a municipal system should be embarked upon. In this way considerable delay was occasioned, and hence the action of the postmaster-general referred to above.

The Tramways Exhibition, which is held biennially in London, will be held this year, and will be opened on July 4th.

The question of liability for accidents on tramways does not seem to have been very seriously considered in this country by the large number of tramway owners which now exist. The leading tramway association in Great Britain has recently been inquiring into the matter, and, out of 131 replies, no less than 107 undertakings have taken no steps in the matter to guard themselves against excessive claims, although it must be admitted that the number of claims all over the country is small. Only eight undertakings have entered into third-party insurance, and, while 16 have taken steps to limit their liability to £25 for each accident, by issuing tickets at lower fares than the normal statutory prices and expressly stating this on the tickets, of these 16, 10 are companies and six local authorities.

In relation to the discontent of the employes of the National Telephone Company as to their prospects of being taken over by the government when the telephone system of the country is transferred, it is now stated that the postmaster-general has given something akin to an undertaking, that he will give employment to the whole of the present staff. Many members of Parliament say they will urge such a condition to be embodied in the agreement when it comes before a parliamentary committee.

A further instance of the efforts of the Local Government Board to keep down municipal expenditure upon schemes with the slightest element of risk in them has occurred at Torquay, where it was proposed to build a second generating station. The loan has been practically refused, however, on the ground that the present undertaking has entailed a loss.

G.

## New York.

New York, May 13.—Routes for four new four-track subways, running the length of Manhattan Island, were laid before the rapid-transit commissioners on Friday, and earlier in the week the publication of the quarterly report of the Interborough Rapid Transit Company showed a daily

average of 1,000,000 passengers a day, with greatly increased earnings. Details of these matters appear in another column.

George S. Rice, acting chief rapid-transit engineer, announced yesterday that subway trains will be running between Fulton Street and the Battery within six weeks. Within the same period the subway cars will also be running through to the Bronx via the Harlem River tunnel.

An evangelistic tent at Greenpoint, Brooklyn, is to be lit by electricity during the coming summer. The tent measures 40 by 60 feet, and the incandescent lamps are strung between the poles and in a cluster over the platform. The current is brought through from the mains of an adjoining church.

Writing to the New York Times on Wednesday, a Niagara Falls resident argues that the amount of water likely to be taken from the Niagara River for the proposed Ontario power canal would be as insignificant at the Falls as the water flowing into a ferry slip from the Hudson at New York. "If," he adds, "this scheme is unworthy, let it be killed; but do not let it be destroyed by a sentimental lie."

W. S. Harper of Brooklyn, W. F. Bissell and D. O. L. Colahan of New York have organized the Nicholas Quadrille Traction, Vehicle and Power Company, with a capital of $300,000.

The telegraphers employed on the New York, New Haven and Hartford railroad will be affected by the introduction of the Brown system of enforcing discipline, to go into effect on June 1st. The Brown system is a means of recording merit and demerit. D. W. W.

## Southeastern States.

Charlotte, N. C., May 13.—It is announced that a $1,000,000-lock-and-dam power plant will be erected at Hales' Bar on the Tennessee River by J. C. Guild and C. E. James of Chattanooga, Tenn. Notice of the contemplated project has been given at the United States engineer's office at Washington.

The streets of Dallas, Ga., are now lighted by electricity.

Drake, Harkee & Co. of Philadelphia have the contract for building the electric railway between Winston and High Point, N. C., the road to cost about $400,000. Work has been started on the line.

The town of King's Mountain, N. C., has voted $15,000 of bonds for an electric-light plant.

A syndicate is said to be investigating the building of an electric railway over the Wilkesboro-Jefferson Turnpike in North Carolina, near the Blue Ridge Mountains.

The Virginia Valley Traction Company is chartered at Staunton, with H. B. Sproul president and H. G. McGary secretary and treasurer. The company will operate railroads with steam or electricity as motive power.

The Mount Gilead (N. C.) Telephone and Electric Light Company has been chartered, with a capital of $25,000, by J. R. Blair and others. L.

## Ohio.

Cleveland, May 13.—Youngstown men have gained the control of the Youngstown and Southern Railroad Company by purchasing $900,000 of the $1,800,000 stock. This, with some other stock already owned in a pool, places the control at home. It is announced that the road will be completed as a third-rail electric system at once. It has been operated as a steam road from Youngstown to Columbiana for some time. When it is completed to East Liverpool it will be 75 miles in length. James A. Campbell, A. E. Adams, Richard Garlick, R. C. Steese and John Stambaugh are some of the well-known men interested in the deal. Lieutenant-governor Jones, who promoted the road, John H. Ruhlman and Baker & Phelps of Boston retire. The road taps some rich coal lands, which may be developed.

A car on the Lake Shore jumped the track on the high bridge over Rocky River at the west end of Cleveland, Saturday, and narrowly missed going into the water, nearly 100 feet below. As it is, the front trucks are hanging over the side of the bridge. The motorman stuck to his place and applied the brakes, the conductor succeeding in getting the 16 passengers out safely. President Warren Bicknell of the company was on the car.

The Circuit Court at Chillicothe has reversed the decision of the lower court to the effect that electric roads are amenable to the same law as steam roads respecting grade crossings. The court holds that interurban roads are subject to the laws that were enacted for the governing of electric street railways.

It is reported that the Postal Telegraph Company may build a telegraph line along the right-of-way of the Big Four railroad from Berea to Union City.

M. J. Loftus has been made superintendent of the Dayton, Springfield and Urbana road and other allied lines out of Springfield and in that section of the state which were built by the Appleyard interests. Mr. Loftus was formerly connected with the Central Market road at Columbus. Two parlor cars are to be put on between Columbus and Dayton within a short time.

Refunding bonds to the amount of $25,000 have been authorized at Hamilton to pay off bonds issued for the waterworks and electric light plant.

J. J. J. Sloat has been made general manager of the Northern Traction Company, which owns the Cincinnati, Dayton and Toledo line. Several other officers have also been changed.

On the Akron, Bedford and Cleveland electric railway at the Humboldt Street viaduct in this city Monday a car jumped the track, broke through the railing and stopped after a portion had gone over the edge of the structure, which is 60 feet high. The car contained 60 passengers and only one was injured slightly. The motorman and conductor stuck to their places and got the people out as soon as possible.

H. P. Clegg of the Dayton and Troy and Valentine Winter of the Dayton and Western were in Cincinnati in consultation with W. Kelsey Schoepf of the Northern Traction Company a few days ago. It is said that Mr. Schoepf is looking for a link of his Ohio road west to connect with some of his Indiana lines and that the conference was in reference to this matter.

An injunction suit has been brought against the Board of Public Service and the Urbana Light Company of Urbana to prevent a new contract going into force. It is said that the old contract which has some time to run, was cancelled and a new one made that calls for $700 more for city lighting.

The Wilmington, Jamestown and South Solon Electric Railway Company of Wilmington has been incorporated with a capital stock of $10,000 by A. J. Wilson, B. F. Patterson and others.

The car barns of the Rapid Transit Company of Tribenis, east of Dayton, are reported to have been burned during a storm last week. Three cars were also burned. Lightning started the fire.

The settlement of a condemnation suit a few days ago gives the Scioto Valley Traction Company a clear right-of-way between Columbus and Chillicothe. From several sources it has been reported that the Union Traction Company of Ohio will soon be formed to take over the properties of the Union Traction Company of New Jersey, the capital stock being something like $16,000,000. The new company would own the lease of the Cincinnati street railway, the Cincinnati Interurban Company, the Cincinnati Car Company and the Cincinnati Zoological Gardens. The change is for the purpose of having the company incorporated in the state where the assets of the company are located.

It is reported that the Norfolk and Western, the Big Four and the Baltimore and Ohio are planning to meet trolley competition in Central Ohio, particularly that of the lines running out of Columbus. The Hocking Valley has already made the same rate between Columbus and Lancaster as that of the Scioto Valley Traction Company. O. M. C.

## Indiana.

Indianapolis, May 13.—At a conference held in Fort Wayne this week, J. Levering Jones of Philadelphia, James Murdock of Lafayette and local officials of the Fort Wayne and Wabash Valley Traction Company, decided to build an electric road from Fort Wayne to Marion by way of Bluffton. Contracts for grading and material will be let at once for 50 miles of road. Ground will be broken next week for the new $1,000,000 power house in Fort Wayne to supply power for the traction and interurban lines of the company, and for the electric lighting of the city. The power plant will be equipped with four 1,500-kilowatt turbine units.

It is currently reported that Hugh J. McGowan and associates have obtained an option on the Indianapolis and Martinsville traction line, and will soon take over the property. Secretary Payne acknowledges that the officials have been approached on the subject. Charles W. Smith, the heaviest stockholder, is home from Texas.

The Indianapolis and Northwestern Traction Company announces that it will erect a handsome terminal station in Lafayette this summer. The building will be located on the market space on North Fifth Street.

Experiments conducted by representatives of the Westinghouse Electric and Manufacturing Company on the Rushville division of the Indianapolis and Cincinnati traction line, show that the cars now in service on this division are capable of making 55 to 60 miles an hour between Rushville and Indianapolis, including the regular stops. The experts say that the Rushville line will be the fastest in the state, and that no difficulty will be had in maintaining a schedule of 60 miles an hour when the roadbed is finally completed.

The Seagraves syndicate of Toledo, which has a franchise through the city of Auburn and Dekalb County for an electric railway, has begun work on the line. The syndicate already has a line in operation from Toledo west nearly to the state line.

The directors of the Winona Assembly have awarded the contract for the construction of the Warsaw-Goshen electric railway to a New York construction company, represented by John B. Marshall.

A. W. Fishbaugh, chief engineer for the Fort Wayne and Springfield Traction Company, completed the survey for the Fort Wayne-Portland [illegible] and will be given a practical test on [illegible] on the Northern Indiana [illegible] bash. The system is manufactured by the McClintock Manufacturing Company of St. Paul, and the tests will be made by Edward McClintock, a representative of the company, who says that it will be found practicable [illegible]

The 1,000,000-volt transformer installed in Purdue University, under the supervision of Prof. J. Walter Esterline, is attracting the attention of electrical engineers. It is expected that results will be obtained which may revolutionize high-voltage transmission.

An inspection in Anderson has revealed that in a great many places people have been getting electric light free, and an effort is being made to discover who wired the houses with the purpose of defrauding the electric-light plant, which is owned by the city. The wire was attached with a loop wire, immediately behind the meter and joined to the service wires in front of the meter, the current thus not registering.

Articles of incorporation have been filed by the Laycock Power House Company of Indianapolis, with a capital stock of $250,000, for the purpose of erecting and installing a large power house to furnish space and power for small industries and manufacturers under one roof. T. B. Laycock is president, Charles E. Coffin, vice-president, and Charles E. Holloway, secretary.

The union electrical workers who are striking for an increase of wage, have organized a co-operative company for taking care of electrical contracts, and will compete with their former employers for the electrical work in Indianapolis.

The Evansville Battery and Electrical Company has incorporated with a capital of $100,000. The company will manufacture automobiles and other electrical vehicles, and electrical devices and machines, in the city of Evansville. Willis M. Copeland, A. F. Korges and H. C. Porter are the directors. S. S.

## New England.

Boston, May 13.—The mayor of Cambridge, Mass., has prepared plans and a proposition for a two-tube tunnel, accommodating four tracks, to be constructed under Charles River from Boston to Cambridge. It is proposed by the mayor that the Boston Elevated Street Railway Company, which now has a franchise under legislative sanction for an elevated structure in Cambridge, shall accept in the place thereof a subway franchise, the route to be from the subway and tunnel terminals in Boston, and under the principal thoroughfare in Cambridge, to Harvard Square, in the vicinity of the Harvard University site. The chief objection on the part of the railway company to the relinquishment of its present franchise is found in the fact that it obtained a most advantageous bill from the legislature, whereby it has what may be termed a location in perpetuity in the streets of Cambridge for an elevated structure.

Plans have been made for a new electric railway from Ayer to Boston, the company having a capital of $1,500,000, and the line to be under the same control as the Fitchburg and Leominster and the Leominster, Shirley and Ayer street-railway companies. It will be entirely over private way from Ayer to Cambridge, via Littleton, Acton, Concord, Lexington and Belmont, so that high speed can be attained.

The Consolidated Street Railway Company, controlled by the New York, New Haven and Hartford steam railroad, and used as its holding medium in the acquisition of street-railway properties, has absorbed the Suffield Street Railway Company in Connecticut. The price paid was $150 per share for the trolley line, and $125 per share for stock of the waterpower company, four per cent bonds being exchanged for the stock.

Construction work will shortly be begun on the new street-railway tracks of the Boston Elevated Railway Company and the Boston and Northern Street Railway Company into what is known as the Middlesex Fells, an extensive wooded reservation a few miles out from Boston, comprising parts of Melrose, Stoneham and adjacent municipalities hitherto inaccessible by cars, although set apart especially for public use as an immense park.

Leonard C. Wedmore, widely known as an old-time and expert telegraph operator, 50 years of age, died at Hough's Neck, Mass., May 10th. He was for many years chief operator and night manager in the Western Union office in Springfield, Mass., and had been an Associated Press operator. For the last six years he had been in the employment of the New England Telegraph and Telephone Company. B.

## Michigan.

Detroit, May 13.—Clinton M. Allen of West Bay City has been granted a patent on a device for the prevention of accidents on steam roads, which employs space telegraphy.

Plans and specifications for a new 3,200-horsepower engine, barometric or vertical jet condenser and a 2,000-kilowatt alternating generator are being discussed by the Detroit Municipal Lighting Commission. The commission has also taken a decided action against the Co-operative Telephone Company in the conduit controversy, and an order has been given the company to vacate the public lighting conduits. The corporation council of the city has been asked to act for the commission in the matter. The commission will also place a large electric sign upon the power building overlooking the river, so that the people who go up and down the river may know that Detroit has a public lighting commission. In times past the city has run a large "Welcome" sign upon the front of the City Hall which was put in use every time a convention was called in Detroit, but this expense was discontinued by the new mayor, so the lighting commission will take it up again at its own expense.

The report of the Muskegon Traction and Lighting Company shows an increase of eight per cent. in travel for the last two months. This company operates the street-railway system of Muskegon, as well as the gas and electric-light plants. The report shows that the company had spent, in improvements during the last year, about $25,000.

The bill giving electric railroads the right to condemn property, the same as the steam roads, which had already passed the House, has also passed the Senate, with only five votes against it.

At a recent meeting of the directors of the Detroit, Flint and Saginaw Electric Railway Company Thomas G. Sullivan was elected vice-president, succeeding Timothy Nester, and Charles P. Anderson was elected secretary, in the place of Arthur S. Nester, Timothy E. Tarsney was re-elected president and James B. Peter, treasurer. The report of the company shows it to be in a good financial condition. C. G. W.

## Dominion of Canada.

Winnipeg, Man., May 13.—James Stuart, Robert Stuart and others have incorporated, with a capital stock of $100,000, under the name of the James Stuart Electric Company, for the purpose of supplying electricity for light, heat and power purposes. The head office is in Winnipeg.

Public interest is manifest in the question of running Sunday cars here. The street-railway officials say that it will not pay at first, although it may later on, but they say they are willing to accept the loss for the present to oblige the citizens. Manager Phillips states that it is the intention of the company to put on a complete new outfit of cars in a short time and also to improve the car service of Norwood.

A by-law has been carried in Dauphin, Man., to spend $25,000 on a municipal electric-light plant. C. F. Turner is mayor.

The Macleod (N. W. T.) Electric Light and Power Company has just installed a plant at Coleman, and the lights were turned on for the first time last Sunday.

The Selkirk (Man.) Electric Light and Power Company has been organized and incorporated with a capital stock of $50,000. Winnipeg and Selkirk persons are interested and the object is to furnish electric light and power to consumers in the town of Selkirk.

It was announced in the private bills committee of the Ontario Legislature that the government has decided to appoint a commission to deal with the whole question of electric railways.

The T. A. Garlan Company has installed a complete electric-lighting plant in its department store at Portage la Prairie, Man. The dynamo is operated by a 15-horsepower gasoline engine, which with the plant was purchased in the United States and installed by the Manitoba Iron Works of Winnipeg.

The Nanaimo (B. C.) Electric Light Company has had such an increasing demand for electric light that the generating plant on Fraser Street has become inadequate. The company, of which Joseph Hunter is president, has now nearly completed a new plant on the banks of the Millstone River.

The government has decided not to recommend that the Legislature ratify the agreement between the Electric Development Company of Ontario and the Niagara Falls park commission of January last. This means that the Development company, which has one charter for the development of 125,000 horsepower at Niagara Falls, will not be allowed to develop the 125,000 extra horsepower in accordance with the agreement mentioned. It was found on the completion of the Electric Development Company's intake that the extra power sought could have been developed with a few inexpensive changes. The company promptly made its application, and the agreement arranged called for the payment of $5,000 a year until half the extra power is developed; then $10,000 a year until all is developed, after which the usual $15,000 for ground rental was to be paid, and $1 per horsepower for the first 10,000 horsepower, 75 cents for the second 10,000 horsepower and 50 cents for the remaining horsepower developed. The company is composed largely of capitalists interested in the Toronto street railway and the Toronto electric-light companies. It is now building a pole line from Niagara Falls to Toronto to convey electric power generated under its original agreement to Toronto to be utilized in running the street-railway cars and also to supply electric light.

The present city lighting plant of Windsor, Ont., being inadequate to do the city lighting, it is proposed to build an entirely modern and up-to-date lighting plant. The city will apply for legislation to permit it to engage in commercial lighting as soon as the new plant is established.

The Town Council of Galt, Ont., is discussing a proposition looking to the installation of an independent lighting scheme for municipal purposes. The company proposing the new plant is from Toronto.

The franchise of the Brantford Electric Light Company shortly expires. The company does all the street lighting and there is a strong feeling in favor of the city doing its own lighting and buying out the plant of the local company. H.

Ottawa, Ont., May 13.—The Toronto and Hamilton Electric Railway Company is entering into an arrangement with the Toronto and Niagara Power Company for the use of the latter's right-of-way and to increase its capital stock.

The Kingston (Ont.) electric street railway is on the market at an upset price of $125,000, and if not sold the city is likely to step in and operate it.

The city electric-light plant at Oxford, N. S., has been entirely destroyed by a fire which broke out in an adjoining furniture factory.

The Power, Heat and Light Company of Sherbrooke, Que., has offered to sell out to the city for $233,000. This offer includes the gas works, the real estate and the company's Rock Forest property.

The question of operating the Temiscaming and Northern railway from North Bay to New Liskiard by electricty generated from waterpower on the Montreal River will soon be definitely settled. Experts are preparing complete reports and plans and every detail for the guidance of the Ontario government.

All motormen and conductors who have been in the service of the Montreal Street Railway Company for five consecutive years will receive 19 cents an hour instead of 18 cents as before May 1st, and those who have served for three successive years, free uniforms. Twelve hundred out of 1,800 men will be thereby benefited. The increase is voluntary on the part of the company and adds about $50,000 to the pay roll. W.

## Mexico.

City of Mexico, May 11.—The promoters of the Jalisco Rapid Transit Company, recently organized under the laws of South Dakota, with a capital stock of $12,000,000, for the purpose of building an electric railway from Guadalajara to the Pacific Coast, state that the contract for the construction of the entire line will soon be let. M. C. Miller of Guadalajara is president of the company; H. S. Dudley of San Francisco, Cal., vice-president; C. W. Whittemore of the City of Mexico, general manager, and Bert Linderman of Guadalajara, chief engineer. Mr. Miller says that the equipment will include 675 miles of trolley wire, steel towers and 80-pound steel rails, 10 electric locomotives, 200 freight cars and 50 passenger cars, the latter to include four single-motor cars. The company has obtained from the government a grant of 4,000 acres of land fronting on the Bay of Chamala, as a site for the future city of Chamala.

W. T. McGraw and A. B. Bennett of Detroit, Mich., and W. H. Blecher of St. Louis, Mo., are negotiating for the purchase of the electric-light plant and the city electric street-railway system of Torreon.

It is announced by the governor of the federal district that inspectors will be appointed to inspect all electrical installations in the City of Mexico. A set of rules and regulations governing the electrical wiring of buildings and the installation of electric plant in the city has been prepared and will soon go into effect.

The mule-car street-railway system in Matamoras is to be converted into an electric system. The existing lines will also be extended.

F. R. Pearson, president of the Mexican Light and Power Company, which is constructing a large power and transmission plant at Necaxa, says that, in addition to the transmission lines which are now being built to the City of Mexico and El Oro, additional lines will be built to Sultepec, Saltillo and Tulancingo.

Extensive improvements are to be made to the electric-light system of Puebla. Gardner & Shearer, electrical contractors of the City of Mexico, have the contract for the work.

An electrical distributing station will be erected at La Barca, state of Jalisco, by Fructuoso Castellanos of La Barca. Power will be furnished industrial concerns of La Barca. W. D. H.

## Northwestern States.

Minneapolis, April 13.—The Aitkin (Minn.) Power and Light Company has been organized and will erect a plant at once. C. S. Kathan heads the list of promoters.

The city of Melrose, Minn., has voted in favor of municipal ownership of the lighting system, and a plant will be erected at a cost of about $30,000. Bonds will be issued.

The Omaha and Council Bluffs Street Railway Company has announced that it will build electric lines from Omaha to Bellevue, Fort Crook and Forest Lawn.

The Des Moines (Iowa) Interurban Company has awarded the contract for the construction of the proposed line to Woodward and Perry to the Ware Construction Company of St. Louis, Mo. The line will be about 34 miles long, and the cost is to be about $150,000.

The City Council of Virginia, Minn., is considering a proposition from the Virginia Light and Water Company for the purchase of its plant at about $70,000.

The municipal lighting plant at Atlantic, Iowa, is to be sold at auction.

The Eastern Iowa Railway Company has applied for a franchise in Muscatine, Iowa. The Davenport and Suburban Company has also applied for an extension of its franchise.

The Cloquet Electric Company of Cloquet, Minn., has completed the extension of its lines into the village of Thompson, Carlton County, Minn., and now lights the cities of Cloquet and Carlton and the villages of Scanlon and Thompson, having about 35 miles of line. The company has installed over 40 motors the last year, aggregating over 200 horsepower, and has just closed a contract with the Diamond Match Company to furnish motors and current for its new factory at Cloquet, work on which has been commenced.

Building operations at Sault Ste. Marie, Mich., have been started on the enlargement of the power plant of the Edison Sault Electric Company. It is proposed to have the work completed by November 1st. R.

## Pacific Slope.

San Francisco, May 12.—The Lick Observatory committee of the board of regents of the University of California met in San Francisco last week to consider the proposal of capitalists of San Jose, Cal., to build an electric road between that city and Smith Creek, with a cable-road extension to the top of Mount Hamilton. Work on the light and power plant of the observatory, toward which the last Legislature gave $10,000, has been begun by Director Campbell.

A. L. Levinsky of the Stockton (Cal.) Electric Railroad Company says that the company is preparing to change the present street-car lines of that city to standard gauge. The system will be equipped with new cars.

The Spring Valley Telephone Company has been incorporated at Dairy, Klamath County, Ore., with a capital stock of $1,000. The incorporators are C. W. Sherman, W. L. Welch and Theodore Flackus of Dairy.

Under the leadership of the Huntington Beach Board of Trade committees are in the field securing a right-of-way between Huntington Beach and Santa Ana, Cal., for a proposed branch of the Pacific electric railway between the two towns. It is stated that the Los Angeles-Santa Ana line will be in operation by October 1st.

J. L. Hartmen, H. L. Powers and E. L. Thompson have incorporated as the St. Johns Waterworks and Lighting Company of St. Johns, Ore., with a capital stock of $50,000.

The supervisors of Contra Costa County, Cal., have awarded to the East Shore and Suburban Railway Company of Martinez, Cal., a franchise to construct an electric railway through the town of Richmond and to Stege and San Pablo. The franchise was originally applied for by Henry Ells and John R. Nystrom.

W. T. Forsman and W. H. Buster have filed an application with the supervisors of Glenn County, Cal., for an electric-railway franchise from Princeton to St. Johns and Butte City, thence to the Butte County line, and from Orland to Chico Bridge. The applicants have secured franchises in Sutter and Colusa counties.

The El Pizmo Company has concluded to put in an electric plant at Pizmo, San Luis Obispo County, Cal.

The Nevada County Traction Company of Grass Valley, Cal., will probably build an extension of the electric road from Grass Valley to Marysville, with a branch to Auburn.

It is reported that J. Kilpatrick of New York will build an electric railway in Mendocino County, Cal. The proposed route is through Dry Creek and Anderson Valley.

The City Council of Goldendale, Wash., has granted a franchise to H. W. Fellows, recently of Spokane, for an electric plant. The power house will be located about nine miles from Goldendale on the Little Klickitat River, power to come from Blockhouse Creek. A.

## PERSONAL.

Mr. H. D. Critchfield has severed his connection with the Automatic Electric Company of Chicago.

Henry P. Broughton has taken charge as general manager of the Great Northern Power Company at Duluth, Minn. Mr. Broughton has been with the General Electric Company for a number of years.

The engagement is announced of Charles Foster Bancroft, electrical engineer of the Massachusetts Electric Companies, to Miss Cornelia Herriman Dow of Brooklyn, N. Y. The wedding will take place in Brooklyn, June 7th.

T. K. Henderson of New York city has been named as the successor of George Foster Peabody, who announced his resignation as a director of the General Electric Company at a stockholders' meeting at Schenectady, N. Y.

Mr. J. C. Kelsey, professor of telephone engineering at Purdue University, Lafayette, Ind., is reported to have resigned to accept a position with one of the large telephone manufacturing companies of Chicago, probably the Kellogg Switchboard and Supply Company.

Charles S. Davis, master electrician, serving as superintendent of the construction and repair department at the Charleston navy yard, has resigned, to accept a situation with a Boston business house. Mr. Davis installed the electric appliances on the Olympia, Admiral Dewey's flagship.

Major George O. Squier, chief signal officer at San Francisco, Cal., was called to Dryden, Mich., by the sickness and death of his father, Almond J. Squier. Major Squier is the originator of a system of space telegraphy transmitted through trees, described in the Western Electrician of February 25, 1905. He has been able, it is said, to send messages five or six miles and to receive them from 60 miles. He expects soon to be able to determine from which direction messages are received.

Samuel G. McMeen gave an interesting lecture before the students of the Armour Institute of Technology of Chicago on May 8th on "Telephone Engineering." The lecture was delivered to the Armour branch of the American Institute of Electrical Engineers. He gave many valuable ideas relating to the necessity for trained engineers and their opportunities. Several problems illustrative of those occurring in regular practice were presented as examples of the scope of technical ability required in order to become a successful telephone engineer.

Henry Percy Bradford, until recently connected with the Underground Electric Railways Company of London and the Metropolitan District Railway, and now a director of the Société des Tramways et Voies Ferrées du Nord of Lille, France, was in Chicago last week. Mr. Bradford is an American, and he operated the interesting Little Rock (Ark.) electrical plant, which was designed by B. J. Arnold 14 years ago. His electric-railway experience extends to Switzerland as well as to France, England and the United States. He expects to return to England soon.

Albert S. Crane, who was formerly principal assistant engineer of the Sanitary District of Chicago, in charge of the design and construction of the 30,000-horsepower waterpower development of the Chicago Drainage Canal, has been made chief hydraulic engineer of J. G. White & Co. of New York. Mr. Crane was born in 1867 and graduated from Cornell in 1891. He has been employed successively since leaving the university on sewer and waterworks construction in Newton, Mass., on the Fortress Monroe sewerage system, as assistant engineer of the department of city works of Brooklyn, and as chief assistant engineer on the developments of the Michigan and Lake Superior Power Company at Sault Ste. Marie. Mr. Crane has also acted as consulting engineer on many hydraulic installations of importance.

## ELECTRIC LIGHTING.

M. J. Shields and others are about to put in an electric-light and power plant in Uniontown, Idaho.

The Rantoul Light and Heat Company has been incorporated in Rantoul, Kan., with a capital of $2,000.

The Springfield (Ill.) Light, Heat and Power Company has increased its capital from $175,000 to $325,000.

The City Council of Prairie Grove, Ark., has granted a franchise to C. L. Cummings for an electric-light plant.

The business men of McLoud, Okla., are considering the proposition of several promoters to put in an electric-light plant.

The papal villa at Castel Gaudolfo, in the Alban Hills, 30 miles from Rome, where Pope Pius X. and the cardinal secretary of state spend some of their leisure time, is to be lighted by electricity. The palace at the villa was built during the seventeenth century by Pope Urban VIII. Last year the government provided direct telegraphic and telephonic communication between the villa and the Vatican Palace in Rome. To further gratify the pope's fondness for modern conveniences an electric elevator has replaced the old lift which formerly rose only to the pope's apartment in the Vatican Palace.

The Mount Carmel Coal Company of [illegible], Kan., and the company operating the street railway in that city, both have applications before the City Council for a franchise to light the city with electricity.

The Hattiesburg (Miss.) Traction, Light and Power Company, with a capital of $250,000, has been incorporated by H. H. Camp of Lumberton, H. L. McKee of Meridian, A. F. Thomasson of Hattiesburg and others.

The city of Hastings, Neb., will equip an electric-lighting plant. The generating unit will consist of a heavy-duty cross-compound Reynolds-Corliss engine, with cylinders 14 and 22 inches in diameter, with a 36-inch stroke, direct connected to a 222-kilowatt single-phase Bullock alternator.

The Chicago Edison and Commonwealth Electric companies report a grand total of 69,989 16-candlepower incandescents as the equivalent of the amount of business contracted for during the month of April, 1905. This includes no unusually large contracts, but is the general run of business taken with many small customers.

The City Council of Gallipolis, Ohio, has repealed the ordinance providing a rate of eight cents per kilowatt-hour for electric current for lighting purposes and passed one in which the rate is based on the hour's use of the customer's installation. The maximum rate is 12 cents, being graduated as follows: Two hours use per day, eight cents; three hours, 6½ cents; four hours, six cents; five hours, 5½ cents; six hours, five cents; seven or more hours, 4¾ cents. The Gallipolis Gas and Coke Company, which is affected by the new rates, believes there is not a similar ordinance in the state.

## ELECTRIC RAILWAYS.

It is said that President Andrews and Manager Stanley of the Cleveland (Ohio) Electric Railway Company have invented a device by which women will be prevented from alighting from a car backwards and thereby prevent many accidents. The idea is to have the hand rails placed in such a position that they can only be useful in alighting when the passenger is facing forward.

The East St. Louis and Suburban Electric Railroad Company has notified its patrons that cars on the Stock Yards, Landsowne and State Street divisions would be discontinued from through service over the Eads Bridge to St. Louis, perhaps for all summer, owing to the reconstruction of the bridge. Bridge service will be provided for by local cars running between Main Street in East St. Louis and the west end of Eads Bridge.

Daily papers report that the Southern Pacific railroad has discontinued 25 regular passenger trains between Los Angeles and suburban points as a direct result of the competition of the electric lines. The lines affected are those to Santa Monica, San Pedro, Long Beach and Whittier, and only one regular passenger train will be run daily between Los Angeles and these points. Officers of the road say that for 18 months passenger trains have been run at a loss.

A party of newspaper men and other guests enjoyed the hospitality of the Boston and Northern railway on May 7th, in the form of a trolley trip on one of the company's new observation cars, which is arranged with an open platform at each end, with parlor in the middle. On the platform chairs were placed, from which an uninterrupted view of the many beautiful scenes in the Merrimac Valley was obtained. The trip was arranged by R. H. Derrah, general passenger agent of the Boston and Northern and Old Colony railways.

Citizens of Lake Forest, Ill., have voted by a large majority to grant a perpetual franchise to the Chicago and Milwaukee Electric Railroad Company, permitting that company to run its lines through the city. The question had been three times fought out in the council of the North Shore suburb. Three aldermen favored the franchise and three opposed it. The council decided to submit the question to a referendum vote of the citizens. The victory of the ordinance is mainly due to the fact that the electric-railway company has given and promises to give in the future better service than the city could hope to get by operating its own lines at any future time.

## POWER TRANSMISSION.

Directors of the Golden Treasure Mining Company will meet in Boise, Ida., in the near future to decide on details for the power plant to be installed on the Payette River, from which it is planned to generate 10,000 horsepower. Machinery and equipment will be ordered as soon as plans [illegible]

[illegible]

[illegible]

[illegible] erate power at Niagara Falls, was incorporated at Albany recently under the title of the Electric Power and Transmission Company of Niagara County. Under its charter the company may operate anywhere between Buffalo and Albany. The directors are Edward B. Bruce, a New York distiller, Frank H. Cole, John J. Daly of Brooklyn, Allan C. Rearick and Edward E. Stowell. On the following day a $2,000,000 concern was also organized, to be known as the General Public Service Corporation, as well as the Universal Service Company, the latter being capitalized at $100,000, for supplying electrical current over an area practically coterminous with the state of New York, and both with a directorate comprising Frederic H. Cowden, William C. Dreyer and Samuel H. Gainsborg of the Fuller Building, New York city. These three concerns, together with another previously incorporated, appear to have been organized hastily for the express purpose of evading the conditions of pending legislation, which will refer all such applications to the proposed state Public Service Commission, which is to deal with all future power and traction franchises.

## PUBLICATIONS.

The Fletcher Manufacturing Company of Dayton, Ohio, has issued a special circular supplementary to its catalogue No. 530, in which are described a number of Fletcher specialties, such as pole brackets, inner-running mast-arms for arc lamps, insulated racks, etc.

The Wellman-Seaver-Morgan Company of Cleveland, Ohio, describes its waterpower equipments for low heads in an attractive new catalogue. Its installations up to 100 feet head embody the Jolly-McCormick turbines, which the company can furnish in a variety of settings.

The Crocker-Wheeler Company's line of railway generators, manufactured at its factory in Ampere, N. J., is attractively set forth in a new bulletin. Besides a detailed description of these machines the bulletin contains several views of actual installations which are interesting.

Daily consular report No. 2,256, dated May 12, 1905, treats of municipal ownership of public utilities, and consists of reports received on this subject from United States consular officers from 1897 to 1905. These consular reports are issued by the Department of Commerce and Labor.

The Chandler & Taylor Company of Indianapolis, Ind., is sending out a catalogue devoted to its line of enclosed self-oiling engines which, it states, is the first in the country to be manufactured in accordance with the recommendations of the American Society of Mechanical Engineers and the American Institute of Electrical Engineers.

The Westinghouse catenary line construction has been widely exploited in connection with alternating-current railway work and has been described in various papers before the American Institute of Electrical Engineers and other societies. The company has just issued a valuable bulletin which goes minutely into this construction, which will be found of much use as a reference and is worthy of careful preservation.

The application of storage batteries in the electrification of steam roads is the question discussed in a new bulletin from the Electric Storage Battery Company of Philadelphia, and the subject is certainly one abreast of the times. The company has already closed contracts for undertakings of this kind, and some installations have been made which are described and illustrated pleasingly in the bulletin.

"We devote our entire time to improving the design of these goods," says the Dayton Fan and Motor Company of its electric fans. To bring the merits of these fans more impressively to the notice of the trade it has recently issued a handsome catalogue describing the ceiling and desk varieties for direct current. The company's works are at Dayton, Ohio, and those interested in fans will find the new catalogue worthy of careful reading.

The New York Public Library is paying particular attention to collecting current trade catalogues and similar publications. Its collection now numbers over 30,000 pieces and as fast as possible these are being catalogued and shelved in a way

to bring out the names of firms or companies issuing the catalogue and the articles listed therein. The library will be glad to secure a satisfactory collection of catalogues of every manufacturer not represented on its shelves today.

A complete and comprehensive catalogue of electric-railway and mining appliances has been issued by the Wesco Supply Company of St. Louis. This catalogue will be highly appreciated by all buyers of electric-railway and mining equipment, as it brings together in one volume a wide and comprehensive variety of standard apparatus and supplies particularly adapted for users of these materials. The book contains approximately 550 pages, carefully compiled and edited and thoroughly indexed as to subjects, code words and catalogue numbers.

A copy of the Japanese translation of the Incandescent Wiring Handbook has been just received by Prof. F. B. Badt, who is the author of the original book. The Japanese publication is smaller, but very similar in general appearance to a like translation of the Dynamo Tenders' Handbook, an illustrated description of which was printed in the Western Electricion of May 6th. A letter in Japanese from Matsunosuke Matsushiro, No. 16 Nishinokubo Tomoyecho, Shiba-ku, Tokyo, Japan, who translated the wiring handbook, is almost as interesting as the book. The letter was translated for Mr. Badt by Mr. Kunihiko Iwadare, and, although the English translation contains less than 200 words, the paper on which the original is written measures 4 feet by 7¼ inches. In it Mr. Matsushiro apologizes to Mr. Badt for publishing the book without getting permission. "More than 10 years ago," he says, "when there was in Japan no good book for beginners on the subject of electric-light wiring written in Japanese, I learned a great deal from your book. In order to let others enjoy its benefit, I translated your book and published as per copy forwarded, and a good many wiremen were then benefited from it." In presenting the copy as a souvenir, the translator says that he is not the only one who wants to express thanks from Japan for Mr. Badt's valuable work.

## MISCELLANEOUS.

At its new 2,000-foot wharf at the foot of St. Louis Street, New Orleans, the Southern Pacific company, it is stated, will install an electric-light plant and build three electric conveyors at a cost of $25,000 each for loading and unloading vessels.

The Union Pacific railroad has introduced news bulletins in its library and observation cars on through trains. Twice a day dispatches are handed over by the telegraph operators at scheduled points, in typewritten form, to the conductors of the overland trains, who post them where passengers can read them. The service is operated at a comparatively small cost to the railroad by using its own wires and employes.

The steamship Minnesota, which left Seattle, Wash., a few days ago for the Orient, had in its cargo 14 steam locomotives for Japan. The locomotives are consigned to Yokohama and are to be used on the railroads of Japan and Manchuria. They are of the Japanese standard gauge, three feet six inches. Five more will be shipped from Tacoma soon.

## TRADE NEWS.

Bids will be received at the office of G. W. Wagenseller, secretary of the Middlecreek Electric Company, Middleburg, Pa., from May 20 to noon of June 1, 1905, for the construction of a complete waterpower electric plant on Middlecreek, two miles south of Selinsgrove, Pa. The requirements are a solid concrete dam, two units consisting of four wheels direct connected to two generators, switchboard, power house, about 25 or 30 miles of line construction and the entire plant complete ready to run for supplying light, heat and power for Selinsgrove, Sunbury and Northumberland, and perhaps Middleburg. Plans and specifications can be seen after May 20th at the office of the secretary in Middleburg, Pa., or at the office of E. F. Shatzer, hydraulic engineer, on the site two miles south of Selinsgrove, Pa.

The Wagner Electric Manufacturing Company is taking over its Pacific Coast business, handled for a number of years by the Wagner-Bullock Electric Company of California, and is opening offices of its own at Room 417 Rialto Building, San Francisco. On June 1st the Wagner-Bullock Company ceases to exist, and thereafter the Wagner business will be under the exclusive management of A. J. Myers at the new office, who has been identified with Wagner apparatus on the coast for the last 10 years. Sales offices will be established at Los Angeles and Seattle later.

The Abner Doble Company of San Francisco announces that arrangements have been made with the John McDougall Caledonian Iron Works Company of Montreal, Canada, whereby the latter becomes sole licensee for the manufacture of the Doble system of waterwheels in the Dominion of Canada. The McDougall company has extensive machine works in Canada, its plant including machine shops, pattern shop, foundry, forging works and structural-material shop. The Abner Doble Company requests that all engineers or other parties interested in waterpower developments in Canada address the McDougall company direct, it having retained the Abner Doble Company as consulting engineer.

## BUSINESS.

Acme is the name of the well-known commutator compound that is manufactured by J. J. Egan, 317 Austin Avenue, Chicago. He states it has not yet failed to give satisfaction wherever given a fair trial. A sample stick will be mailed free to applicants.

The Teater-Heany Developing Company, whose wire department is at York, Pa., believes that its Heany fireproof insulated wire should be of especial use to electric railways. It states that a coil of its wire may be heated red hot 200 times and the insulation still remain intact.

Job-press motor equipments are a specialty of the Jenney Electric Manufacturing Company of Indianapolis, Ind. The motor is built on the company's standard frame with a special slow-speed winding, calculated to give the best working conditions and making an equipment substantial and durable.

T. P. Bradley, secretary and general manager of the Duluth Log Company of Duluth, Minn., was in Chicago recently. Mr. Bradley states that the cedar pole and tie business in which his company is engaged is unusually good. He expects to do a larger business this year than in any previous year. The company recently established a new yard at Hawthorne, Wis., where it operates 40 cars, which run between the company's camps and the Hawthorne yard, hauling poles and ties.

The American Steel and Wire Company, maker of sulphate of iron for water purification, states that experiments have proved that purification of water, using iron and lime, is more efficient and lower in cost than where alum and lime are used. The sulphate of iron used during this investigation contained a very small percentage of sulphate of copper, which made it possible to produce a water free from pathogenic bacteria, a feat in water purification said to have been never before accomplished.

The Newcastle Portland Cement Company of New Castle, Pa., has placed an order with the Westinghouse Electric and Manufacturing Company of Pittsburg for two 175-kilowatt, three-phase, alternating-current generators, two 42-kilowatt exciters and the necessary switchboard for the control of this apparatus. These machines will supply current for operating a number of induction motors ranging from 10 to 100 horsepower each, which were also included in the contract. The Western Engineering and Construction Company, through the San Francisco office of the same company, has also ordered 180-horsepower in variable-speed induction motors, 130-horsepower in constant-speed induction motors, and four transformers.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued (United States Patent Office) May 9, 1905.*

789,146. Apparatus for Electrolyzing Liquids. Léon Dion, New York, N. Y., assignor to the Americus Electro-hermetic Company, New York, N. Y. Application filed June 10, 1904.

Combined with a chamber adapted to receive liquids to be treated are co-operating positive and negative electrodes arranged therein, and means for energizing these electrodes. These, with the necessary filtering apparatus, complete the device.

789,161. Dental Electrode for Medicamental Diffusion. Samuel H. Linn, Rochester, N. Y. Application filed September 30, 1903. Renewed September 19, 1904.

An insulating sheath having an opening therein contains an electrode of suitably absorbent material. An elastic medium of electric conducting material supports the absorbent material and projects it through the opening in the sheath and in contact with the tissues to be treated. Other means supply an electrolyte to the absorbent material.

789,171. Electric Signal System for Railways. Ara P. Rickmire, Rhinelander, Wis. Application filed August 11, 1904.

An electric railway signal system comprises a track block, a generator and signals, the track block and signals being in electrical connection and normally charged by the generator. The signals are disposed by adjacent track blocks, and train-operated means co-operate with the conductors of the first-named block to short circuit the signals.

789,188. Combined Drop and Jack for Switchboards. Henry Tideman, Menominee, Mich. Application filed August 13, 1904.

In a combined drop and jack are an electromagnet and a shutter. Means are adapted to release the shutter when the electromagnet is energized.

789,208. Signal Instrument for Telephone Substations. Henry M. Crane, New York, N. Y., assignor to the Western Electric Company, Chicago, Ill. Application filed January 2, 1904.

In a substation instrument for telephone exchanges is a supporting plate carrying a call signal receiving magnet. A tapper is actuated by the magnet and a protecting cover incloses the magnet and is secured to the supporting plate along a portion of the edge of the cover.

789,210. Toll Box for Telephone Pay Stations. William W. Dean, Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed January 14, 1902.

In a toll box for telephone pay stations are combined a movable coin carrier for depositing coins within the box, and a contact device adapted to be actuated by a coin held in the coin carrier.

789,221. Electric Safety Appliance for Railway Trains. John A. Larkin, Glenridge, N. J. Application filed November 12, 1903.

The system embodies an electric circuit on a locomotive controlling the air brake system. Traveling contacts form the terminals of this circuit and engage contact pieces of an electric conductor carried along the track. The track is divided up into insulated sections and the arrangement is such that two locomotives in the same block are automatically stopped before collision takes place.

789,225. Underground Conduit for Electric Railways. John H. Munson, Chicago, Ill., assignor of one-half to Charles G. Hawley, Chicago, Ill. Application filed July 10, 1896.

An underground electric conduit comprises the conduit proper having a surface slot together with a series of lateral yokes through which the conduit is continued, the yokes being provided with lateral recesses and with connection and contact chambers. A plunger operative in each yoke has a part to engage a contact block separating the chambers.

789,239. Electric Signal System. Howell W. Souder, Tamaqua, Pa., assignor of one-half to W. D. Zehner, Lansford, Pa. Application filed May 26, 1904.

A pair of parallel oppositely arranged contact elements are insulated from each other, one of the elements being divided into insulated sections along a transverse plane. A feed connection is provided for the undivided element and work connections for each section of the divided element, the whole so associated as to provide for automatic opening and closing of the circuits in the operation of the signals.

789,240. Signaling System. Howell W. Souder, Tamaqua, Pa., assignor of one-half to W. D. Zehner, Lansford, Pa. Application filed May 16, 1904.

In a signal system for electric railroads are a series of blocks, a single signal circuit for each block having a ground connection and a single feed connection, a rotary circuit breaker in each feed connection, electromagnetic means for giving the circuit breaker a step-by-step rotation, contact-making devices located at each end of each block and conductors extending from the two contact-making devices of each block to the circuit-breaker operating magnet of that block.

789,256. Electrical Test Set. Alva J. Carter, Idagrove, Iowa. Application filed December 23, 1902. Renewed April 4, 1905.

An electrical test set includes a generator, an electromagnetic signal device, switches wired to the line to connect the signal device and generator in either series or multiple and means including one of the switches for commuting the alternating current of the generator to produce a direct pulsating current. (See cut.)

789,265. Electric Cut-out. Reinhold Dreibholz, Höchst-on-the-Main, Germany, assignor to O. & H. Keller, Frankfort-on-the-Main, Germany. Application filed August 17, 1903.

The invention embodies an electric cut-out adapted to serve at pleasure as a distributing box, a plug contact or ceiling block for pendants.

789,286. Surgical Appliance. Willard F. Main, Iowa City, Iowa. Application filed May 28, 1904.

An appliance is described for applying electric currents to the body for electrotherapeutical purposes.

789,295. Electrical Cut-out. William D. Packard, Warren, Ohio. Application filed May 8, 1903.

An electrical cut-out comprises a hollow body of non-conducting material, open only at its lower end. An electrical connection is placed between the interior and exterior at the upper end, a switch lever being interposed within the body and in contact with the connection. A cap of non-conducting material is removably secured to the upper end of the body and adapted to protect the electrical connections.

789,345. Memorandum Attachment for Telephones. Frank R. Welsh, Philadelphia, Pa. Application filed February 21, 1905.

A pad holder to be attached to telephones is the device patented.

789,350. Interconnecting Telephone System. Albert K. Andriano, San Francisco, Cal., assignor to the Direct-line General Telephone Company, San Francisco, Cal. Application filed February 18, 1904.

A station is connected to several others by conductors individual to the other stations and terminating at contacts at the first-named station. Means complete an electrical circuit between any station of the system and the first-named station, where means are provided for selecting the conductor individual to any other station and

completing a circuit therewith. A source of electrical energy in the conductor individual to a station is situated outside the selecting means of the station.

789,353. Plant for the Electrodeposition of Metal. Anson G. Betts, Troy, N. Y. Application filed April 11, 1904.

An electrolytic metal-depositing plant contains a number of tanks, each of which contains in electrical series sets of positive and negative unipolar electrodes, the sets arranged internally in multiple.

789,365. Electric Snap Switch. Monroe Guett, Hartford, Conn., assignor to the Hart & Hegeman Manufacturing Company, Hartford, Conn. Application filed November 16, 1903.

Combined with the stationary and movable contacts is actuating mechanism comprising an operating lever, an arm and a spring connecting the lever with the arm. The arm is separate from but has a driving connection with the movable contacts.

789,366. Electric Switch. Monroe Guett, Hartford, Conn., assignor to the Hart & Hegeman Manufacturing Company, Hartford, Conn. Application filed November 18, 1903.

Stationary and movable parts, the latter provided with actuating mechanism, including a pair of levers connected together to move in unison, and devices connecting one of the levers with the movable switch member and having a controlling engagement with the other lever, are the essential features of the device.

NO. 789,256.—TELEPHONE TEST SET.

789,367. Electric Switch. Henry F. Keil, Bronxville, N. Y. Application filed July 19, 1904.

An electric snap switch of the rotary type has stationary and movable contacts, a lever and mechanism interposed between the movable contacts and the lever separate from, but having driving connection with, the former and connected with the latter.

789,377. Unsymmetrically Wound Electric Motor. Frederick J. Newman, Chicago, Ill., assignor to the Woods Motor Vehicle Company, Chicago, Ill. Application filed January 9, 1905.

In a direct-current electric motor provided with a number of poles are a series of unequal induction windings upon the poles and means for variously connecting the windings to vary the strength of the magnetic fields in the poles.

789,378. Apparatus for Teaching Telegraphy. Howard G. Page, Fitchburg, Mass. Application filed September 26, 1904.

A self-contained transmitting and receiving instrument for the use of students in telegraphy is the basis of the patent.

789,379. Static Electric Machine. Theodorus H. Patee, Greenfield, Ind. Application filed June 14, 1901.

In a static electric machine having the electric-current generators within a closed cabinet are an equalizer and means extending outside of the cabinet for changing its position.

789,383. Electric Trolley. Charles L. Rogers, Uxbridge, Mass. Application filed November 30, 1903.

In a trolley head are a fixed slotted side piece, a detachable slotted side piece with a tongue fitting into a corresponding socket, conductor springs having their ends extending out through the slots in the side pieces to the outside of the trolley head and a bolt fastening the detachable side pieces and one of the conductor springs in place.

789,402. Electrical Collector. Peter Ackermann, Chicago, Ill. Application filed September 4, 1902.

A bracket hanger is provided with countersunk apertures and a contact shoe is loosely engaged in the apertures and provided with a broad contact surface extending laterally from the bracket hanger.

789,404. Alternating-current Generator. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 14, 1904.

In an alternating-current generator are a field magnet with projecting poles, a field winding on the poles provided with a commutator, auxiliary poles on the magnet between the main poles and means for supplying to the commutator an alternating current derived from the armature.

789,411. Charging Station for Electrically Propelled Vehicles. Frank P. Cox and Charles E. Holmes, Lynn, Mass., assignors to the General Electric Company, Schenectady, N. Y. Application filed June 13, 1901.

A prepayment station for electric current comprises a closed chamber containing a circuit controller, means for operating the controller in a predetermined way, a charging receptacle for battery terminals, an electric signaling device at the supply station responsive to the controller and a switch at the station governing the supply of current. (See cut.)

789,413. Overload Cut-out for Hoists. Philip J. Darlington, Glenridge, N. J., assignor to the Sprague Electric Company. Application filed October 5, 1904.

A controller for the hoisting motor [illegible] means responsive to [illegible] contact the controlling [illegible] the load, [illegible] motor circuit.

789,419. Magnetic Controlling Device. Charles [illegible] Eveleth and Oran O. Rider, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed June 3, 1903.

Combined with a magnetic conductor [illegible] and movable member [illegible] with a section of non-magnetic material [illegible] part of magnetic material adapted to shunt li[illegible] about a greater or less portion of the section [illegible] netic material.

789,435. Alternating-current Dynamo-electric Machine. Marius C. A. Latour, Paris, France, assignor to the General Electric Company, Schenectady, N. Y. Application filed September 10, 1904.

A parallel or lap armature winding has two commutators on opposite sides of the winding, each commutator being composed of alternate live and dead segments. The live segments of each commutator are connected to the adjacent side of the armature winding. The brushes are so arranged that a brush of one set is on a live segment when the corresponding brush of the other set is on a dead segment.

789,436. Dynamo-electric Machine. Marius C. A. Latour, Paris, France, assignor to the General Electric Company, Schenectady, N. Y. Application filed September 10, 1904.

A field magnet is provided with projecting poles, the field coils being arranged in sections varying in regard to number of turns in accordance with a sine function, but the resistance of all the sections being approximately equal. A many-part commutator is connected to the field winding and means for supplying polyphase currents to the commutator are supplied. (See cut on next page.)

789,438. Process of Treating Phosphate Rock. Florentine J. Machalske, Brooklyn, N. Y., assignor to Frederick Darlington, Great Barrington, Mass. Application filed February 25, 1905.

The high temperatures necessary in the process are obtained electrically.

789,447. [illegible]

[illegible] is fitted.

789,456. Automatic [illegible] Schenectady, N. Y., [illegible] Electric Company, Schenectady, N. Y. Application filed September 20, 1901.

[illegible] brush is mounted, a wheel journaled on the carrier, and [illegible] put under tension by the rotation of the wheel.

789,457. Electrically Operated Switch for Controlling Circuits, etc. Howard R. Sargent, Schenectady, N. Y., [illegible] Electric Company, Schenectady, N. Y. Application filed August 23, 1900.

The switch is provided with terminal contacts, and a switch-piece with an actuator adapted to hold it in its closed position is added, while a movable magnet [illegible] multiplying the movement of the member. Two magnet coils move the member in opposite directions, to open and close the switch.

789,458. Lightning Arrester. Howard R. Sargent, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed August 28, 1902.

A lightning arrester consists of cylindrical dischargers arranged within arcing distance of each other, and with their axes parallel, the dischargers being formed of a mixture of carbon and clay.

NO. 789,411.—CHARGING STATION FOR ELECTRIC VEHICLES.

NO. 789,476.—ALTERNATING-CURRENT GENERATOR.

789,439. Process of Treating Phosphate Rock and Producing Compounds of Phosphorous and Nitrogen. Florentine J. Machalske, Brooklyn, N. Y., assignor to Frederick Darlington, Great Barrington, Mass. Application filed February 25, 1905.

Electric-furnace heating is employed in reducing the phosphate rock.

789,440. Process of Treating Phosphate Rock and Producing Phosphorous Chlorides and Alkali-metal Cyanides. Florentine J. Machalske, Brooklyn, N. Y., assignor to Frederick Darlington, Great Barrington, Mass. Application filed February 25, 1905.

The process of treating rock containing calcium phosphate and producing a chlorid of phosphorus and a cyanid of an alkali metal consists in mixing the rock with an alkali-metal chlorid and carbon, electrically smelting the mixture at a high temperature in the presence of nitrogen and electrically smelting the resulting dyanamids with an alkali-metal carbonate.

789,442. Controlling Alternating-current Motors. Maurice Milch, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 24, 1903.

Combined with motors having main field coils and auxiliary field coils are a source of alternating current and a switch adapted to connect with the main coils to the source and to connect the auxiliary coils in a local circuit with the rotor windings of the motors, and to vary the relative connections of the auxiliary coils and rotor windings.

789,444. Electric Motor. Jakob E. Noeggerath, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 1, 1904.

In a dynamo-electric machine of the "homopolar" field structure are a revolving armature, conductors carried thereby and means for collecting current from the conductors. Stationary conductors are carried by the field structure, and connections are made from the collecting means to the stationary conductors, the connections each extending a fraction of a circumference in one direction around the armature, whereby the current in the connections produces the magnetization of the machine.

789,459. Electrical Switch. Howard R. Sargent, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 9, 1902.

An armature-core punching and supporting member are each provided with a keyhole-slot, the slot in the supporting member being provided with a drilled circular enlargement for a locking-key.

789,463. Reactive Coil. Elihu Thomson, Swampscott, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 1, 1904.

In a reactive coil of helical form are a number of turns the radii of curvature of which progressively decrease from the ends of the coil toward the center so that each turn of the coil incloses substantially the same magnetic flux.

789,475. Circuit Breaker. Jonathan E. Woodbridge, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 3, 1902.

Fixed and movable members have opposing windings, while series and potential transformers in the controlled circuit supply the windings respectively. Means preserve substantially constant phase relations [illegible] secondary circuits.

789,476. Alternating-current Generator. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to the General Electric Company. Application filed August 19, 1904.

Associated with a polyphase alternating-current generator having a field-winding provided with a commutator, are a source of polyphase potential connected to the commutator, non-inductive resistances connected in series with the source, and series transformers having their primaries connected in series with the several phases of the armature and having their secondaries connected in shunt to the resistances. (See cut.)

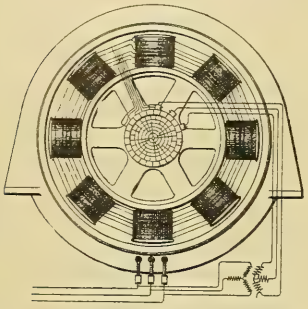
789,487. Control of Electric Motors. Walter E. Carpenter, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 10, 1904.

For connecting a shunt-wound motor in driving relation to a load and disconnecting the load therefrom

a clutch is used. A switch has a movable member connected to the clutch and is adapted to close the armature circuit of the motor. A resistance is in shunt to the switch.

789,488. Synchronism Indicator. Paul L. Clark, Chicago, Ill., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 19, 1903.

Synchronizing indicator apparatus comprises an electric signal responsive to exchange currents between machines to be synchronized, a solenoid in shunt to the signal, a solenoid core controlling a switch in the signal circuit, a yielding support for the core, and an adjustable resistance in circuit with the solenoid.



NO. 789,436.—DYNAMO-ELECTRIC MACHINE.

789,508. Attaching Plug. Howard R. Sargent, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 9, 1902.

An attaching-plug comprises an insulating base, part having on one end a threaded contact sleeve and a center contact, and on the other end a contact ring electrically connected to the sleeve. A second insulating part is provided on one side with two wire terminals and an axial rod pivotally connecting the parts together and electrically connecting one of the wire terminals and the center contact.

789,514. Storage-battery Plate. Charles H. Whiting, New York, N. Y. Application filed June 25, 1904.

A grid for a storage battery plate embodies an end piece and strips or bars united with the end piece and definitely separated one from the other a small distance apart. Each strip is adapted to receive the active material with the receiving surfaces for the material running parallel with the outer side faces of the end piece of the plate.

789,515. Leading-in Conductor. Willis R. Whitney, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 14, 1904.

Removing occluded gas from a conductor is done by heating the conductor in a rarefied atmosphere at a temperature below the melting point of the conductor and subsequently cooling the conductor in a rarefied atmosphere.

789,518. Electric Switch. John A. Wright, Irwin, and William F. O'Neill, Wilkinsburg, Pa. Application filed April 19, 1904.

A switch blade constructed with two side members and a bulged top portion has an auxiliary blade operatively mounted between the side members and adapted to project downwardly. A spring within the bulged portion of the blade operates to hold the auxiliary blade normally confined between the blade side members.

789,519. Electric Drop-light Bracket. Carl E. Zeisinger, Durand, Wis. Application filed August 13, 1904.

A cord holder consists of a single piece of metal cut and bent to form a hook, and oppositely opposed horizontal semicylindrical arms, also having openings. Means clasped by the arms are adapted frictionally to engage and be slidable on an electric cord.

789,523. Process of Electrolytically Refining Copper-nickel Alloys. Anson G. Betts, Troy, N. Y. Application filed April 11, 1904.

Electrolytically depositing metallic nickel from solutions of nickel sulfate is accomplished by electrolyzing the solution with a suitable cathode and with an anode of spongy lead, subsequently reducing the lead sulfate produced by electrolysis as a cathode in a solution of sulfuric acid.

789,556. Electric Switch. Gustave C. Marx, Elizabeth, N. J., assignor to the Diehl Manufacturing Company. Application filed September 1, 1904.

An electric switch embodies a circuit-changing and a circuit-interrupting member, a common actuating device for operating it successively, and means for retarding the action of the actuating device intermediate its actuations of the members.

789,559. Attachment for Telephones. Alice L. McSweney, Crafton, Pa. Application filed November 4, 1904.

An extensible bracket is described.

789,572. Controller for Electric Motors. Charles A. Stauffer, Elizabeth, N. J., assignor to the Diehl Manufacturing Company. Application filed September 1, 1904.

The armature and field of the motor are adapted to be normally connected with the main circuit to set the motor in operation. Means are arranged to effect successively the short-circuiting of the armature and the opening of the field connection with the main circuit. Automatically acting means controlled independently delay the opening of the field connection.

789,573. Insulator. Louis Steinberger, New York, N. Y. Application filed July 17, 1903.

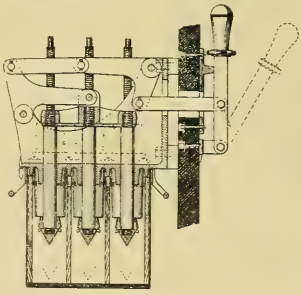
An insulator consists of a body portion of insulating material provided with an aperture, a member of yieldable material disposed within the aperture and provided with a thread and a metallic member provided with a thread for engaging the first thread.

789,574. Binding Post. Louis Steinberger, New York, N. Y. Application filed September 26, 1904.

The invention consists of a binding post comprising a body member provided with means for engaging an electrical conductor and with prongs curved outwardly from each other, for anchoring the body member within a plastic material.

789,597. High-potential Switch. William L. R. Emmet and Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed February 14, 1901. Renewed January 11, 1905.

A high-potential switch for electric currents comprises an oil chamber in which the contacts are opened and closed beneath the surface of the oil, an insulating support for the fixed contacts, and means for shifting the movable contacts in the oil downwardly from the fixed contacts when opening the circuit, and upwardly into engagement with the fixed contacts when closing the circuit. (See cut.)



NO. 789,597.—HIGH-POTENTIAL OIL SWITCH.

789,609. Arc Electrode. Duncan A. Holmes, Samuel A. Tucker and Edward Van Wagenen, New York, N. Y. Application filed August 6, 1904.

An arc electrode consists of zirconium carbid (ZrC) mixed with a suitable binding material.

789,613. Trolley-wire Splicer. William L. Kerlin, Wyoming, Ohio, assignor of one-half to Josiah Kirby, Wyoming, Ohio. Application filed January 4, 1905.

The wire splicer is composed of a tube with tapering cut-away threaded portions at each end and tapering steel nuts with tapering threaded bores adapted to be screwed over the threaded ends to bite into the exposed parts of the wires beneath the ends.

789,618. Apparatus for Automatically Lighting Smudgepots. Henry H. Lyon, Riverside, Cal. Application filed November 21, 1903.

Automatic smudge-lighting apparatus is described, which is made up of a coherer, high resistance wires electrically connected therewith, a source of electricity for heating the wires and a Hertzian-wave apparatus for reducing the resistance through the coherer, whereby the inflammable material in the smudge-pot may be ignited as the wires are heated.

789,626. Electrical Indicator Signal. George W. Pettey, Alexandria, Va. Application filed January 27, 1905.

A pivoted semaphore arm, an electric motor for raising and dropping it, a locking device for the electric motor arranged to stop the latter when the semaphore arm is in elevated position, a tripping device for the locking device, an electromagnet controlling the tripping device, an electric circuit extending from the electromagnet to the stall door, and a circuit-closing device arranged to be closed by the opening of the stall door are the characteristic parts of the device.

789,649. Electrofluid-pressure Switching Mechanism. Walter J. Bell, Los Angeles, Cal., assignor of one-half to Leon F. Moss, Los Angeles, Cal. Application filed January 18, 1904.

In a railway switching mechanism are combined a main trolley wire, a divergent trolley wire, a circuit breaker in the divergent wire, an operating circuit connected with circuit breaker and a starting circuit for effecting the closing of the operating circuit, the starting circuit including pendent contacts independent of the trolley wire. A contact on the car is adapted to engage one of the pendent contacts, and a manually operated circuit closer on the car connects a constantly charged wire with a wire leading to the car contact.

789,651. Electrical Conductor. Charles L. Burlingham and William J. Burton, Chicago, Ill., assignors to Burton and Juanita M. Burlingham. Application filed February 16, 1903.

Combined with a switchboard plug is a spiral flexible conductor connected to the plug and composed of a strong resilient wire surrounded by a good conducting material.

789,652. Switchboard Cord. William J. Burton, Chicago, Ill., assignor of one-half to Juanita M. Burlingham, Chicago, Ill. Application filed February 9, 1904.

A flexible electric conductor comprises insulated conductors wound in parallel convolutions to form a single continuous spiral. A resilient rod is located within the spiral.

789,666. Trolley. James W. Patterson, Cutler, Ohio. Application filed January 5, 1905.

Parallel upright guide rollers are pivoted to the guard arms on the trolley and have their inner surfaces above and in the planes of the marginal edges of the trolley wheel.

789,690. Process of Galvanizing, Tinning or Otherwise Plating Wire or Other Metallic Bodies. George A. Goodson, Providence, R. I., assignor to the Goodson Electric Galvanizing Company, Minneapolis, Minn. Original application filed March 31, 1904. Divided and this application filed June 9, 1904.

Plating wire or other metallic bodies is done by maintaining an attenuated body of plating metal around a portion of the metal to be plated, and in passing an electric current through the attenuated body and the submerged portion of the metal to be plated.

## EXPIRING PATENTS.

Following is a list of electrical patents (issued by the U. S. Patent Office) that expired on May 15, 1905:

382,714. Switch for Electric Motors. R. H. Mather, Windsor, Conn.
382,715. Switching Device for Electric Motors. R. H. Mather, Windsor, Conn.
382,734. Coin-operated Electrical Apparatus. N. W. Russ, London, England.
382,738. Galvanic Battery. G. H. Sloane, Boston, Mass.
382,766. Electromagnetic Car Brake. A. P. Massey, Watertown, N. Y.
382,767. Manufacture of Telegraph Cables. W. R. Patterson, Chicago, Ill.
382,768. Method of Manufacturing Electric Cables. W. R. Patterson, Chicago, Ill.
382,777. Underground Conduit for Electric Wires. W. F. Smith, Philadelphia, Pa.
382,781. Insulated Wire. J. D. Thomas, New York, N. Y.
382,788. Automatic Fire Alarm. J. Young, Chicago, Ill.
382,811. Electromedical Apparatus. P. Horst, Sioux City, Iowa.
382,829. Telegraph Cable. William R. Patterson, Chicago, Ill.
382,845. Commutator for Dynamo-electric Machines. N. Tesla, New York, N. Y.
382,846. Manufacture of Incandescent Electric Lamps. E. P. Thompson, Elizabeth, N. J.
382,856. Repeating Induction Coil. J. A. Barrett, Brooklyn, N. Y.
382,876. Electric Railway. R. M. Hunter, Philadelphia, Pa.
382,877. Electric Railway. R. M. Hunter, Philadelphia, Pa.
382,914. Electric Indicator. J. Tregoning, Hartford, Conn.
382,941. Electrical Agricultural System. E. M. Bentley, New York.
382,968. Storage Battery. C. D. P. Gibson, New York, N. Y.
382,976. Electric Tele-thermoscope. H. W. Hardinge, Leadville, Colo.
382,990. Electrically Propelled Vehicle. W. H. Knight, New York, N. Y.
382,997. Directory Indicator for Buildings, etc. (Electro-Magnetic). F. J. McTighe, New York, N. Y.
383,013. Telephone-exchange System. C. E. Scribner, Chicago, Ill.
383,014. Switchboard. C. E. Scribner, Chicago, Ill.
383,015. Clearing-out Annunciator. C. E. Scribner, Chicago, Ill.
383,016. Automatic Shunt for Mangneto Generators. C. E. Scribner, Chicago, Ill.
383,017. Test Circuit for Telephone Call Boxes. C. E. Scribner, Chicago, Ill.
383,018. Keyboard Apparatus for Telephone Exchanges. C. E. Scribner, Chicago, Ill.

## SPECIAL MENTION.

The low-fare route from Chicago to New York is the Pan Handle, says the management of the Pennsylvania Lines. The Keystone express leaves Chicago via that route daily at 10:05 a. m., after arrival of trains from the Northwest and West, and reaches New York at three p. m. the next day. The privilege of going via Baltimore and Washington on Philadelphia and New York tickets without extra cost includes a 10 days' visit at the National Capitol; also visits at Baltimore and Philadelphia. Information will be given by C. L. Kimball, assistant general passenger agent, No. 2 Sherman Street, Chicago.

The Gregory Electric Company of Chicago reports an unusual amount of good business. This company has recently sold one 360-kilowatt three-phase General Electric alternator to the North Mountain Electric Company, Eureka, Cal.; one 300-kilowatt Western Electric 220-volt generator to the Wolverine Portland Cement Company, Coldwater, Mich.; three 300-light dynamos to Felix Gutierrez & Co., Guadalupe, Costa Rica; one 400-light dynamo to the Sonora Brewing Company, Sonora, Mexico; six 350-600-light dynamos to F. E. Monteverde, Jr., Hermosillo, Mexico, and two 150-kilowatt three-phase General Electric alternators to the Alpena Power Company, Alpena, Mich.

The engineering agency started in Chicago in 1893 by Mr. Frederick A. Peckham announces that it has in the intervening time filled approximately 10,800 positions with competent technical men. One feature has been the supplying of instructors and professors for the principal colleges of engineering.

An installation of engines manufactured by A. L. Ide & Sons of Springfield, Ill., has recently been placed in Hillman's department store in Chicago. The engines are two in number, of 250 horsepower each, to take the place of an outgrown installation erected in 1899. They are direct connected to generators for furnishing light exclusively.

# WESTERN ELECTRICIAN

**EVERY SATURDAY**

Vol. XXXVI. CHICAGO, MAY 27, 1905 No. 21

## Storage Batteries on the Metropolitan West Side Elevated Railway in Chicago.

By J. M. S. Waring.

The Metropolitan West Side Elevated Railway Company of Chicago was the first elevated road to be operated commercially by electric power. The Intramural railway at the World's Columbian Exposition in 1893, it is true, was operated two years prior to the Metropolitan system, but that was in the nature of an experimental exhibit of an electric elevated railway in connection with the Fair. The construction of the Metropolitan Elevated was commenced in the same year and the road started operation in April, 1895 It runs due west from the Fifth Avenue terminal, from its connection with the Union Loop, and on the West Side the main line splits up into four branches, included in the Douglas Park, the Garfield Park and the Humboldt Park and Logan Square divisions. At the Garfield Park terminal the track inclines to the surface and connects with the Aurora, Elgin and Chicago interurban road, which system now operates its cars on an express schedule over the tracks of the Metropolitan Elevated to the Fifth Avenue terminal. At present the Metropolitan elevated road has 42.47 miles of track and operates 418 cars, of which 157 are motor cars. A description was given in the Western Electrician of July 16, 1904, of extensive improvements to the car equipment of this system.

An idea of the rapid development of the West Side, owing to the excellent service given by this elevated road, is shown from the fact that the number of passengers carried has increased from 46,000 a day in 1895 to 114,000 a day at the present time. The officers of the road are H. G. Hetzler, president; H. M. Brinckerhoff, general manager, and W. S. Menden, chief engineer.

The rapid increase of travel on the system necessitating more power facilities, the management of the road made a very careful study of the application of storage batteries to electric railways, which resulted in its installing during the last year two storage batteries, each consisting of 256 cells, of Chloride accumulator, type G 49, manufactured by the Electric Storage Battery Company. [illegible] during the rush hours of the morning and evening, and if it were not for the storage battery additional generating units and boilers would have to be operated for a relatively short time during these peaks, lying idle the remainder of the 24 hours, with a consequent low economy. These general features regarding batteries led to their installation on the Metropolitan West Side Elevated system, and there they furnish an admirable illustration of the storage battery as applied to heavy electric-railway service.

A number of tests were made during January, 1904, at the time this battery installation was being

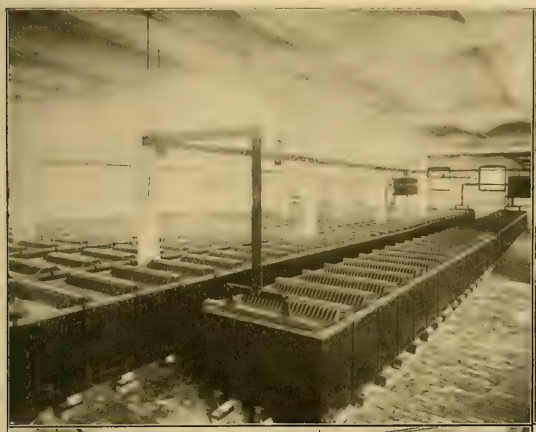


Fig. 1. Battery in Robey Street Sub-station.

Fig. 2. Battery in Forty-sixth Avenue Sub-station

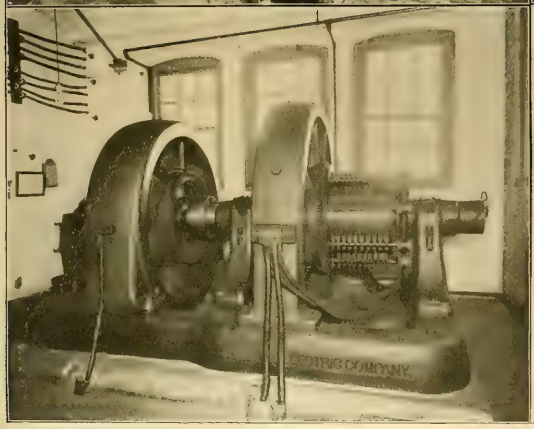


Fig. 3. Booster for Forty-sixth Avenue Sub-station.

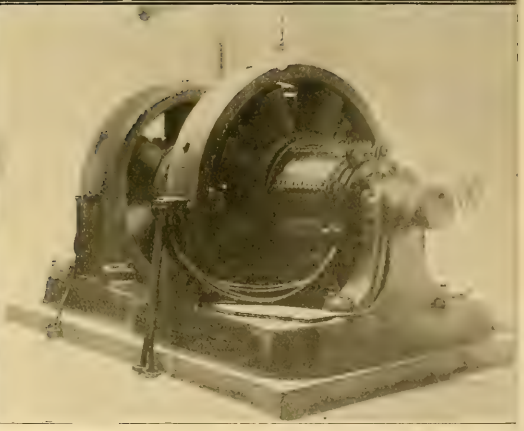


Fig. 4. Booster for Robey Street Sub-station.

STORAGE BATTERIES AND BOOSTERS OF THE METROPOLITAN WEST SIDE ELEVATED RAILWAY IN CHICAGO.

Philadelphia, each of these batteries being capable of furnishing 1,920 amperes for one hour. This article will be devoted to this new feature of the system.

One of the most widely developed and therefore best-known applications of the storage battery is in the field of electric-traction service, and under this head comes the system operating in a direct-current power house with direct transmission. The batteries may be installed here to relieve the generating units of load fluctuations, or in addition to this they may be required to take a part of the morning and afternoon peaks. They may also, in the case of line batteries, maintain a high and uniform voltage at some point distant from the power house, thus effecting a saving in copper. One or more, or in some cases all, of these results may be accomplished by the batteries.

considered, the tests including certain observations taken at the power house together with observations of current and voltage on the various branches of the Metropolitan with a view of determining the capacity of the batteries and the best locations for them. After the batteries were installed and during the month of January, 1905, further tests were conducted for the purpose of determining just what the batteries were accomplishing. A comparison of these tests shows how nearly the batteries have effected the results for which they were installed.

In the early part of 1904 the Metropolitan company contemplated the operation of a number of additional trains during the rush hours of the morning and evening. It was not its intention, however, materially to increase the service between the peaks. At the time this matter was being con-

sidered the load for 24 hours during a day in January, 1904, was as shown in Fig. 5. This load was typical of the week-day conditions obtaining at this plant during the winter months. In Fig. 5 are also shown the boilers and generators that it was necessary to operate at that time. During the morning and evening peaks the entire generating equipment was in service. It was, therefore, necessary, in order to care for the contemplated increase in schedule, either to install additional boilers and another generating unit, or storage batteries of large investment in copper would be necessary on the Garfield Park division and on the Humboldt Park and Logan Square division. To offset this amount of copper it was decided that it would be better in place of a battery at the power house to install two smaller batteries with approximately the same aggregate capacity, one to be located on the Garfield Park branch and the other on the Logan Square and Humboldt Park division, each to be placed at a point near the end of the line on which it was to be installed. While this of course ate extra units to care for the heavy momentary fluctuations and unforeseen loads such as are frequently caused on this system by blockades. While in this case the generators in service follow the load line very closely, even better results in this respect could have been obtained had the battery been installed at the power house, as it would then have been more completely under the control of the switchboard man. This advantage in operation was of so little importance when compared with the copper saving to be effected by placing the bat-

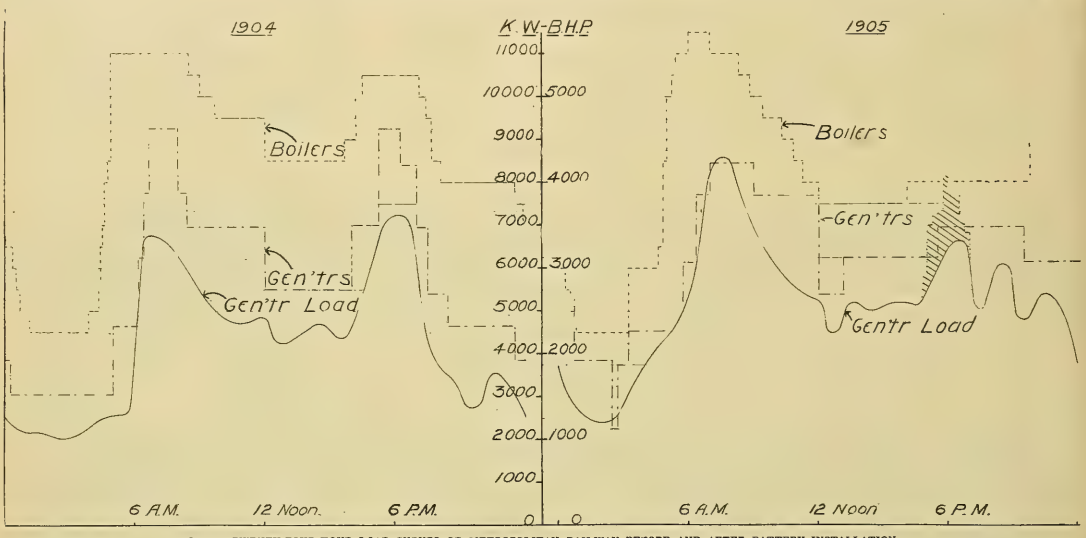



FIG. 5. TWENTY-FOUR-HOUR LOAD CURVES OF METROPOLITAN RAILWAY BEFORE AND AFTER BATTERY INSTALLATION.

sufficient capacity to care for the increase in the load during the peaks.

Investigation showed that if a battery or batteries of a size to meet these conditions were discharged during the peaks they could be recharged during the periods of light load without necessitating the operation of any more generating units or boilers than would be necessary during light load without batteries. It was evident that as the batteries would be floating on the line at all times they would obviate the necessity of carrying boilers with banked fires or under steam in anticipation of the peaks, as was at that time necessary.

The first argument in favor of batteries was, then, the improved load factor and the elimination of reserve boilers, which could be effected by their installation and which would necessarily result in a reduction in the coal consumption per unit of output, which could not have been obtained by installing another unit, as this would have tended to decrease the load factor and to increase the reserve boiler capacity necessary. As noted above, the increase whether in generators or batteries would have to be sufficient to care for the total increase in the load. A comparison of costs showed that the battery was not more expensive than its equivalent in boilers, engine and generating apparatus. Thus far the consideration of batteries dealt only with the relief which they would afford the power house and with certain economies in station operation which they would effect. If these had been the only conditions to be met the necessary results could have been accomplished by installing one large battery at the power house.

It was found, however, that there were certain other conditions to be considered. The operation of the Metropolitan system is as follows: All trains leave the Loop, which is located in the business center of Chicago, and run to Marshfield Avenue, the power house being located between Marshfield Avenue and the Loop. At Marshfield Avenue the line diverges into three branches, which are known as the Douglas Park, the Garfield Park, and the Humboldt Park and Logan Square divisions. It was the intention of the Metropolitan company to operate nearly all of the extra cars on the two latter divisions, and it was found that the amount of copper on these two divisions would be entirely inadequate to maintain a satisfactory operating voltage with the contemplated increase in service. Calculations showed that if the generating apparatus or a battery were installed at the power house a would necessitate some additional expense for buildings for the batteries, and also additional attendance, both of these items were small as compared with the copper investment that would be necessary without batteries at these locations. The final conclusions were that the annual interest and maintenance on battery investment would be materially less than the annual interest and depreciation on additional power-house equipment and copper that would be needed were generators installed.

In regard to operating conditions, the batteries had the advantage of decreasing the coal consumption per unit of output and of maintaining a much more constant voltage on the lines where they would be installed than could be accomplished by the installation of additional copper. The latter point, namely, the constant voltage, assured not only a decreased expense for motor maintenance, but also a more uniform train speed. In the case under consideration the latter point is of great importance, owing to the fact that four different elevated roads operate on the Union Loop. Any slight interruption to service in the outlying districts is liable to occasion a more serious delay at the Loop, as its crowded condition makes it difficult for a road to get back on its schedule if it is once lost.

Of the accompanying pictures illustrating the new installation, Figs. 1 and 2 show, respectively, the batteries in the Robey Street and Forty-sixth Avenue sub-stations. Fig. 3 is the booster for the Forty-sixth Avenue sub-station, and Fig. 4 the booster for the Robey Street sub-station. Fig. 8 shows the exterior of the Robey Street sub-station and Fig. 9 is a view of the switchboard in the latter.

In order to illustrate how well the batteries have accomplished the results that were anticipated a number of curves have been plotted. As stated above in Fig. 5, is plotted a 24-hour load curve during a day in January, 1904, prior to the battery installation; also curves showing the generators and boilers in service to care for this load. In the same figure are plotted corresponding curves for a day in January, 1905.

A comparison of the two load curves shows that the load in January, 1905, was materially greater than that of the preceding year. In spite of this, it will be noted that in January, 1905, the generators in service during the morning and afternoon peaks closely approximated the average load, the batteries rendering it no longer necessary to operteries on the line that the latter location was determined upon. An inspection of these curves shows also that in 1904 it was necessary to start up additional boilers on the peaks, while during the balance of the 24 hours these boilers were banked so as to be available at all times. The 1905 curves show that this is no longer necessary, as it will be seen that the plant operated during the afternoon peak with fewer boilers than were necessary the year before. During the morning peak, while the average load on the station was considerably

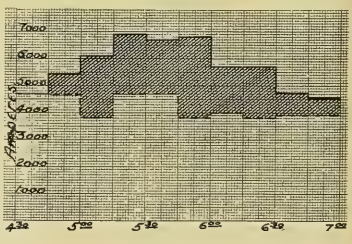



FIG. 6. LOAD DIAGRAM FOR GARFIELD AND HUMBOLDT DIVISIONS.

greater than that of the preceding year, it was not necessary to operate any additional boilers.

An inspection of these curves shows the following results:

| | Kw. Hrs. for 24-hour run. | Station Load Factor. | *Boiler Hours. |
|---|---|---|---|
| With battery | 126,527 | 79 per cent | 386 |
| Without battery | 102,425 | 72 per cent | 412 |

*All of the boilers in this plant are of equal capacity, each having a rating of 250 boiler horsepower.

In Fig. 6 are shown two curves, the upper or solid line representing the total load on the Garfield Park division and the Humboldt Park and Logan Square division. The shaded area shows the discharge of the two batteries. The readings from which these curves were plotted were taken on the same day as the readings plotted in Fig. 5. They are 15-minute averages of readings taken at 10-second intervals from 4:30 until seven p. m. It will be noticed that the maximum battery discharge occurred between 5:45 and six p. m. and amounted to 3,000 amperes. In other words, the batteries at this time were relieving the power house of an average load of 1,800 kilowatts and a maximum momentary load of 3,400 kilowatts.

This battery discharge has also been superimposed on the generator load shown in Fig. 1 during the afternoon peak.

It should be borne in mind that while the solid line in Fig. 5 represents the total load on the system as well as the generator load in the 1904 curve, it only represents the generator load in the 1905 curve, the load on the system during the afternoon peak being equal to the generator load plus the battery discharge as shown. It should, therefore, be remembered that the morning peak shown on this curve is only the load on the generators. Gravity readings showed that at the time of this morning peak the batteries did practically the same work as in the afternoon, but as no ammeter readings were taken at the battery at this time it was impossible to plot the morning battery discharge. From some observations that were available it is perfectly safe to assume that the battery discharged at an average rate during the morning peak, relieved the power house of approximately 1,800 kilowatts, or, in other words, the total average load on the system at 7:30 a. m. on the 1905 day reached about 10,400 kilowatts.

In order to illustrate the value of the battery in maintaining a uniform voltage the curves in Fig. 7 were plotted. Curve (C) and curve (A) were plotted from simultaneous ammeter and voltmeter readings at the Garfield Park battery and extend over a period of 15 minutes during an afternoon peak. Curve (C) shows the discharge of the battery in amperes, while curve (A) shows simultaneous line voltages at the point where the battery is installed. Curve (B) shows the voltage that would have obtained at this point under the same load conditions without the battery. This latter curve was calculated as follows: The resistance of the line between the power house and the battery was determined experimentally and this resistance, multiplied by the ampere discharge of the battery at any moment, gave the increase in voltage caused by the battery at that instant. This voltage deducted from the corresponding point on curve (A) gave a point on curve (B).

From these readings the battery was maintaining an average line voltage of 521 volts and varying between a maximum of 532 and a minimum of 480 volts. The average voltage without the battery and with the present copper would have been 393 volts, fluctuating in this case between a maximum of 516 and a minimum of 220 volts. In other words, under the present load conditions the battery has raised the voltage on the Garfield Park branch at the point where it is installed 128 volts. To have obtained this same voltage without a battery it would have been necessary greatly to increase the copper. This copper investment alone on the Garfield Park division would have amounted to 80 per cent. of the total cost of the Garfield Park battery installed. Even with this installation of copper, however, while the average voltage would have been the same as that existing at present, it would have fluctuated between wider limits than is now the case.

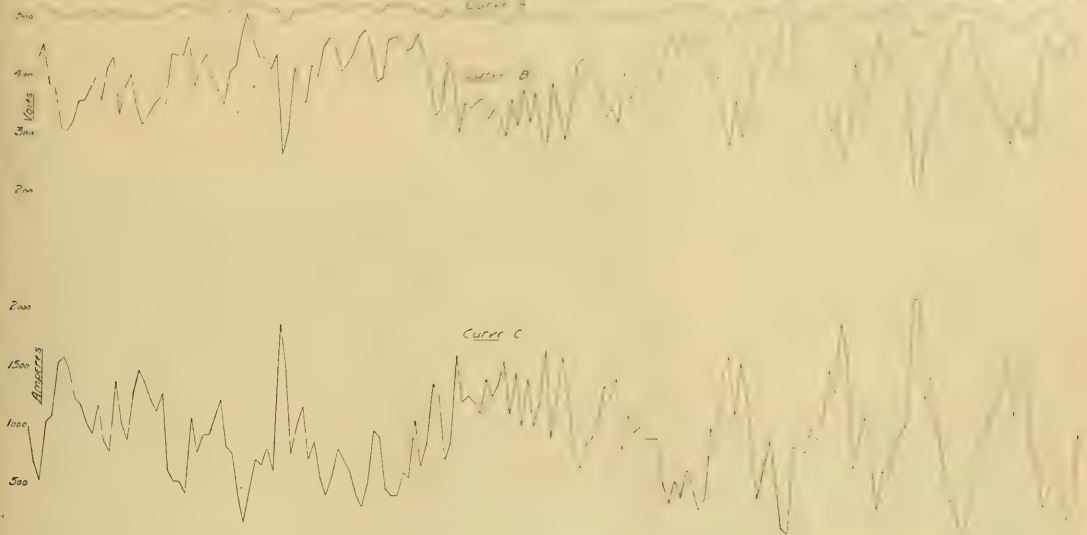



FIG. 7. CURVES SHOWING ACTION OF BATTERY IN MAINTAINING UNIFORMITY OF VOLTAGE ON METROPOLITAN ELEVATED RAILWAY.

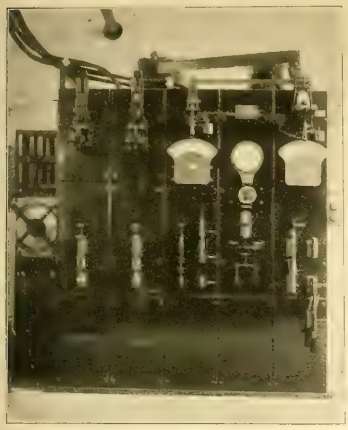


FIG. 9. SWITCHBOARD IN ROBEY STREET SUB-STATION.

FIG. 8. EXTERIOR OF ROBEY STREET SUB-STATION.

A strong effort, which, it is said, will probably succeed, is being made to get the 1906 meeting of the American Mining Congress to Joplin, Mo. The 1905 meeting will be held in El Paso, Texas, in August. Another matter of importance to the Missouri, Kansas and Arkansas zinc and lead districts, and which is also being quietly considered, is the establishment of a national zinc and lead mining exchange at Joplin. The next congress will also advocate the establishment of a department of mining. To hold the congress in Joplin in 1906, it is believed, will be to materially benefit the lead and zinc districts, which have recently been benefited by the introduction of electricity for the operation of the mines by the Spring River Power Company of Joplin, whose plant was illustrated in the Western Electrician of April 29th.

## Patent Office Statistics.

[illegible]

ing an alphabetical list of patentees for the year.

In 1904 there were received 51,168 applications for mechanical patents, 818 applications for design patents, 157 applications for reissues of patents, 2,524 applications for registration of trademarks, 1,335 applications for registration of prints and 397 applications for registration of prints. There were 30,824 patents issued, including designs, 110 patents reissued and 2,158 trademarks, 1,114 labels and 297 prints registered. The number of patents that expired was 20,429. The number of allowed applications awaiting the payment of final fees was 9,362, and the number forfeited for non-payment of final fees 5,413. The total receipts were $1,657,326.53; the expenditures, $1,476,000.38, and the surplus of receipts over expenditures, $181,326.15. The total balance to the credit of the Patent Office in the treasury of the United States on January 1, 1905, was $5,863,866.76.

In proportion to population, more patents were issued to citizens of Connecticut than to those of any other state—1 to every 1,097. In Louisiana there was only 1 to every 10,084.

As to foreign patents, 910 were granted to citizens of Germany, 830 to those of England, 412 to those of Canada and 331 to those of France, these being the highest four in order.

During the summer of 1904 83 iron model cases and about 25,000 models were removed from the galleries of the Patent Office to the second floor of the Union Building. This leaves less than 100 models in the Patent Office Building, and they will be removed to the Union Building very shortly.

## "The Ideal Corporation."

At the twenty-eighth convention of the Western Gas Association, held in Chicago last week, Mr. N. D. Cochran of Toledo, Ohio, read a paper on "The Ideal Corporation," in which he said:

"There is a demand for 'so-called' municipal ownership that will grow in proportion as the companies get out of relation with the public. Before this war is fought there must be more organization—the water must be organized out of the capitalization and public confidence organized in. This growing demand for municipal ownership isn't because the public craves it as a beverage, but rather because it feels something is needed to establish better social health. It is a war measure. In the war right here in Chicago one of the most palpable, significant developments is the palpable inefficiency of the political municipal government—it has failed to govern."

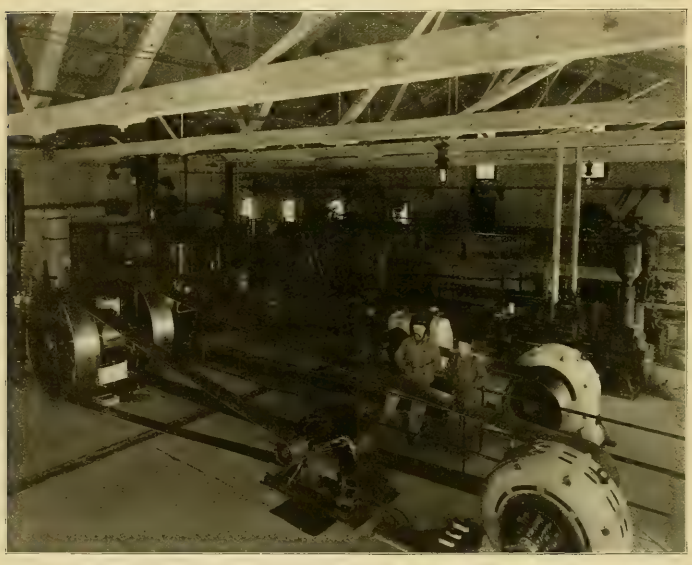
The association selected Cleveland, Ohio, as the next meeting place. The following-named officers were elected: President, Paul Doty, St. Paul; vice-presidents, K. M. Mitchell, St. Joseph, and W. A. Blahr, St. Louis; secretary and treasurer, J. W. Dunbar, New Albany, Ind. J. H. Eustace of Chicago is one of the directors.

## Light, Heat and Water Plant at Pontiac, Ill.

Few cities of 5,000 inhabitants possess a more satisfactory and better conducted electric-light and water plant than does Pontiac, Ill. The plant there is owned and operated by the Pontiac Light and Water Company, of which Mr. J. A. Carothers is president. This system furnishes electric light and power, a large amount of heating for the central portion of the city and pure water for the waterworks system. In addition to this, one end of the station is fitted up for the temporary power installation of the Bloomington, Pontiac and Joliet single-phase railway, which was described in the Western Electrician of March 25th, and which derives its steam from the boiler plant of the light and power company.

The accompanying illustration shows the interior of the plant. It contains two 250-kilowatt three-phase 60-cycle alternators, which are shown in the foreground. These are belt-driven by an Ideal 16 by 22 by 18-inch engine and a Westinghouse 14 by 22 by 14-inch engine. The Westinghouse engine also drives from another flywheel a 100-kilowatt 500-volt direct-current machine. The boiler plant is located back of the engine room and furnishes steam for the engines and also for the central-district heating system.

The company now supplies 75,000 square feet



LIGHT, HEAT AND WATER PLANT AT PONTIAC, ILL.

of radiation, heating one shoe factory, a number of residences and the principal business places in the heart of the city about the courthouse square. The system was put in by the American District Steam Company. It is giving entire satisfaction and the plant runs at its full capacity. Many are desirous of obtaining connection who cannot, the company now having all the radiation that it can take care of in a thorough manner. The charge for heating is 50 cents a thousand pounds of condensation.

Current from the electric plant furnishes light, both incandescent and arc, and also a small amount of power. Power is used to some extent in a number of small factories which are located not far from the plant.

The waterworks system is interesting in the method of purifying the water, which is pumped from the Vermillion River, on the banks of which the plant is located. The gravity filtering process is used. Sulphate of iron ($FeSO_4$) is used as a coagulator, and the average removal of bacteria by the process is over 98 per cent. The sulphate of iron is drawn into the water though the suction end of a centrifugal pump, and limewater is then injected. The whole is then run into the settling tanks, shown in the picture, where it is allowed to stand for one or two hours, when it is run into a cistern, from whence it is pumped into the mains.

The plant thus briefly described is one of the many small and thriving ones which are scattered over the country, in the smaller cities and towns, and it is making money for its owners.

## Large Electric Plant for Chicago Mail-order House.

One of the interesting features about the new buildings of Sears, Roebuck & Co., in Chicago, is a complete power plant, which will be installed to furnish light and power. The buildings of this company are nearly completed and are at the corner of Central Park Avenue and Harvard Street, where railroad connections are to be had with the Chicago Terminal Railroad. When all is completed there will be a merchandise building, or the "works," the administration building, the power plant, printing plant and the advertisement-department building. Besides, there will be a fine park east and south of the administration buildings, which will contain fountains, trees and shrubbery for the benefit of the company's employes.

Altogether, the plans now include buildings aggregating 100 acres of floor space, and to serve these buildings with electric light and power a plant of no small size is required. There will be a total capacity in generators of 2,900 kilowatts, generating current for 30,000 incandescent lights necessary to run the works at night. From this plant heat and power will also be developed for all the departments.

The orders for the engines and generators was placed some time ago with the Allis-Chalmers Company, and the various units are as follows: Three 24 by 50 by 48-inch and one 20 by 40 by 42-inch heavy-duty cross-compound Reynolds-Corliss engines. Three 750-kilowatt, one 500-kilowatt, one 100-kilowatt and one 50-kilowatt 240-volt multipolar compound-wound engine-type generators.

## Conditions on the Isthmus of Panama.

Dr. Albert B. Hale of Chicago gave an instructive and interesting lecture upon the Isthmus of Panama before the last meeting for the season of the Electrical Section of the Western Society of Engineers in Chicago. The meeting was of a semi-social nature, and many ladies were present, the audience filling the assembly room of the Western Society of Engineers to overflowing.

During the course of his lecture Dr. Hale showed over 100 lantern slides, many of them colored, which, with his clear and originally worded descriptions, made the listener almost imagine that he was seeing the places described. Most of the slides were from photographs taken by Dr. Hale himself, who has recently seen the country in the canal zone thoroughly.

The lecture brought out clearly the conditions as they are in Panama. Conditions which are acting always against the American engineer in his work of constructing the canal. Cities must be drained and put in a sanitary condition before the work can go on in a large way and healthful quarters must be provided for the men.

The great French failure in the Panama, Dr. Hale said, was not so much due to lack of engineering ability as to "grafting" among the French contractors. Indeed, American engineers now at work upon the canal have great respect for the ability of their engineering predecessors of 20 years ago, and many of the plans and estimates then made are now being used, with a great saving of expense. But the works of the unscrupulous contractors were in evidence on every hand, as shown very clearly in the pictures. Side-track upon side-track, all along the canal, were seen to contain strings of locomotives by the dozen, standing end to end, and which were said never to have had steam in their boilers. In a like manner great derricks and cranes stood in rows, only their grotesque "necks" showing above the young trees and underbrush which had grown up around them; great dredges lay rotting in the lagoons.

Some later pictures, however, showed what is being done now, and already American enterprise and energy are beginning to manifest themselves, and work is being pushed as rapidly as possible.

## New Electrical Companies in New York State.

In view of the pending change of the law relating to franchises and the formation of a state commission to deal with all future applications affecting traction, power, lighting, telegraph and telephone developments in the whole of New York state there has been an unprecedented number of new concerns incorporated at Albany within the last few days. The combined capital involved totals up to several millions of dollars in actua cash, for under the laws of the state a concern must have the cash capital in hand before it can be incorporated.

Following is a list of the new companies, with the capital stock and the name of one incorporator: Aqua Light and Power Company, New York city, $100,000, Daniel H. Foley of Brooklyn; Blasdell Electric Company, Blasdel, $50,000, J. B. Wall of Buffalo; Cazenovia Electric Company, Cazenovia, $30,000, Henry Barden of Cazenovia; Central New York Power Company, Utica, $1,000,000, William E. Lewis of Utica; Empire Transmission Company, Albany, $25,000, J. P. Brooks of Albany; General Public Service Corporation and Universal Service Company, Monroe County, extensions of powers, former capital $2,000,000, latter $100,000, Frederic H. Cowden of New York; Homans Light, Heat and Power Company, White Plains, $50,000, J. F. Aldrich of Buffalo; Hoosick Falls Illuminating Company, Hoosick Falls, $150,000, Roger Lewis of New York; Hudson Counties Gas and Electric Company, Ossining, $100,000, Moses Ely of New York; International Power and Transmission Company, Niagara Falls, $2,500,000, S. P. Franchot of Niagara Falls; Lindenwald Light, Heat and Power Company, Chatham, $25,000, A. B. Gardiner of Chatham; Manitou General Electric, Gas and Power Company, Rochester, $10,000, A. W. Moore of Rochester; Nassau and Suffolk Lighting Company, Hempstead, $500,000, Dana T. Ackerley of Brooklyn; New York and Lake Erie Power and Transmission Company, Erie County, $100,000, J. F. Aldrich of Buffalo; New York Public Service Company, Queens Borough, $50,000, J. A. Murray of New York; Northern Power Company, Syracuse, $100,000, W. B. Cogswell of Syracuse; Oswego River Power Transmission Company, Syracuse, $20,000, Louis W. Emerich of Syracuse; Overland Power Company, Syracuse, $20,000, George W. Pulver of Syracuse; Rensselaer Heat, Light and Power Company, Troy, $5,000, Lewis Griffith of Troy; State Public Service Company, Queens Borough, $50,000, John Mason of Queens Borough; Troy Public Service Company, Troy, $100,000, Charles S. Aldrich of Troy; Western Counties Transmission Company, Buffalo, $2,000,000, Robert W. Chapin of Buffalo.

## Foreign Trade Possibilities.

The Town Council of Beaconsfield, Cape Colony, British South Africa, projects the erection of an electric plant to furnish light and power.

The Harbor Board Commission at Cape Town, British South Africa, will spend $930,000 for new electric cranes and other harbor improvements.

Materials for the construction of an electric-railway and lighting plant for the city of Johannesburg are to be supplied. The stipulations can be obtained from the consulting engineers, Mordey & Dawbarn, 82 Victoria Street, London.

The estimated cost of works whereby the water-power of the Sentino, in Italy, is to be used to supply electric energy is $400,000. A money prize will be awarded for the best plan for the works, which are projected by the Provincial Council of Ancona, Italy.

The Société Generale des Tramways of Madrid has been granted the concession for building an electric street-railway line in Madrid, Spain.

The Spanish Ministry of Marine will receive proposals for an electric-light installation on the cruiser Catalona.

## Electric Sight-seeing Automobiles in Chicago.

Several electric automobiles of unusual proportions and design are being operated in Chicago for the purpose of "seeing Chicago." The vehicles are built with eight seats and are capable of seating 40 passengers each comfortably. As will be seen from the accompanying picture, the floor of the car is built like the orchestra circle of a theater so as to afford unobstructed view to the passengers in the rear seats.

The machines are provided with Veco batteries, a special battery for truck service made by the Vehicle Equipment Company of Long Island City, which company also makes the automobile. The battery consists of 44 cells, the pressure being 112 volts when fully charged. They are guaranteed for 30 miles on one charge, although in actual service the cars have been run from 35 to 40 miles.

ELECTRIC SIGHT-SEEING AUTOMOBILE IN CHICAGO.

Two General Electric single-reduction motors operate the car. They are mounted on the rear axle and the power by a simple gear arrangement is applied directly to the wheels. This arrangement, it is said by the drivers of the cars, is superior to the chain method. The gearing is simple and compact and offers little chance for the driving apparatus to get out of order.

The maximum speed of the cars is 10 miles an hour, the average speed on the sight-seeing trips being about seven miles an hour. There are four speeds forward and two backward. The cars bear the legend "Seeing Chicago" and are proving popular. Mr. W. E. Sebree, with office at the Saratoga Hotel, is manager of the sight-seeing company. The machines were introduced in Chicago by Mr. John R. Kinsey, representing The Rainier Company of New York city, general sales agent of the Vehicle Equipment Company.

## Seventy-five-year Lease for Philadelphia Gas Plant.

The City Council of Philadelphia, Pa., at a recent meeting leased the Philadelphia gas works to the United Improvement Company for a term of 75 years. Two thousand citizens were present to protest this action by the aldermen, and it is said that those who voted for the lease had to be protected by the police.

There were two propositions reported by a council committee—one from the United Gas Improvement Company and the other from E. B. Smith & Co., bankers of Philadelphia, representing New York and Philadelphia capitalists. The Smith bid proposed to share the profits with the city at the rate of one-third for 10 years and one-half for the remaining 65 years; and also provided that the city could reduce the price of gas as the profits increased. The bid of the United Gas Improvement Company proposed to take the city plant for 75 years and to pay the city therefor a rental of $25,000,000, all to be paid before the end of 1907. The latter was accepted by the council amended so that the city would get 80-cent gas after 1956.

Mayor Weaver has announced himself as opposed to the lease and in favor of a postponement of the whole question until 1907, when the first 10 years of the present 30-year lease to the United Gas Improvement Company will expire. At that time the city has the right to take back the works on payment to the gas company of the amount of money expended in improvements. Mayor Weaver is expected to veto the bill and as that event it is said both chambers will probably pass it over his veto.

## An Electrolytic Switch.

Besides its asymmetric peculiarity the aluminum cell possesses the peculiarity of high resistance to the passage of electric current, capacity and leakage, which may be turned to account in preventing or damping inductive arc. It has been found that if such a cell be inserted across a point to be broken in a circuit there will be no flash when the continuity of the circuit be broken at that point, the increase or surge of pressure resulting from the break driving current through the cell instead of causing an arc. The insulation of the cell then breaks down, but quickly re-establishes itself, when the mains may be entirely disconnected without a spark.

An interesting description of a switch of this character was given in a paper read by Mr. William Smith Horry before the American Electrochemical Society in Boston, April 25th. What follows is taken from Mr. Horry's paper.

To obtain the best results an electrolyte for the cell should be chosen that substantially shuts off all current at the working voltage but allows considerable leakage to occur with any increased pressure, a cell that has a critical voltage a little above the line voltage. Other matters have to be considered, the conditions being different from those ruling when the cell is to be used for other purposes. For small cells intended for use on circuits of one horsepower or less at 110 volts the matter is not of much importance, but for larger ones it becomes so, as the electrolyte largely determines the size of the cell required for any given circuit.

The circuit contains an electromagnet, a double-pole switch for the line, a rheostat contact and an aluminum cell. If the switch is closed no current will flow except that which leaks through the cell, but if the rheostat arm is moved to the left, then the full current will pass.

But the cell possesses capacity, and, if it be a large one intended to suppress a powerful arc, there will be a spark at the arm contacts when the terminals of the cell are connected. To make the circuit sparklessly the rheostat must be moved before the switch is closed. If the arm be moved [illegible] inches of aluminum, respectively. The smaller one leaked 600 and the larger [illegible] 100 volts direct current. With a certain circuit of three amperes broken in the ordinary way there was, of course, an arc, and the voltage ran up to 350 [illegible]. When the [illegible] switch in the same circuit there was no arc at the break and the maximum volts were only 250 +. With the larger cell, tried in the same way, the volts were but 149 +. These readings were obtained by setting the voltmeter needle in certain positions, free to move upwards, then breaking the circuit. With the voltmeter disconnected the maximum voltage would be higher than here given, but for all that the protective property of the cell on the circuit is clearly shown.

By using a much larger cell the voltmeter showed a rise of potential of only 10 volts above the line. If it is desired that the maximum voltage on a certain circuit, the field of an alternator for instance, shall not rise above 1½ times the applied voltage, then the proper size of the cell can easily be found.

The connections between the switch and the cell should be of low resistance and noninductive. If an ampere meter be inserted between them the discharge current may select the path by way of the air gap at the switch rather than by the cell with its added impedance.

It is not essential, of course, that both anode and cathode should be of aluminum; indeed, for large cells it is better theoretically to have the cathode of some other material to reduce the resistance. But it is generally convenient to have both plates the same to simplify the chemistry of the cell, and both plates formed to obviate the trouble of testing for polarity.

## Taking Moving Pictures in the New York Subway.

A unique experiment was successfully tried on May 21st, when the American Mutoscope and Biograph Company took a moving picture of 6,300 separate exposures of the subway in New York city.

The pictures were taken for the personal pleasure of Mr. August Belmont, president of the Interborough Rapid Transit Company, and are not intended to be exhibited in public. The method adopted was to arrange a battery of 72 Cooper-Hewitt mercury-vapor lamps in nine groups, as shown in the accompanying picture, reproduced from a photograph specially taken for the Western Electrician. Current for the lamps was supplied from a Westinghouse motor-generator set, belt-connected on one of the cars, the current for the motor being supplied at 550 volts from the third rail, and delivered to the lamps at 125 volts.

VIEW OF TRAIN EQUIPPED FOR TAKING MOVING PICTURES IN NEW YORK SUBWAY.

Three trains were used in the operation. The camera was taken uptown on a train traveling on the down-express tracks; the lamps were on a train on the up-express tracks, and a third local uptown train "faced the camera" and was photographed as it traveled between Astor Place and Forty-second Street.

The annual report of the United States Rubber Company shows that the net profits for the year, amounting to $3,761,922, were more than double those of the preceding year, although the net sales, $32,931,210, show a slight decrease from last year. In the report mention is made of the advancing price of crude rubber, and it is stated that the company has provided independent facilities for procuring its crude material. President Colt calls attention to the fact that the employes' profit-sharing plan has proved most successful.

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## DATES AHEAD.

**National Electric Light Association (annual convention), Denver, June 6th, 7th and 8th, and Colorado Springs, June 9th, 10th and 11th.**

American Institute of Electrical Engineers (annual convention), Battery Park Hotel, Asheville, N. C., June 19th to 23d.

National-Interstate Telephone Association (first convention of consolidated telephone associations), Chicago, June 20th and 21st.

Canadian Electrical Association (annual convention), Montreal, June 21st, 22d and 23d.

National Electrical Contractors' Association (fifth annual convention) and Electrical Exhibition, Mechanics Hall, Boston, Mass., July 15th to 22d.

Ohio Electric Light Association (annual convention), Hotel Victory, Put-in-Bay, August 16th to 18th.

International Association of Municipal Electricians (annual convention), Erie, Pa., August 29th, 30th and 31st.

Old-Time Telegraphers' and Historical Association (annual meeting), New York city, August 29th to September 1st.

American Electrotherapeutic Association (annual meeting), Academy of Medicine, New York city, September 19th, 20th and 21st.

American Street Railway Association (annual convention), Bellevue-Stratford Hotel, Philadelphia, September 25th to 29th.

A SENSATION has been caused in Independent telephone circles by the consummation of the negotiations whereby the Central Union Telephone Company (Bell) has come into control of the property of the United Telephone Company, one of the strongest Independent companies in Indiana, which at present holds a practical monopoly of the business in Wells, Grant, Blackford and Huntington counties. The arrangement which has been entered into is an important one, and marks the policy of the Bell interests to buy out, where it cannot otherwise meet Independent competition. But the opposition, while not underrating this strategic move of the older company's forces, is not dismayed. It maintains that Independent companies will immediately enter the field now secured by the Central Union and attempt, by the installation of competing plants in the territory of the United Telephone Company, to win back the region from Bell control. In the meantime the Central Union will lease the Bell instruments to the United company, as it now has no connections in the field occupied by the latter. The United Telephone Company has property that is said to be worth $700,000 and gives service to 5,000 subscribers. That the Independent interests will let such valuable territory slip through their hands without demur is not to be expected, and a long and fierce struggle for supremacy will undoubtedly be the outcome.

SOME INTERSTING DATA concerning the firing of boilers with coal dust is contained in a paper read by Mr. Eustace Carey before the Liverpool Section of the Society of Chemical Industry, the author quoting experiments which go to show that more water can be evaporated per pound of coal thus burned than where lump coal is used, with the additional advantage of practically smokeless combustion. Mr. Carey described the drying and grinding apparatus installed at Haydock, which consists of a revolving cylinder four feet in diameter by 27 feet long, making six revolutions a minute. It was found that one pound of carbon evaporates eight pounds of water, the coal, when delivered direct from the pit, generally containing from four to six per cent. of moisture. The temperature of the fuel is kept at about 120° F., and the burner consists of a hopper into which the dust is conveyed, and then spread and projected into the fireplace by a brush, which revolves at 800 to 1,000 revolutions a minute. Incandescent brickwork for a distance of about six feet at the mouth of the furnace is necessary to secure complete combustion. Assuming a Board of Trade unit to cost 0.507 cent, Mr. Carey computes that the drying and grinding machinery uses electrical energy to the amount of 2.7 cents per ton of coal dealt with, while the energy required for the stoking mechanism is valued at 0.548 cent. These, together with the interest and depreciation charges, wages for drying and grinding, etc., amount to a total of 22.47 cents a ton.

RELAYS form such an important part of the protective apparatus for the station equipment and feeders of large alternating and direct-current distribution systems that the paper by George F. Chellis upon "Time-limit Relays," which was read before the last meeting of the Institute in New York and which is given in abstract elsewhere in this issue, is an especially valuable one. Where synchronous converters are used, because of the great amount of energy stored in them, it is entirely possible for the sub-station to feed back into a short circuit. An ideal combination for cases of this sort would be an overload time-limit relay at the power house and an instantaneous reverse-current relay at the sub-station end of each feeder. But an alternating-current reverse-current relay, the operation of which does not depend upon the pressure of the system, nor a relay which depends upon the pressure, operating on a reversal only, that would not become completely inoperative at zero pressures or at comparatively low pressures are what engineers are puzzling their brains over now. If differential relays were used with a "differential factor" sufficiently high to render the relays of any appreciable value at low pressures, it is probable that they would be so sensitive that any disturbance causing a momentary reversal, without a serious decrease in pressure, would cut the station out unnecessarily. This theory has been borne out in practice and it has been found that, with feeders operated in parallel, where one becomes short-circuited all the differential relays at the sub-station end will operate, and also one or more of those at the other sub-stations.

TRIALS of strength and speed between electric and steam locomotives, though not particularly new, are followed with interest, especially since the electric locomotive has been developed to a stage which makes it a worthy competitor of the older type of engine. As far back as the Chicago World's Fair in 1893 a test was made to determine the relative tractive effort which could be exerted by a steam and electric locomotive, and two such engines were made to pull against each other. In this case the steam engine carried off the honors, for the electric locomotive, although supplied with an abundance of power, was unable to hold its own, and was dragged back. Since that time, however, the electric locomotive has been greatly increased in size, weight and power, and as the recent test of one of the New York Central locomotives shows, it is now able to hold its own and more with the steam-driven type. The test mentioned took place recently on a stretch of track near Schenectady between a specially selected Pacific-type steam passenger engine and the New York Central electric locomotive illustrated and described in the Western Electrician of November 19, 1904. In spite of the fact that the train of the electric locomotive weighed 400 tons to the 344 tons pulled by its competitor, it left the latter well behind in all of the trial runs. The total weight of the electric locomotive was 200,500 pounds with 142,000 pounds on the drivers. The steam engine weighed 342,000 pounds, with 141,000 pounds on the drivers, making the total weight of each train approximately equal and the conditions fair to each.

COLORADO, with characteristic western hospitality, is making elaborate preparations for the forthcoming Denver-Colorado Springs convention of the National Electric Light Association, which will be held in the cities named on June 6th to 11th, inclusive. The business sessions of the convention will be held in the Brown Palace Hotel in Denver on June 6th, 7th and 8th., and on the 9th the entire party will be taken to Colorado Springs on special trains, from which, as a center, visits will be made to power plants, mountains and other points of interest in the vicinity on that and succeeding days. Entertainment is also provided in Denver in abundance, including a "broncho-busting" contest—a characteristically western spectacle—for which the best men and horses to be found in Wyoming, Colorado and New Mexico have been secured.

But President Davis and his fellow officers have been no less diligent to see that members and visitors shall have the solid meat of practical information in papers and reports than the warm-hearted local committees have been to provide relaxation and opportunity for sight-seeing. The business programme is indeed unusually full and varied, and every central-station man will be well repaid for attending the convention.

This convention will be ditinctively a western one, and we trust that readers of the Western Electrician generally will avail themselves of the unique combination of technical advantages and recreation features which it offers. The attendance is sure to be very large, including an unusual proportion of ladies, but both Denver and Colorado Springs are used to conventions and will cordially welcome all who attend.

## The Lewis and Clark Exposition.

By W. E. Brindley.

The Lewis and Clark Exposition, which is to be held at Portland, Ore., this summer, is the first great fair to be held west of the Rocky Mountains under the sanction and patronage of the United States government. The fair, while not so large as those held at Chicago and St. Louis, is by all odds the biggest thing ever attempted in the West, and the West has put its heart into the undertaking, with the result that the exposition, while showing many things that might have been seen at earlier fairs, is in many ways original, and has a number of attractive features which are possible only at a fair so advantageously situated.

The state of Oregon appropriated for the fair $450,000, equal to nearly a dollar for every man, woman and child within its boundaries, and the sale of stock in the fair corporation brought in $430,000, when the city of Portland contained not more than 100,000 inhabitants. Other western states made generous appropriations, especially California and Oregon, whose legislatures voted, respectively, $90,000 and $75,000. The Fair on opening day, June 1st, will represent an expenditure of $5,000,000 and its exhibits will have an estimated value of five times that sum. The participation which the United States government has provided could not be duplicated for $800,000, although not all of this sum was appropriated especially for Portland.

The specific historical event which the Lewis and Clark Centennial commemorates is one worthy a great enterprise of its nature—the exploration by Captains Meriwether Lewis and William Clark of the great Pacific Northwest, and the discovery by them of an overland route to the Pacific Ocean, an accomplishment which added 307,000 square miles to the territory of the United States.

One purpose of the Exposition is the exploitation of the Pacific Northwest, with a view to attracting settlers, and while the national aspect of the Fair is assured by government participation and representation on the part of 14 states, and the enterprise is made world-wide in its scope through participation of some sort by nearly every nation on the globe. The efforts of the Fair management have been directed primarily toward securing adequate representation of the resources of the Pacific Northwest. Every state in this new country is represented by a building and a comprehensive display, while many counties in Oregon, and not a few in the adjoining states, have individual displays.

The Lewis and Clark Exposition grounds have natural advantages which are far superior to sites for earlier fairs. The entrance gates are only 15 minutes by street car from the downtown portion of the city, and open upon an exposition which is laid out charmingly and with such good taste, that, while the buildings are not crowded together, the long miles of weary wanderings which visitors to earlier fairs recall so vividly are avoided. The grounds embrace 126 acres of woodland, and a natural lake of 220 acres, in the center of which is a peninsula, 60 acres in extent, where the United States government's five magnificent buildings are located.

Five of the principal exhibit palaces, the Forestry, Oriental Exhibits, European Exhibits, Agriculture and Varied Industries buildings, occupy a slightly elevated plateau, with their short ends facing the water feature, Guild's Lake. The central feature of the exposition, Columbia Court, which consists of two wide avenues with beautiful sunken gardens between, occupies the space between the Agricultural and European Exhibits buildings, and a broad flight of steps, called the Grand Stairway, leads from the court to the music shell on the shore of the lake. The Auditorium, the Machinery, Electricity and Transportation Building and the Mines and Metallurgy Building occupy a court east of the main group, while the state buildings, manufacturers' pavilions, Fine Arts Museum, and miscellaneous structures are grouped about the principal exhibit buildings. The Administration and Fire Department buildings flank the main entrance, and an ornate colonnade of Ionic columns forms a bow that connects these structures.

The site itself is one of unusual attractiveness, and the setting which nature has given it enhances its beauty. The foothills of the Cascade Range reach down to the western edge of the grounds. From Lakeview Terrace, at the head of the Grand Stairway, the view embraces the shimmering lake, with the twin towers of the main government building reflected in it, the government peninsula, with its staff palaces clustering among the trees, the Willamette River in the near distance, and beyond, half a hundred miles away, four snow-capped summits of the Cascade Range—Mount Hood, Mount Adams, Mount St. Helens and Mount Rainier.

In the western part of the grounds a large portion of the site has been left almost in its natural state, forming Centennial Park. In a small canyon are the Experimental Gardens, another unique feature, wherein all kinds of western crops are seen as they actually grow. A popular promenade, called the Lake Shore Esplanade, extends the length of the grounds, roughly parallel with the lake shore, being built like a bridge on piles over the water. The promenade is a mile long and connects the group of state buildings on the east with the American Inn at the west, passing the music shell, and intersecting the Bridge of Nations.

Such are the principal distinctive features. The plan of segregating exhibits has proved extremely popular. All the European exhibits are displayed in one building and all the Oriental displays in another, while the states which have separate pavilions have gathered all their exhibits within their own buildings.

## Railway Telegraph Superintendents in Convention.

The twenty-third annual convention of the Association of Railway Telegraph Superintendents was opened in the Read House in Chattanooga, Tenn., on May 17th. President H. C. Hope of St. Paul, Minn., presided. After a few opening remarks he introduced Col. G. L. Lang of Chattanooga. Mayor Chambliss then delivered an excellent welcoming address, which was responded to by M. L. O'Leary of New York city.

After the business features of the association and the organization of the convention, letters were read from the Postal Telegraph-cable Company, the Western Union Telegraph Company, the American Telephone and Telegraph Company and the East Tennessee Telephone Company, in which each offered the services of its lines free to the members of the association.

The only paper read on the first day was that on "Composite Telephone Circuits," by L. B. Foley of New York city. The paper was instructive and interesting.

Sixteen new members were then admitted to the association; of this number the following named are active members: J. L. Orbison, superintendent telegraph C., C. and L. railway, Cincinnati; B. F. Forbes, superintendent telegraph Oregon Short Line, Salt Lake City, Utah; N. E. Smith, superintendent telegraph New York, New Haven and Hartford railroad, New Haven, Conn.; E. M. Day, assistant superintendent telegraph Baltimore and Ohio railroad, Baltimore; B. Meeks, assistant superintendent telegraph Illinois Central, Memphis; J. M. Walker, superintendent of telegraph Denver and Rio Grande railroad, Denver, Colo.; J. C. Browne, general foreman of telegraph St. Louis, Iron Mountain and Southern railroad, St. Louis.

The second day, aside from the social and entertainment features, was devoted to the election of officers and the reading and discussion of papers. "High-tension Currents on the Right-of-way," by W. J. Camp, chief electrical engineer Canadian Pacific railway of Montreal, and "Better Overhead Construction Work," by William Maver, Jr., electrical engineer of New York city, were the two principal papers. The former was read during the morning session after the business was completed, and the discussion following it lasted until early in the afternoon session. The second paper was given in the afternoon and its discussion took up all the time until adjournment.

The election of officers resulted as follows: President, E. E. Torrey, superintendent of telegraph Mobile and Ohio railway, Jackson, Tenn.; vice-president, E. A. Chenery, superintendent of telegraph Missouri Pacific railway, St. Louis, Mo.; secretary and treasurer, P. W. Drew, superintendent of telegraph Wisconsin Central railroad, St. Paul, Minn. P. W. Drew was re-elected to serve his twenty-third annual term as secretary and treasurer of the organization. Mr. Drew was elected to this position at the first annual meeting of the organization and he has been re-elected unanimously at every meeting since that time.

The entertainment features of the convention were numerous. Through the courtesy of the Chattanooga Electric Railway Company and the Rapid Transit Company of Chattanooga the delegates and their ladies were permitted to see the many interesting sights and historic places about Chattanooga.

There were a number of interesting exhibits at the convention, the principal ones being those of the Morse Code and Signal Company of Milwaukee and the Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y. The former consisted of an elaborate array of apparatus illustrating the selective telegraph signals. The exhibit was so arranged that it presented the telegraph system of a miniature railroad. The Stromberg-Carlson exhibit consisted of several portable

## Annual Meeting of the Institute.

The annual meeting of the American Institute of Electrical Engineers was held in Carnegie Hall, New York, on May 17th. President [illegible] called the meeting to order, announcing the annual election of officers and the following committees.

Secretary R. W. Pope presented the report of the meeting of the board of directors, held the previous day, [illegible] and that the annual report showed a total membership on May 1st of 3,460. He also read the report of the committee on the Engineering Building and extracts from the report of the board of directors.

Other reports read were on local organization and on papers and meetings by Dr. Samuel Sheldon; reports of library and finance committees, by Gano S. Dunn; land and building-fund committee, by Mr. Rice, who also read the report of the general reception committee of the Institute, in connection with the International Electrical Congress. In the report of the library committee it was announced that the total valuation of the library is now $21,099.59. There were, on May 1st, 7,219 titles and 10,204 volumes.

The net gain in membership of the Institute during the last fiscal year was 433, an increase of 14 per cent. One member resigned during the year, and 22 associates. Seventeen deaths were reported.

The report of the tellers on the election of officers for the ensuing year was as follows:

President—Dr. Schuyler Skaats Wheeler, president of the Crocker-Wheeler Company, Ampere, N. J.

Vice-presidents—Charles A. Terry, Westinghouse Electric and Manufacturing Company, New York; Townsend Wolcott, electrician, New York city, and Gano S. Dunn, vice-president and chief engineer of the Crocker-Wheeler Company, Ampere, N. J.

Managers—C. C. Chesey, chief electrical engineer of the Stanley Electric Manufacturing Company, Pittsfield, Mass.; Calvert Townley, New York, New Haven and Hartford Railroad Company, New Haven, Conn.; Bancroft Gherardi, chief engineer, New York and New Jersey Telephone Company, Brooklyn, N. Y., and C. L. Edgar, president of the Edison Illuminating Company of Boston.

Secretary—Ralph W. Pope of New York.

The papers of the evening were then read and were on the subjects of "Time-limit Relays," by G. F. Chellis, and "Duplication of Electrical Apparatus to Secure Reliability of Service," by H. W. Buck, electrical engineer of the Niagara Falls Power Company. An abstract of Mr. Chellis' paper appears elsewhere in this issue.

## Institute Meeting in Chicago.

A good attendance marked the last meeting of the season of the Chicago branch of the American Institute of Electrical Engineers, which was held on May 23d. P. Junkersfeld, local secretary, presided. George A. Damon of The Arnold Company abstracted his own paper on "Line Construction for High-pressure Electric Railroads" and also Theodore Varney's on "High-pressure Line Construction for Alternating-current Railways." Both these papers had been presented in New York, and have been published in abstract in the Western Electrician. Mr. Damon also showed a number of lantern-slide pictures illustrating the Huber system of line construction as used on several high-voltage railways in Europe. These slides were kindly loaned by C. O. Mailloux of New York. In the discussion Fay Woodmansee and B. J. Jones of Sargent & Lundy, Chicago, gave details of the line-construction work of the Indianapolis-Cincinnati single-phase road. Fred L. Lucas, general manager of the Bloomington, Pontiac and Joliet single-phase line, contributed interesting information about the operation of his road.

J. R. Cravath read an original paper on "Light Electric Railways," in which was set forth a plan for an inexpensive, narrow-gauge electric railway for farming communities. This was discussed by W. Owen Thomas of Chicago, Mr. Damon and Ernest Gonzenbach of Sheboygan, Wis.

## Interior Wiring and Fire Protection.[1]

By Washington Devereux.

Possibly there is no better way to treat the subject before us this evening than to commence at the beginning and with the steps taken to raise the standard of electrical equipments and the introduction in buildings of the same.

At an early stage it was found necessary to regulate the manufacture and introduction of electrical equipments. To the English insurance interests may be attributed the credit of compiling the first code, better known as the "Phœnix Fire Office Rules." The rules were somewhat prohibitive, due to cost of installation of apparatus required. In the early days electric-lighting apparatus and materials were far more expensive than at present. The use of electricity for lighting purposes was a rare novelty, and only for the favored few of great wealth. Electricity for power purposes was unknown.

The insurance interests of America were far more lenient and generous than our British cousins. Perhaps we were not so well posted in knowledge of the hazard involved and were therefore eager to learn and gain a knowledge to ourselves of that mysterious power of electricity. We have learned much in the last 25 years, and yet how little we know after all. In the light and power world "a little knowledge is dangerous indeed," if the individual thus afflicted ventures too far unassisted.

As a rule the insurance companies pay for the lack of knowledge. In the last 25 years many fires have originated from defective electric equipment. Many regulations were published by the insurance and electrical interests in an effort to correct previous errors, and while the advancement has been none too rapid in reducing the fire hazard, a marked improvement in the last 25 years is most pronounced, and we trust the next decade will enable the engineering world to reduce the hazard of electricity to a minimum.

During the time spoken of opinions as to the best method of installations varied very much among the insurance and electrical interests, and there was a strong desire on the part of both to establish a code, which would be acceptable to those most affected. And while there is quite a difference of opinion regarding some details, on the whole the present regulations are commendable.

Today we have the National Electrical Code, which is the result of a gradual development originating with the Phœnix Fire Office Rules, having for its primary object the reduction of the fire hazard from electricity, and, secondly, a uniform requirement which could be mutually recognized by the insurance and electrical interests, and a basis for the acceptance or rejection of electrical installations. We do not claim this an ideal code, as experience has shown the necessity for improved equipments. This code is, nevertheless, the expressed opinion of the combined insurance and electrical interests.

As we look we are somewhat amazed at the marked difference in the construction and installation of apparatus. During this period certain features seemed to mark a new era in this particular line, yet in but a short time another feature of equal import was introduced. The history of the National Electrical Code is made up of a series of discoveries which will be dwelt upon.

At an earlier date the importance of wire insulation was not recognized, and bare copper conductors, with a difference of potential from 300 to 500 volts, were stapled to woodwork, and this method of construction was considered good practice. Difficulties were encountered as must be expected, such as electrolytic action, grounds, short circuits and fires, and these were only limited, due to the fact that very few plants were in operation. It was learned that these difficulties could be reduced to some extent by covering the conductors with insulating material. This led to covering the conductors with cotton paraffined. These insulated conductors were held in place by means of wooden cleats. Such an insulation is highly inflammable, and while some difficulties were eliminated the fire hazard was greatly increased. This led to the adoption of the "Underwriters" wire. The insulation on this wire consisted of cotton and asbestos fiber, impregnated with white lead. This insulation was fireproof (and was and is today most serviceable in hot drying room, boiler houses and places of like nature), but not damp proof, reducing to some extent the fire hazard, but presenting the serious objection, an insulation materially affected by dampness, having a very low insulation resistance compared with that of cotton-paraffined wire.

The wiring contractors make formal application for inspection to the underwriters having jurisdiction. The examinations are made by trained inspectors, whose duties require a strict compliance with the requirements. In the examination, points not covered by the code are pointed out and corrected. This inspection tends to educate those directly or indirectly connected with electrical matters by this transference or interchange of ideas. New ideas are reserved for future consideration by the National Board of Fire Underwriters, and after acceptance are made a part of the revised code. Thus the latter is a flexible requirement, changing with the changing of ideas or customs, adjusted to suit these new ideas and customs, but always improving.

In addition to the use of wood cleats for mechanical support the conductors were laid in V-shaped grooves in wood joist, unprotected except by the wire insulation.

The conductors were subject to mechanical injury and breakage, as the floor boards were sometimes unevenly laid, very often loose, and a constant wear was sustained by the conductors, as the occupants of a building would tread upon the surface wired over. Occasionally joists were bored and the conductors drawn through wooden base switches, and open-link wooden cut-outs served as controlling and safety devices in all cases on low-potential system, 110 to 220 volts.

The weakness of the above methods were soon noticed and eliminated to this extent, the conductors were no longer laid in V-shaped grooves, and the holes in joists through which conductors passed were bushed with soft rubber tubing. This insulation proved a failure. Then followed the hard-rubber tube; failure again. Papier maché tube treated with several coats of asphaltum, then papier maché sheathed with brass. All in turn were failures, lacking qualities desired and necessary solder was at a premium, judging from the number of unsoldered joints. Tin foil was often used as a substitute, principally with a view of deceiving the inspector.

The necessity for support of higher insulating qualities developed the porcelain knob and cleat. The application of glass and porcelain to the manufacture of insulators and of porcelain to the manufacture of cut-outs and switch bases was a marked stride in the development of higher quality of electrical fittings.

The "Underwriters" or composition asbestos wire had in it the weak feature that it was readily affected by moisture. This wire was later covered with a cotton or hemp braiding coated with asphaltum, pitch and tar, or a composition similar to chatterdon compound, making a comparatively good insulation. While fresh this insulation will burn readily, but when thoroughly dried out is of slower combustion, and is commercially known as "Slow-burning," sometimes "Fire and Weatherproof." The latter title, however, is erroneous and misleading.

The necessity for an insulation having a higher value than "Underwriters" and "Slow-burning" insulations was apparent and led to the construction of rubber-covered wire. This was followed with a rubber-covered wire having a single outer wrapping of tape. Two weaknesses were noted. First, the copper wire was chemically affected by the sulphur mixed in with the rubber, and second, the outer covering dried up, unwrapping or otherwise exposing the inner insulation to a varying atmosphere, eventually drying and cracking the rubber. The first trouble was remedied by tinning the wire, the second by applying a braid of one, two or three layers.

From the number of layers of braid we name the wire—for instance, the triple braid having in addition to the rubber insulation three distinct braids of insulating material. Undoubtedly the braid greatly enhanced the insulating value of rubber-covered wire.

We have briefly scanned the field from the use of bare wire stapled, to the rubber-covered wires mechanically supported by knobs and tubes. This is indeed a great improvement and it will no doubt surprise you to note a backward step.

Knob construction was found objectionable from an artistic standpoint, also because the wiring in many instances was subject to mechanical injury. The circuits thus disarranged came in contact with gas pipes, water and steam pipes, causing grounds, leaks in multiple and many times creating a fire of more or less magnitude. Thus the need for some device that would entirely conceal the wire brought forward the astrakan molding.

This molding was made of hard wood, grooved in the back. The wires were laid in the grooves and nailed anywhere. This class of construction was not without fault and its adoption was indeed a backward step. The rubber wire very often resting against new plastered walls and ceilings was acted upon by the chemical lines, etc., rapidly deteriorating the insulation and creating a fire.

The astrakan molding was soon replaced with the present two-piece molding, though of lighter construction and untreated with a moisture repellant, and the same disastrous results followed as in the absorption of the astrakan molding, to a lesser degree, however.

The present molding is of heavier construction, thoroughly treated with two and sometimes three coats of moisture-proof paint and has proved fairly satisfactory. Care, however, is needful never to install molding work in wet places or where the possible overflow of a tank, sink or accidental breaking of a water pipe may saturate the molding and thus cause a fire.

Attention was given to the development of some form of insulation between gas fixtures and the house piping. Insulating joint having soft-rubber insulation was adopted, but failed, owing to the chemical changes in the rubber and its mechanical weakness.

The principal weakness, however, was the extreme inflammability of the rubber. "Bug" cut-outs were invariably placed in the canopies of fixtures. The melting of a fuse many times would flash sufficiently to ignite the soft rubber, which quickly communicated with the illuminating gas contained in the house piping, creating a fire close to the ceiling. Sometimes side brackets were thus effected, located on hollow frame partitions. The fires were not easily controlled, as it was always necessary to turn the gas supply off at the meter. Before this could be accomplished a fire of no small proportion sometimes occurred.

The soft-rubber joint after a few years proving unsatisfactory and unsafe was replaced by the hard-fiber joint, and finally the mica insulating joint, while not indestructible, when subjected to an electric arc has proved more satisfactory than any insulating joint yet produced. The introduction of the mica insulating joint greatly reduced one of the most serious weaknesses in an electrical installation.

If we will but consider that the combination gas and electric fixture contained two factors, having dangerous characteristics if improperly handled, one being able to puncture the gas pipe and the gas ignited by the consequent spark (arc), we more readily appreciate the real value of the insulating joint. The possibility of grounds to earth on fixtures attached to gas piping has been reduced by the use of the mica insulating joint. It was also required to cover the wires at the outlet to avoid possible contact with the house piping. This was accomplished by covering the wires with soft-rubber tubing, a poor remedy; later the improved means of flexible, slow-burning tubing, and finally porcelain tubes.

"It is also recommended that the gas outlet pipe be protected above the insulating joint by approved insulating tubing, having a flange at the lower end where it comes in contact with the insulating joint." The use of electric gas lighting on the same fixture with electric lighting is most inadvisable, as the insulating joint is rendered practically worthless by the gas-lighting wires bridging the insulating joint. In fact, straight gas or straight electric is the best practice.

Probably no portion of the electrical equipment, with one exception, is more roughly handled than the sockets, and the introduction of the lined socket was a marked improvement indeed.

The great need of a wireway or raceway for electrical conductors was most apparent; a method system, if you please, whereby the electrical conductors could be more systematically installed and at the same time practically accessible at all times. The desire to better general conditions brought forth the "interior conduit system," which consisted of tubes of papier maché treated with several coats of asphaltum, an excellent insulating composition but very inflammable. Iron-outlet and junction boxes into which the tubing and open-link cut-outs nicely fitted completed the system and was pronounced by many as ideal.

The serious objection to this system was its freedom to mechanical injury and its inflammable qualities. The applying of an outer thin brass covering, forming what is known as brass-armored tubing, did not remedy the difficulty, as the brass was readily punctured, adding an additional defect in the form of a sharp projection, very often cutting the insulation and increasing the fire hazard.

The great problem is how to secure safety, and this may be answered—by the proper method of construction, using only high-grade material.

The fire hazard should be always carefully considered in an electrical installation and the National Electrical Code carefully applied. In applying the code care must be taken in the proper discrimination of the hazard and to apply that electrical system which will be less apt to increase the hazard. The equipment should be installed by skilled wiremen guided by experienced engineers.

Evidences of the lack of knowledge on electrical subjects are quite apparent—nails and screws driven into electric-light and power molding, wires in contact with gas pipes, water pipes, water tanks, metal awnings, metal ceilings, iron beams, cornices, awning frames and metal signs. The introduction of various auxiliary devices for varying the candle-power of lamps, lamps in series with bell and telephone systems and connected to lighting systems and other similar makeshifts are in the wrong direction, increasing the fire hazard, not necessarily because of faulty construction but because their constant manipulation is in the hands of those less informed or absolutely ignorant of the danger involved.

In the manufacture and distribution of electrical energy there is a loss by heating due to the fact that all substances have a resistance which has to be overcome and which represents a loss in energy, which is substantially all transformed into heat. The heat which is produced in a wire only depends on the number of watts expended electrically by the current in overcoming the resistance of the wire, which resistance varies with different materials and goes to raising the temperature of

1. Abstract of a paper read before the Electrical Section of the Franklin Institute on February 9, 1905. Mr. Devereux is the electrical engineer of the Philadelphia Fire Underwriters' Association.

the conductor and indirectly that of the surrounding bodies; and this rise continues until the rate at which heat is lost equals that at which it is generated, then the temperature becomes constant. It is obvious, therefore, that an electrical conductor is only capable of carrying a certain current with a given elevation of temperature, and practically the allowable temperature is limited by consideration of injury to insulation and the danger of fire.

The lined iron conduit was next introduced. The conduit was of iron, having the general characteristics of gas pipe as to size and quality and was bushed throughout its entire length with a treated wood else papier-maché lining.

This class of tubing presents numerous objections. The most serious is perhaps its liability to fracture the insulation of conductors during the process of "drawing in," the wood lining often giving way, forming sharp projections and puncturing the conductors.

This tube was soon followed by a galvanized iron pipe similar to gas pipe, but galvanized to prevent corrosion. The iron conduit is an inflexible system and the demand for a system of piping having all the properties of iron conduit with additional flexibility led to the flexible-iron conduit system.

The outline here shown of the improvements in methods of construction are only the more important. The step from uninsulated wire stapled to double-braided rubber-covered wire in metal conduit is a big one, covering more than 24 years of slow and steady care in selection.

The insurance inspector has played no small part in these improvements. His experience with the various classes of apparatus or of construction has sifted out the bad features and only the most improved appliances and fittings withstand his criticism. After years of experience, of tug and tussle, of acceptance and rejection, has resulted in the present National Electrical Code.

The temperature elevation of a wire for a given current strength depends upon its resistance, diameter, covering and its surroundings. A copper wire carefully insulated by a thin coating of waterproof material and placed in still water is usually kept comparatively cool, owing to the rapid conduction of heat through the insulated cover into the water.

The same wire carrying the same current but suspended in air instead of being immersed in water will usually attain a considerably higher temperature, as still air does not carry away heat from the surface of the wire so effectively as still water. For the same reason a wire buried in the ground will in almost all cases be found cooler than where supported in the air. A covering of, say cotton, rubber, or other electrical nonconductor will, up to a certain thickness, serve to cool the wire by increasing its surface.

The same heating conditions would apply to switches, switch or fuse lugs, bus bars, commutators, and in fact to any current-carrying parts of a circuit, and it is therefore necessary that they be sufficiently heavy to carry the required current without undue heating.

Heating may be the result of insufficient contact surface, and the tendency in all cases is to increase the temperature to a dangerous point or to melt and ignite the insulation of an inflammable nature, such as rubber and cotton. It is necessary, therefore, that the carrying capacity of current-carrying parts and of contacts shall be limited.

Poor connections at fuse blocks may produce heat enough to cause the fuse to melt when there is really no trouble elsewhere on the circuit. This may occur when the fuse blocks have too little contact surface at the connection points to properly carry the current, or when the contact surface is not secure, in which case arcing occurs, pitting the surfaces and intensifying poor contact.

The formation of an arc may be understood by the following explanation: The two conducting terminals under ordinary circumstances are brought together before being separated to establish the arc. As soon as this separation commences the spark which tends to form at any break in a closed circuit vaporizes a portion of the materials of the electrodes, thus establishing a bridge of conducting vapor through which the current flow is maintained. The concentration of energy in a small space produces an intense heat, which vaporizes the electrodes more rapidly. The temperature of this arc, although difficult to determine accurately, is about 3,500° C. We may obtain an approximate idea of this heat when we consider that about 500° C. are necessary to make solid bodies glow with light, and that the melting point of platinum is 1,775° C.

As was noted previously, the presence of two leaks on an electrical circuit, creating an electrolytic action and finally a break in a circuit, is attended with the destructive arc. It is equally true that the breaking of any circuit, whether it be by means of a properly proportioned switch, the melting of a fuse, or the breaking of a current-carrying wire, is attended with this arc. Where the numerous blowings of fuses have occurred the porcelain surface of the fuse block is often covered with a layer of metallic substance, which becomes a partial conductor. Upon the repetition of this blowing an arc is formed and maintained by this metallic [illegible] ... [illegible] tured and broken.

In other cases, particularly [illegible] distributing boards, the melting and [illegible] have been known to [illegible] and the [illegible] conductors [illegible]. In other cases the short-circuiting of [illegible] lamp has destroyed the socket or controlling device beyond repair. The throwing out of [illegible] from arc lamps and the dropping of hot carbons have been known to cause fire. Sparks from the commutators to motors, from the short-circuiting of flexible cords and of fixture wires, from the short-circuiting of cables in conduits and in manholes, igniting accumulated gases; from short-circuits in sockets, attachment plugs, receptacles, switches and various other devices have been known to cause fire.

Overheating of wires, of motors, dynamos and switchboards from overloads; overheating of starting boxes; overheating of theater dimmers and regulating boxes from overload; overheating of improperly made joints, which may be considered the weakest part of an installation, and may include joints between wires, between wires and lugs, between lugs and bus bars, or between switch blades and clips; overheating or magnet coils or resistance of arc lamps, and innumerable other similar defects have been known to create a fire.

Other sources of fire may be the contact of an incandescent lamp with inflammable material, such as cotton, paper, wood, celluloid goods, etc.; the melting of fuses, the breaking down of insulation, sparking from electrolysis, or short-circuits in places impregnated with inflammable gases, such as benzine, naphtha, ether, hydrogen, gasoline and many others of explosive nature; also in any class of manufacture where vegetable material is distributed through the atmosphere in the form of dust, extra precautions are absolutely necessary, the least flash or arc being sufficient to cause an explosion.

Candy factories, sugar refineries, flour mills, breweries, sawmills and others of like hazardous nature may be considered in this category; also textile mills, where there is an accumulation of the particles of stock that is carded out, which particles, owing to their extreme lightness, fill the air in the rooms, and, settling, completely cover everything with an inflammable material usually known as "fly," which is a fine dust of vegetable matter. In this condition the dust may be ignited by the blowing of a fuse or similar accident.

It will be noted from the remarks made in this paper that electricity is treated as a source of heat and as such is classed as a fire hazard, and it is fair to say that it presents to us a most dangerous and powerful factor in that respect, if an equipment is improperly installed, abused or permitted to be neglected.

That electrical equipments are abused and neglected is a fact too well established to permit of argument. This is particularly true of isolated plants. There is no class of industry which should receive greater consideration than the interior wiring of buildings for light and power purposes.

After due consideration of the fire hazard involved, we must admit, if properly installed and not abused, electricity is the safest source of light which the ingenuity of man has produced, and its fire record is far below the oil record and its casualties are nil compared with oil-lamp statistics.

## New High-tension Transformers.

While the main object of high-tension transmission systems is to transmit power from a generating station to the center of distribution, it is often of decided financial advantage for the operating company to retail power along the transmission line. This power may be used for pumping, for the irrigation of farms and ranches, for mill, mine and factory purposes, and for the lighting of small outlying communities. As the volume of business does not always justify the maintenance of a substation, the Westinghouse company has developed a line of transformers for this class of service known as the high-tension O. D. type.

The severe conditions of service which these transformers have to withstand have been given great consideration in their design, and a line of apparatus has been produced of great ruggedness and durability. Particular attention has been given to insulating these transformers to withstand the strains due to lightning and static disturbances which occur on high-tension lines. The same method of insulating has been followed as in the large high-voltage apparatus. They are all designed for operation in oil, which acts both as an insulator and as a cooling medium. It is said the transformers have given universal satisfaction wherever installed, and have proven themselves to be exceedingly long lived under the most trying conditions.

The smaller sizes (five and 7½ kilowatt), as shown at the right in the accompanying illustration, are mounted in cast-iron cases, larger sizes (10 to 50 kilowatt) in cases having corrugated sides of heavy sheet steel, with heavy cast-iron tops and bases. The latter style is shown at the left in the picture. All cases are absolutely waterproof. The smaller sizes are provided with lugs and hanger irons for mount- [illegible]

[illegible] boosted in proportion to the number of turns cut [illegible]

NEW HIGH-TENSION TRANSFORMERS.

low its rated value. This flexibility of [illegible] valuable feature.

These transformers are manufactured in sizes from one to 50 kilowatts for primary voltages up to 16,500, with 440 and 220 or 220 and 110 [illegible] secondary voltages. A line with capacity of from [illegible] to 50 kilowatts is arranged for 2,200 and 1,100-volt secondaries, while another line ranging from 15 to 50 kilowatts supplies low-tension current at 2,400, 2,300, 2,200 or 2,100 volts. The 60-cycle type may be successfully used on circuits of 6,000 to 16,000 alternations, the 25-cycle type on circuits of 3,000 to 4,800 alternations. The electrical performance of these transformers is excellent. They show good efficiency at all loads, and the regulation approaches that of central-station apparatus.

## Automatic Release Starters for Use in Steel Mill.

Among the recent orders received by the Cutler-Hammer Manufacturing Company of Milwaukee is one covering two 1,500-horsepower 250-volt automatic release starters, for use in the Edgar Thompson Steel Works of the Carnegie Steel Company of Braddock, Pa. These starters are particularly interesting, not only on account of the size, but on account of the general arrangement of the starter, the unique type of resistance used and the large overload capacity of the equipment.

The starter proper will be built in the form of a switchboard of white Italian marble, approximately seven feet eight inches high and 11 feet long. The starter parts will be of the type where the several sections of starting resistance are controlled by a number of independent levers. For the starter in question, the levers which will carry the motor current continuously are to have a continuous capacity of 10,000 amperes, and are guaranteed to carry this amount with a temperature rise not exceeding 40° C. The intermediate starting levers, which, as occasion demands, may also be used temporarily for regulating duty, will have 6,000 amperes capacity on the same basis.

The switchboard will consist of five panels, each panel containing two levers. The connection between the different panels will be made at the rear of the switchboard by bus bars in the usual manner. At the front of the switchboard, such arrangements will be made that, with very little trouble, an entire panel may be removed from the board without disturbing the other panels, or the parts mounted on them. It will even be possible to operate the starter with one of the intermediate panels removed. The levers on the several panels are mechanically interlocked in the manner adopted for the multiple-switch type of starters, so that the several levers composing the starter cannot be operated except in a predetermined order. As giving some idea of the large size of the starter levers, the overall length of each of the levers is a trifle over three feet, but, by means of a toggle-joint action, these heavy switches may be closed with a remarkably small amount of force.

The resistance for these starters will consist of standard steel rails, mounted in a steel rack approximately 20 feet high, 14 feet wide and 27 feet long. There will be about 100 25-pound rails and 200 40-pound rails used. This enormous capacity of resistance material is provided so that the resistance may be used to control the speed of the motor for short periods of time, even under comparatively heavy loads, without permanent injury. The main connections to the starter will consist of six 1,000,000-circular-mil cables, while the intermediate resistance leads will consist of four 1,000,000-circular-mil cables.

The motors which these starters will be used to control are of the Westinghouse make, and will be

very heavily compounded. The motor armature shaft will carry a flywheel 20 feet in diameter, weighing approximately 125,000 pounds, and will be directly connected to standard blooming-mill rolls. The motors will be designed to stand very heavy overloads for short periods of time, and mechanically constructed so as to stand the enormous strains encountered in this service.

## QUESTIONS AND ANSWERS.

### Wiring Formula.

A subscriber in Davis Creek, Cal., asks: "What size wire will be required to transmit three amperes 3,000 feet, the voltage at the generator being 240 and the line loss being 50 per cent. of 240 volts, direct current? Also give formula for same."

ANSWER.

Perhaps the most practical formula for determining the proper size of wire for a circuit where the current and line loss are given is:

$$\text{Circular mils} = \frac{\text{Feet} \times \text{amperes} \times 21.21}{\text{Loss in volts}}$$

By "feet" is meant the distance from the dynamo to the end of the line, which is, of course, one-half the length of the entire circuit.

Applying this formula to the problem presented, the result is:

$$\text{Circular mils} = \frac{3{,}000 \times 3 \times 21.21}{120} = 1{,}590$$

That is, a copper wire having cross-sectional area of 1,590 circular mils will transmit three amperes a distance of 3,000 feet with a line loss of 120 volts, which is a 50-per cent. drop from the dynamo pressure of 240 volts. Examining a table of wire gauges, it is found that No. 18 B. & S. has an area of 1,624 circular mils and No. 19 has an area of 1,288 circular mils. No. 18 B. & S. gauge is therefore the size of wire to be used in this particular case, its circular mils coming closer to the result obtained by the formula. In practice it will be found best always to select the larger wire, unless the smaller comes very close to the circular mils given by the formula.

For convenience and to facilitate its retention by the memory the formula may be simplified without material loss in accuracy by dropping the decimal fraction, and it may then be given in the form of a rule as follows: Multiply the feet by the amperes and the product by 21; then divide by the volts lost and you have the circular mils required.

If the length of line, the current and the size of wire are given and one wishes to know the resulting drop in voltage the formula becomes

$$\text{Volts lost} = \frac{\text{Feet} \times \text{amperes} \times 21}{\text{Circular mils}}$$

The foregoing information applies to copper wire only. If other metals are to be used the circular mils obtained by the formula must be multiplied by the relative resistance of such metals as compared with copper. For example, in the case of iron or steel wire, which has approximately six times the resistance of copper, the circular mils required for the line described by the Davis Creek subscriber would be $1{,}590 \times 6 = 9{,}540$, which is not far from No. 10 B. & S. gauge, or more nearly No. 13 B. W. G.—the gauge by which such wire is usually rated.

### Current Transformation for Bell Work.

A subscriber of the Western Electrician in Toronto, Canada, desires to know how he can make a transformer that will change alternating into direct current for the purpose of ringing a system of electric bells in his factory, all the bells being connected to a No. 18 wire about 1,500 feet long and presenting, altogether, so much resistance as to make batteries unsatisfactory and expensive to operate.

Answer.—There is no way of effecting the desired transformation other than by the use of a small motor-generator, or possibly an electrolytic or other rectifier. For the correspondent to attempt to make either of these types of apparatus would probably involve a greater outlay than to buy outright from some reliable manufacturer. In case the motor-generator were used it might be used to ring the bells directly from the direct-current end, or it might be used to charge a small storage battery, to be used to furnish ringing current. Whether it would be economical to install such a system or not would depend on the frequency of the ringing and the necessary cost of batteries if the motor-generator were not used,

### Steam Turbines.[1]

By W. E. BOILEAU.

It has been suggested that this paper consider the steam turbine and steam-turbine practice generally, more from a practical central-station than from a theoretical standpoint, and to cover not only the turbine but also the auxiliaries necessary to obtain the highest efficiency and most reliable operation.

A steam turbine can be installed in almost any central station, mill or factory, the chief requisites being steam at 125 pounds to 200 pounds per square-inch pressure, and plenty of water for condensing purposes. There is one instance where a low-pressure turbine is used in connection with a reciprocating engine, the engine exhausting into the turbine. This opens up an entirely new field for the steam turbine and is of much importance to central-station managers.

As a matter of fact, a steam turbine working under such unfavorable conditions as would be met in ordinary central-station practice could not be expected to develop the highest efficiency possible in a modern installation, yet would in most instances be more satisfactory and economical than the average reciprocating engine, as well as much less expensive to maintain.

As might have been expected, and as is usual with any new piece of apparatus, many and various difficulties were encountered in the designing, manufacturing and operating of the earlier machines; nor were the troubles confined to the turbines themselves, but also to the other apparatus used in connection with the turbines. Improvements in the turbines and apparatus pertaining to the turbine installations have been made rapidly, until at the present time there is no more uncertainty, if as much, than with a high-class engine-driven plant. The writer has in mind a station containing three 500-kilowatt turbines, with rotaries, supplying both light and railway service, which has been in continuous operation for a year without an interruption to the service, although at times it has been heavily overloaded. Only two men are employed in the turbine room on each shift. One is on the switchboard gallery and the other has charge of the turbines and all auxiliary apparatus.

The idea of the steam turbine is similar to that of the water turbine or impulse wheel. In both water and steam turbines the theoretical condition of maximum economy exists when the jet of fluid moves with a velocity equal to about twice that of the vane against which it acts. In waterwheels this condition is easily obtainable, as the velocity of water is very low as compared to that of steam. The velocity of a jet of water discharged from a nozzle under 100-foot head is only about 80 feet per second.

Steam expanding from 150 pounds gauge pressure per square inch into the atmosphere is capable of imparting to itself a speed of 2,950 feet per second, and if it is expanded from 150 pounds gauge pressure into a vacuum of 28 inches, it can attain a velocity of 4,010 feet per second, or 46 miles per minute. This tremendous velocity of steam when discharged from a nozzle has been a great obstacle in the way of successful steam-turbine design. This velocity is so high that the materials available for simple wheels and vanes are not capable of sustaining this prohibitive peripheral speed of 120,000 feet, or 23 miles per minute.

The only turbines which have, up to the present time, become commercially developed are those designed by De Laval, Parsons and Curtis.

Since steam turbines differ from other steam engines in many respects, it becomes necessary to make special provision for their use if their greatest advantages are to be made available. When plans of a station are adopted the owner necessarily commits himself to the expenditure of a large amount, and the station should be designed with a definite plan in view, not only for the immediate needs, but for future extensions.

If turbines are to be installed, the advantages of high vacuum should be considered, and special efforts have been made to secure the highest vacuum possible in turbine installations. The energy of the steam is available through a far wider range of expansion in the turbine than is practicable in any reciprocating engine, the usual ratio of expansion of which is about 20 to one, so that there is little economy gained below a 26-inch vacuum.

The ratio of expansion for which the Curtis turbine is designed is about 200 to one, and takes up the energy of the steam to as high a vacuum as is possible to attain, which is 28 inches to 29 inches. As the gain in steam consumption or efficiency from 26 to 29-inch vacuum is about 15 per cent., the first cost of the best condenser installations is warranted.

As no oil is used in the turbine, steam at a pressure of 200 pounds per square inch, and with 150 degrees of superheat can be used. At the present time it is possible to secure pipe, joints, fittings, valves and packing for such pressure and superheat that will give good results, and when protected by a covering of 85 per cent. magnesia, at least two inches thick, there is very little radiation of heat from the piping.

The Curtis turbine also offers other advantages over the reciprocating engine, a few of which are: Lower first cost of land and building, the turbine requiring only about one-fourth of the space required by an engine of the same size; the securing of uniform rotary motion, therefore, ideal conditions for parallel operation of generators, rotaries or synchronous motors; absence of vibration, therefore, lighter and less expensive foundations; a constant flow of steam, thus less strain on the steam piping; closer speed regulation; current for both lights and railway service has been supplied from the same turbine with less than two per cent. variation in speed with heavy fluctuations of the railway load and the steam pressure varying from 125 to 200 pounds.

The auxiliaries for a turbine installation consist of surface condensers, circulating pumps, hot-well pumps, dry-vacuum pumps, step-bearing pumps, boiler-feed pumps and a hydraulic accumulator. All of the pumps are usually steam-driven, with the exception of the hot-well pumps, which are motor-driven, on account of their high speed. The exhaust steam from the auxiliaries is used in heating the boiler-feed water, and gives a better station economy. The circulating-water pump usually consists of a centrifugal pump, driven by a simple high-speed engine with a throttle governor. The quantity of water to be handled is very great, and the head usually low, so that a centrifugal pump is well adapted for this duty. It also is much less expensive and requires less attention. The latest pumps of this type have a water-sealed stuffing box around the shaft. The throttle governor enables a change of speed to be made while the pump is running, which is a great advantage where two or more of these pumps are connected to the same suction line and discharge into the same condenser system.

The hot-well pumps usually consist of small two-stage centrifugal pumps connected directly to the hot wells of the condenser. These pumps possess the advantage of running ahead of the water, and keep the hot wells entirely free. It has been found that when reciprocating pumps are used for hot-well pumps that they do not respond promptly to the different quantities of water, as the turbine supplies more or less condensed steam by reason of a change of load. The valves of these reciprocating pumps frequently become air bound, and have always caused more or less trouble from leakage from around the piston rods. A vapor pipe is also taken from the top of the centrifugal hot-well pump to the dry-vacuum system of the condenser. The stuffing boxes around the shaft are also water-sealed. This pump will maintain a vacuum in the condenser equal to that of the dry-vacuum pump. A check valve is usually placed in the discharge of the hot-well pump, which effectually prevents water from the discharge line backing into the condenser through the pump in event the pump stops from any cause.

The dry-vacuum pump is steam-driven, and it is preferable to have the air cylinder placed at a right angle to the steam cylinder, thus requiring less room and giving a better turning moment on the crank. The steam end is throttle-governed, to permit of speed variations while running. The air end is built single-stage, and will maintain a vacuum on the condenser system to within one inch of absolute, provided the condenser system is as tight as it is possible to make it.

The step-bearing pumps are usually two in number, steam-driven duplex, with outside-packed plungers, either one of which should be of ample capacity to furnish water for all of the turbines, except in large stations built on the unit principle. Steam to these step-bearing pumps should be supplied from double piping or a loop to insure constant operation.

Surface condensers are used instead of jet condensers, because by their use a higher vacuum can be obtained. The surface condenser also has the advantage that the condensed steam can be used over and over again in the boilers, and as no oil enters the turbine, therefore the boiler feed is mostly pure distilled water. This reduces the formation of boiler scale and consequent cost of cleaning the boilers. It is not necessary that the boilers should be blown off as often as where other water is used, thus effecting quite a saving to say nothing of the cost of water where it must be purchased.

In steam turbines of the most improved design impairment of vacuum through leakage of air can be almost entirely prevented. The packings, where the shaft passes through the shell of the turbine, can be sealed with steam in such a manner that leakage of air is impossible, and all joints below the atmospheric pressure can easily be made perfectly tight, since their temperature is not excessive, and since the simple application of heavy paint to the exterior will generally accomplish the purpose, even where joints are not perfectly made.

The writer has in mind an instance where a 27-inch vacuum was obtained with the dry-vacuum pump running at a speed of 120 revolutions per minute. After thoroughly painting the condenser system several times and thoroughly filling the joints in the piping with heavy paint, a vacuum of between 28 inches and 29 inches was obtained with the speed of the dry-vacuum pump reduced

1. Abstract of paper read before the Iowa Electrical Association in Dubuque on April 20, 1905. Mr. Boileau is constructing engineer for the Union Electric Company of Dubuque.

to 80 revolutions. This, and many other cases, show that high degrees of vacuum are commercially attainable with turbines, and the increased efficiency warrants the expenditure of a considerable sum for cooling the circulating water in connection with the condenser system.

## Westinghouse Single-phase Crane Motor.

Following the development of the single-phase alternating-current railway motor and its successful adaptation to the conditions of modern traction service, the Westinghouse Electric and Manufacturing Company has placed upon the market a complete line of motors of similar characteristics but smaller capacity for the operation of electric cranes, hoists, elevators and similar apparatus demanding a heavy starting torque and a wide range of speed variation under control of the operator.

Like the alternating-current railway motors, these motors (Fig. 1) are of the series-wound commutator type, with compensating field windings, laminated cores and inwardly projecting poles. The fields consist of laminated cores built up of sheet-steel punchings, held between end plates and mounted within cast-iron frames. The frames are of the box type and are closed at the end of substantial brackets, which support the bearings.

There are four inwardly projecting poles made of laminated steel, punched solid with the core, and magnetized by field coils of the usual type. An auxiliary field winding is also provided, threaded through slots in the pole faces.

The armature is of the usual slotted-drum type, with core built up of circular punchings of soft sheet steel, mounted upon a cast-iron spider. In the larger sizes ventilating ducts are provided between the punchings, through which air is forced out against the field coils and core.

The motors are wound for a nominal potential of 200 volts, at 3,000 alternations, or 100 volts, at 7,200 alternations per minute, but will operate successfully upon voltages 10 per cent. higher. For other potentials it is advisable to use transformers. They are manufactured in sizes having nominal ratings from five to 35 horsepower and are wound for 25 cycles per second. For larger capacity, the standard single-phase, alternating-current railway motors are recommended. Reference to the curves (Fig. 2) show clearly how closely motors of this type resemble direct-current series-wound motors in operating characteristics; practically the same increase in speed with decrease in torque is found.

The speed of motors of this type may be varied by any method which will vary the electromotive force impressed at the motor terminals. On account of its simplicity and effectiveness, the rheostatic method of control, similar to that used with direct-current series-wound motors, has been adopted as standard. The controllers and resistances are similar to those used with direct-current motors of similar capacity, and are of the dial or commutator type, according to the size of the motor with which they are to be used. These controllers differ from those used with direct-current motors mainly in that blow-out magnets are not used. As the circuit is broken at four points, arcing is reduced to a minimum. At the first notch of the controller all contacts make connection simultaneously, with a maximum resistance in circuit. Succeeding steps are made by one set of fingers at a time. The large number of steps employed makes possible a very exact speed control, with a smooth start and a gradual acceleration, and reduces the starting current to a minimum.

FIG. 1. WESTINGHOUSE CRANE MOTOR.

For use with these motors a complete line of automatic electric brakes, similar to those employed with direct-current series-wound motors and with induction motors in crane and hoisting service, has been developed. The device consists of a set of brake shoes, levers and magnet coils, which are mounted upon the front-end bracket of the motor, and a brake wheel, which is mounted on the motor shaft. The shoes are lined with a special composition and are applied to the wheel by the action of the armature of an electromagnet. A turnbuckle adjustment provides means for taking up wear. The electromagnet consists of a U-shaped core and a U-shaped armature with two windings, one around each limb. Electrical connections are made across the line through a switch on the controller. The switch is automatically operated with the first step of the controller. When closed, the armature of the electromagnet is raised and the brake released. When movement of the controller to the off position opens the switch, the armature of the electromagnet falls under the action of gravity, and the brake is set. The armature is connected with the brakeshoe by means of links in such a way that it is practically impossible for the brake to fail when the controller is in the off position. Should the power fail while the motor is operating, the brake is immediately set and the load held. As both brake and controller are operated by the same mechanism, it is impossible to set the brake while the motor is connected to the line.

FIG. 2. CURVES OF OPERATION OF WESTINGHOUSE CRANE MOTOR.

## Railway Congress Delegates Visit Chicago.

A party of 250 of the foreign delegates to the International Railway Congress just closed in Washington arrived in Chicago on May 19th by special train. The party was on a sight-seeing tour of the important cities of the Middle West and was intent upon studying the railroad and industrial features of the country. The delegates remained in Chicago until the 22d, visiting among other places the Pullman works, Illinois Steel Company's plant in South Chicago, Union Stock Yards, etc. The party was also taken through the tunnels of the Illinois Tunnel Company. The foreign engineers were unanimous in their praise of American railroading methods and many of them were not a little surprised at the grand scale with which such operations are carried on here.

Among the prominent members of the party were: G. C. C. Ambt, manager of the Danish State Railways; Paul Aumont, chief engineer of the Northern Railway of France; E. H. Burrows, secretary of the Great Northern Railway of England; Fred Brunnell, chief engineer of the Belgian State Railways; Ernest Corrovon, vice-president of the Yverdon-St. Croix Railway of Switzerland; George Cartault, chief engineer of the Paris Lines and Mediterranean Railway, and Bela Agai, editor-in-chief of the Hungarian Technical Journal.

The delegates left on the 22d for Niagara Falls.

## Radiology and Ionization Congress.

The minister of Belgium informs the Department of State that the first international congress for the study of radiology and ionization will be held at Liege from September 12th to 14th next, under the patronage of the Belgian government; the ministers of the interior and public instruction, of agriculture, of industry and labor being honorary presidents thereof. He invites this government to be represented by official delegates selected from among the scientists and scientific institutions which may be interested. Members of the teaching corps of the four universities of Belgium and of the military academy are on the committee charged with the organization of the congress.

The following is a summary of the programme framed by the committee: 1. Physico-chemical section—(a) Properties of the electrons and ac-[illegible]

## PATENT LITIGATION.

The United States Circuit Court for the District of Indiana [illegible] on May 1st at Indianapolis [illegible] States Patent No. 422,746, issued on March 4, 1890, to Michael von D[illegible] the Allgemeine [illegible] provements in induction apparatus or transformers, and [illegible] valid, particularly [illegible] induction apparatus [illegible] of iron, forming together [illegible] nearly closed magnetic systems, primary and secondary coils placed on the cores, electric circuits connected to the primary coils, and means for creating in the said circuits alternating currents of successive phases for the purpose of causing a continuously progressive shifting of the magnetic axis, and maintaining nearly constant the total amount of magnetism." The defendant [illegible] man Electric Company, is held to have infringed the patent. A master was appointed by the court to make an accounting of profits and assess the damages.

Judge Joseph Cross, in the United States Circuit Court for the District of New Jersey, on May 17th handed down an opinion overruling the demurrer to the bill of complaint in the suit of the General Electric Company vs. George Campbell (trading under the name of Germania Electric Lamp Company). The bill of complainant alleges infringement of patent No. 726,293, granted April 1, 1903, upon the invention of John W. Howell for a process of exhausting incandescent electric lamps. The patent was assigned to the complainant and covers what is known as the "chemical exhaust" process. The defendant demurred to the bill, assigning for the cause that the patent is void in law for lack of patentable invention and novelty. Concluding a long opinion, Judge Cross says: "We are not able to say that the want of invention and novelty is so apparent that no possible evidence could be adduced to show the contrary; it is not a clear case, free from doubt; we are not convinced that the patent does not disclose invention. The demurrer is overruled." The complainant in the suit was represented by Richard N. Dyer and John R. Taylor of New York, and the defendant by A. P. Smith.

The Mica Insulator Company, through Kenyon & Kenyon, its solicitors, brought suit in equity in the United States Circuit Court for the District of New Jersey against the Union Mica Company, a New Jersey corporation, and John M. Lay. Hon. George Gray of Delaware, United States circuit judge, has just filed an opinion holding that the Union Mica Company and John M. Lay have infringed upon the rights of the Mica Insulator Company, under the Dyer United States patent No. 483,646, relating to a process of making artificial mica sheets for electrical insulation, and that this patent introduced a new and valuable raw material to the art. The bill in the case also charged infringement of United States patent No. 483,853, granted to Charles W. Jefferson on the same date as the Dyer patent, October 4, 1892. This patent relates to a device especially adapted for molding the mica-flanged rings for gramme-ring armatures, and in regard to it Judge Gray concludes: "I think that anyone is at liberty to purchase an artificial mica sheet from an authorized vendor and mold it by pressure and compression into any shape to which it is susceptible." For this reason the Jefferson patent is held invalid as to its second claim.

## Machinery Market in China.

U. S. Consul Anderson, at Hangchau, China, writing about cheap labor in China, and the reluctance on the part of manufacturers to introduce power, says among other things: "There is a growing conviction of the advantage of power plants in the larger concerns, and the number of mills with fair-grade power plants is increasing. It will be only a matter of a short time until the smaller manufacturers come to appreciate the need of power, and when that time comes there will be a field for gasoline engines almost beyond conception in its scope. American manufacturers must remember that while they have the advantage at the present time there is reason to believe that before long they will have to fight for this trade with every weapon known to the modern business world. Already Japanese manufacturers are commencing to make some machinery of this sort, and while it lacks the merit of the American product and will always be more or less behind the latter, it by no means follows that it will not be readily accepted in China. The Japanese have iron, coal and other raw materials and industrial necessities.

They have American and European trained experts, and they have labor so cheap that American competition on a labor basis is impossible. It behooves American manufacturers to get into the market in China with machinery of all kinds if they expect to hold these markets in the future."

## BOOK TABLE.

General Statutes Relating to the Use of Streets and Highways by Street-railway, Gas, Water and Electric-light Companies. Compiled by James S. Cummins. Chicago: H. M. Byllesby & Co. 1905. Pp. (six by nine inches), 268.

The purpose of this valuable book of reference is sufficiently indicated by the title. Mr. Cummins, the compiler, is general counsel for the well-known firm of engineers which publishes the volume. He has done a good service in digesting and arranging the general laws in the various states and territories primarily governing the subject of franchise rights. As a lawyer versed in the subject he has frequently found that money has been wasted by business interests through ignorance on the subject of the fundamental laws governing the issuance of franchises. The present compendium is the result. Mr. Cummins announces his intention of writing a subsequent treatise covering the principal decisions in the franchise litigations which have arisen in recent years.

Brookes' Automobile Hand Book. By L. Elliott Brookes. Chicago: Frederick J. Drake & Co. 1905. Pp. (4½ by 6½ inches), 320, with 114 illustrations.

This is a practical handbook containing information for the use of owners, operators and automobile mechanics. It aims to give concise information on questions relating to the construction, care and operation of automobiles, both gasoline and electric. The information is arranged in alphabetical order, enabling any particular information desired to be found at once. A feature which commends itself is the incorporation in the text of several wiring diagrams, which are a valuable adjunct to the reading matter. One of these diagrams, for instance, shows the wiring of a charging outfit; another shows the connections of an ignition circuit, etc. The various troubles to which automobiles are subject are noted, as well as the remedies. The book is of pocket size, well bound and will be found convenient on the road or in the garage.

Laboratory and Factory Tests in Electrical Engineering. By George F. Sever and Fitzhugh Townsend. New York: D. Van Nostrand Company. 1904. Pp. (6 by 9 inches), 236, with 97 illustrations. Price, $2.50.

Laboratory tests for students in electrical engineering form the chief subject matter of this work, though there are also embodied quite a number of tests which are practicable for factory work. The series is required in the electrical engineering course in Columbia University, both the authors being members of the faculty of that institution. As a text book the work finds its chief merit in the clearness with which the various problems are stated and the methods for their solution explained. Tabulation forms and sample curves are also given which the student is required to follow in the reports which he is required to make upon the various tests performed. The student will find that a thorough mastering of the methods outlined will be of much practical value to him in his later work, for they have been made to conform as nearly as possible to what is standard practice in factory testing and the operation of electrical machinery.

Electrical Instruments and Testing. By Norman H. Schneider. New York: Spon & Chamberlain (London: E. & F. N. Spon). 1905. Pp. (4⅞ by 7¼ inches), 199, with 105 illustrations. Price, $1.

Tests which occur daily in the engine room, power house and technical school are described in this little book, which is modestly put forth rather as an introduction to more extensive works on the general subject of testing. This disclaimer should not, however, detract from the merits of Mr. Schneider's book, for, though perhaps not complete, it possesses the merit of embodying in its pages a maximum amount of information in a limited space. Most of the instruments required in tests generally performed, either in practical service or in the laboratory, are described in the book, with careful directions for their intelligent use. A very good chapter is given upon cable testing and another upon the manipulation of the Wheatstone bridge, one of the most used, perhaps, of all testing instruments. Much attention is also given to the subject of galvanometers. The apparatus described is modern and universally adopted and the work is well up to date.

Alternating-current Machinery. By William Esty, S. B., M. A. Chicago: American School of Correspondence at Armour Institute of Technology. 1905. Pp. (6⅜ by 9¼ inches), 412, with 398 illustrations. Price, $3.75.

Professor Esty, the author of this book, is the head of the department of electrical engineering of Lehigh University, and he has prepared the work with the object of giving the beginner and the so-called practical electrician a working knowledge of alternating-current apparatus to enable him to install and operate it intelligently. For this reason the information is given in a form which contains no mathematics beyond the simplest trigonometry, contrary to the prevalent belief that no one not familiar with higher mathematics can become proficient in alternating-current practice. In the beginning, the source of alternating currents, the alternator, is described, the terms, definitions and conceptions which form the basis of alternating-current work being embodied early in the text, which is followed by a series of alternating-current problems. After the fundamental principles have been laid down alternating-current working is considered, embodying the use of measuring instruments and the measurements of force and power. The general plan of the book is to deal successively with alternators, synchronous motors, transformers, rotary converters and induction motors. Switchboards and station appliances in general and lightning arresters are given due consideration, as are also many special forms of switchboard apparatus. The work is well supplemented with valuable diagrams, as well as illustrations of all the most modern types of electrical machinery. Mechanically, the book has been put together in excellent shape, the binding being of leather and cloth.

American Telephone Practice. By Kempster B. Miller. New York: The McGraw Publishing Company. 1905. Pp. (6¾ by 10 inches), 888, with 643 illustrations. Price, $4.

It would be difficult to imagine a branch of telephone engineering which is not dealt with, and that too in a masterly manner in the fourth edition of Kempster B. Miller's "American Telephone Practice." Always a pre-eminent authority in telephone matters, this work in its present form, as exemplified in the latest edition, which has just been published, is really helpful to the telephone man—from the lineman who sets the poles and strings the wires to the engineer under whose direction the modern and bewilderingly intricate switchboard is erected and kept in operation. The revision of the work for this edition involved practically the entire rewriting of the previous edition. Many things not before discussed are here fully described, as, for instance, the automatic telephone. Again, in the previous edition a very meager description was given of the working of common-battery systems, which at the time of writing were just beginning to come into use, and very little information was then obtainable on the subject. In the new book this subject, which is now important in large exchanges, is gone into with a degree of thoroughness that leaves no criticism possible. Diagrams of the various telephone circuits in common use are given from the simplest to the most complicated, and in this direction the book is certainly more complete than anything ever before attempted.

Sincere praise can be honestly bestowed upon this book. So rapid have been the developments in modern telephony, especially during the last two or three years, Mr. Miller's task has been one of great magnitude. But now that it is completed, the work itself stands unsurpassed as a complete, accurate and useful treatise on practical telephony.

Electric Railways Theoretically and Practically Treated. By Sydney W. Ashe and J. D. Keiley. New York: D. Van Nostrand Company. 1905. Pp. (5¼ by 7½ inches), 285, with 272 illustrations. Price, $2.50.

Much has been written concerning electric-railway apparatus treating of the problems arising in its construction and operation, but this material is more or less in a scattered form, taking up one phase of the subject here and another there. So rapid, too, have been the developments in railway apparatus, especially alternating-current, in the last two or three years that the collection and publication of the data in book form has hardly kept pace with the advances made. Recognizing this want of a modern textbook on the subject, the authors have compiled, with much care, the very latest facts concerning electric-railway apparatus into a book which treats the subject both theoretically and practically, making it available at once as a textbook for technical schools, and as a reference for the railway engineer. The book has been limited to the rolling stock, and in this department alone there is ample scope for a well-written book, as is here evidenced. Beginning with a short chapter on units, curve plotting and instruments, the real work begins with a chapter devoted to train performance, showing how the performance of a train or car can be analyzed into the various constituents, and the results of the data obtained plotted into curves, which show at a glance more than chapters could tell. Next, recording and indicating instruments are taken up, after which comes that all-important piece of apparatus, the railway motor. This chapter is one of the best executed in the book, and the subject is treated in a thorough and painstaking manner, the very latest types of single-phase, compensated and repulsion-type motors being described. Other chapters of interest are upon types of control, car bodies, trucks, brakes and braking, electric locomotives, etc. Altogether, the work is an excellent one, especially for classroom work. It is well printed and bound, and the cuts are all that could be desired.

## Time-limit Relays.[1]

By George F. Chellis.

Relays may be divided into three classes:

1. Differential relays, operating at a lower current value when the direction of the flow of energy is reversed than when flowing in its initial direction.

2. Straight overload relays, operating when the current reaches a certain predetermined limit, irrespective of the direction of flow of energy.

3. Reverse-current relays, operating when the current reaches a certain predetermined limit, upon reversal of the direction of flow of energy.

The type and design of the ideal relay for the protection of alternators will depend upon the conditions under which it is to operate. A relay should operate on overload at normal pressure; on short-circuit at zero pressure, or reduced pressure, or when the direction of the flow of energy is reversed. It can be designed to operate in the event of any of these conditions prevailing, and each at a different value, in which case a differential relay would be required. The principal advantages of the differential relay are that it can be so designed as to permit the alternator to be loaded to its minimum current capacity at normal pressure without danger of being cut out, and also operate on short-circuit, when the pressure is zero, at a point sufficiently under the short-circuit current of the alternator to allow a suitable factor of safety. Compared with the straight overload relay, set to operate on short-circuit with an equal factor of safety, at power-factor values usually attained (50 per cent. and higher), it will permit a greater load being carried at any operative pressure.

In existing forms of alternating-current relays of the differential type, the energizing coils consist of two windings with a common magnetic circuit. These windings, which for convenience will be called a and b, receive current from a shunt transformer, and a series transformer, respectively connected with the alternator. Therefore, the current in a is dependent upon the pressure, and that in b upon the current.

Since with constant pressure the magnetomotive force due to coil a is fixed in direction and magnitude, it serves to polarize the relay. The action of coil b, in connection with coil a, at 100 per cent. power factor, depends, therefore, on the direction of the magnetomotive force due to coil b, and the ratio of ampere-turns of coil a to those of coil b. Under normal conditions a and b act differentially; but if the direction of the magnetomotive force of b is reversed, their action is cumulative.

In general, relays of this type involve such prin-

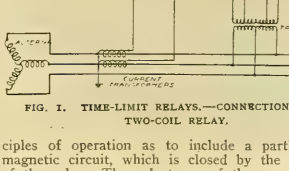


FIG. 1. TIME-LIMIT RELAYS.—CONNECTIONS FOR TWO-COIL RELAY.

ciples of operation as to include a partly closed magnetic circuit, which is closed by the operation of the relay. The reluctance of the magnetic circuit, therefore, varies, being maximum at the starting point and minimum when the relay has operated. If started in operation by a heavy current of short duration, due to an exchange of current between the alternator and the bus bars at the moment of closing the circuit when synchronizing, the magnetic conditions in the relay would so change that it would operate at a much lower current than the normal if the current did not drop sufficiently low to permit the core of the relay to recover its normal position. The liability to this condition is greatest when the time limit is comparatively short. By a series of experiments it was found that the highest permissible differential factor was about 70 per cent. With a differential factor higher than 70 per cent. for the core-type relay, especially at low frequencies, a rise in pressure with no current in coil b would set up a series of vibrations of the armature in synchronism with the alternations of the current, which, in some cases, would not cease if the pressure were reduced to normal, the relay also being so sensitive as to make synchronizing very difficult.

Differential relays are commonly so connected

1. Abstract of a paper presented at the meeting of the American Institute of Electrical Engineers in New York, May 16, 1905.

that the current in coils a and b is in phase when the alternator is operating at 100 per cent power factor. The actual connections for a two-coil relay are shown in Fig. 1, the (B) coils of which are connected to the secondaries of the current transformers in phases 1 and 2, and the (A) coils receive, respectively, the component pressures. By this method of connection the power factor of the relay is approximately that of the alternator.

A two-coil relay, as shown in Fig. 1, would protect a three-phase alternator, as follows: Reversal at normal pressure, poles 1 and 2 operate; short circuit between phases 1 and 2, poles 1 and 2 operate; short-circuit between phases 2 and 3, pole 2 operates; short-circuit between phases 1 and 3, pole 1 operates.

FIG. 2. TIME-LIMIT RELAYS.—TYPICAL LAY-OUT FOR THREE-PHASE SYSTEM.

To the knowledge of the writer, no relay having a positive time-limiting device has been placed upon the market. In relays brought out recently a form of pneumatic time-limiting device has been adopted, such as a bellows or dash-pot, which is acted upon directly, or through a system of levers connected with the core of the solenoid, and provided with suitable means for adjusting the air discharge. While ideal from the standpoint of simplicity, these devices are not positive, the time adjustment being inversely proportional to the current at which the relay is operated.

The method of protecting feeders depends upon the operating conditions. This subject may be most consistently discussed by considering the conditions from the power-house alternating-current bus bar to the sub-station direct-current bus bar.

To guard against overload, and to open the circuit in the event of a short-circuit, a relay is required at the power-house end of each feeder. A relay is also required at the sub-station end, where the feeders are operated in parallel, being connected to a common sub-station bus bar, or, where the sub-station bus bar is divided, leaving groups of two or more feeders in parallel. This can be seen by considering the diagram, (Fig. 2), in which four feeders (A) (B) (C) and (D) are shown in parallel, and four converters connected to the sub-station alternating-current bus bar and feeding the direct-current bus bar. Should a short-circuit occur at the point (x) on (B) feeder, there would be a rush of current from the power-house bus bar, and also from the sub-station bus bar to the point (x). In (A), (C) and (D) the current would be increased, due to the short-circuit being fed by these feeders through the sub-station bus bar.

Since a synchronous converter generates an alternating-current electromotive force corresponding to rated pressure at synchronous speed, in case the point (x) is near the power house, it is possible that the direction of the flow of energy in feeders (A), (C) and (D) would be reversed, due to the synchronous converters feeding the short-circuit back through the power-house bus bar, as well as directly over the short-circuited feeder.

Because of the great amount of energy stored in the synchronous converters, it is also possible for all the sub-stations to feed back into a short-circuit in this manner. To fulfill requirements properly an ideal combination would be an overload time-limit relay at the power-house end and an instantaneous reverse-current relay at the sub-station end of each feeder. The writer does not know of an alternating-current reverse-current relay, the operation of which does not depend upon the pressure of the system, nor a relay that depends upon the pressure operating on a reversal only, that would not become completely inoperative at zero pressures or at comparatively low pressures. If differential relays were used, with a "differential factor" sufficiently high to render the relays of any appreciable value at low pressures, it is probable that they would be so sensitive that any disturbance causing a momentary reversal, without a serious decrease in pressure, would cut the station out unnecessarily.

This theory is borne out by the experience of the Interborough Rapid Transit Company in the sub-stations of the Manhattan division, where instantaneous differential relays were installed at the sub-station end of the feeders. When feeders were operated in parallel, it was found in most all cases where a feeder became short-circuited that all the differential relays at the sub-station end would operate, and also those of one or more of the other sub-stations; this caused the remaining relays in the other stations to operate, because of overload, thus resulting in a total shutdown. After straight overload time-limit relays were substituted for the differential relays, on the occasion of several very severe short-circuits, the affected sub-station cleared itself in a perfectly satisfactory manner and without disturbing the rest of the system. It would appear, then that the straight overload time-limit relay is the most satisfactory device obtainable for the protection of feeders at the sub-station end.

With synchronous converters, a straight overload time-limit relay in the high-pressure side of the transformers will give satisfactory protection for the alternating-current side; while for the direct-current side a reverse-current relay, operating the direct-current breaker, will be required to open the circuit, and thereby prevent the synchronous converter from attaining destructive speeds, in the event of the field circuit being opened.

Satisfactory direct-current reverse-current relays are obtainable; they are commonly of the motor type, having an armature separately excited from a source of constant pressure, such as a storage battery. They are provided with a stop to prevent continuous rotation, the field depending for its intensity and direction upon the line current. This type of relay, as installed on the 1,500-kilowatt synchronous converters of the Interborough Rapid Transit Company, will operate at about 15 per cent. rated current on reversal.

### Discussion (in Abstract).

H. G. Stott, New York: The ordinary overload relay, as treated in this paper tonight, is an attempt to do the opposite of what the telegraph relay does; that is to say, the telegraph relay is introduced to give a strong current to operate the receiving apparatus. The overload relay is introduced in order to allow us to introduce a weaker current to operate a switch apparatus, because the main current has reached such voltages and amounts that it has become exceedingly expensive, if not impossible, to design relays to work on main-line current. Different requirements have called for the design of different types of relays. The principal types mentioned tonight, the overload or differential, and the reversed current, all have a place which is very concisely described in the paper.

Philip Torchio, New York: Seven years ago the company [New York Edison] adopted, with all its high-tension switchboards, two types of relays, one being a fixed time-limit overload relay installed at the generating end, and one at the receiving end of each high-tension feeder, and one instantaneous reverse-current relay added at the receiving end of the feeders. The company, at the beginning, did not feel enough confidence in the reliability of these safety devices, so that at the start the relays were connected only to signal lamps. The relays were not entirely satisfactory, and for a considerable time a lot of experimental work had to be done before it was felt safe to connect a few of these relays to the trip mechanisms in a few stations. Then followed a period of investigation, to find out whether the relays did more good than harm. About three years ago the [illegible] problem [illegible] the [illegible] all requirements [illegible] to [illegible] relation and function to the [illegible] protective scheme. It [illegible] a time-limit relay, which would [illegible] interval of time in inverse proportion to the [illegible] of current. The only type of [illegible] at that time was the [illegible] attached to the ordinary overload relay [illegible] was found to be unsatisfactory in service, and it was dismissed from consideration. [illegible] turers had been urged to [illegible] to meet certain specifications [illegible] in detail. Development along [illegible] paratus, were, however, [illegible] in the meantime the New York Edison Company was not making great headway in protecting its increasing high-tension system.

One day, in the spring of 1903, the speaker happened to be in Schenectady in the office of Mr. Hewlett, the engineer of the switchboard department of the General Electric Company, and he took the occasion for interesting him in the development of such a relay. Mr. Hewlett listened attentively to the solicitation, then he took out of his desk a sort of ordinary overload relay, on the extended shaft of which was mounted a little leather bellows with an adjustable vent at the top. Then he showed the speaker its characteristic curve. The device was so promising that an order for 40 double-pole bellows-type relays was placed at once, and upon this type of relay a whole scheme of safety appliances was designed for the whole system.

C. W. Ricker, New York: In Mr. Chellis' paper reference has been made particularly to the protection of the electrical apparatus and the feeder system, with no particular reference to the rest of the station equipment. With modern methods of construction of electrical machinery, it is frequently the case, in fact, very frequently the case, that the electrical apparatus is able to endure adverse conditions better than much of the apparatus behind it. In one case in the speaker's experience, in an alternating-current plant, driving an interurban railway which was equipped with time-limit relays, the engines did not regulate promptly, and with the relays tested to the lowest time limit available the engine's speed would fall to such an extent that one or more rotaries would reverse before the entire system would come up. While it was not a large system, it was very much more inconvenient to replace the rotaries in proper operation than it would have been if it had been possible to cut out the power station quicker. Shortly after the plant went into operation, with the assistance of an incompetent engine attendant, the relay refused to open, the engineer attempted to shut down th engine, without first attending to his condenser, and succeeded in blowing the top of the cylinder off. The point I wish to bring out is the need of attention to the rest of the apparatus.

## A Vision of the Future.

In a recent issue of the Electrical Magazine of London a humorous writer tells a story of a Scotch engineer who dreamed that after being dead for 12 years he was permitted to revisit the glimpses of the moon. He inquired for the old power house, but found it gone. Instead, there was a great new plant at the pit's mouth in Derbyshire. Here nobody was to be seen save a gentleman in immaculate dress sauntering about, with his hands in his pockets. The narrator continues:

"'Gude morn tae ye,' A says, 'are ye the manager?' 'Well,' he says, 'A'm the resident, the sheefty mon, the driver, the gas expert, colliery manager an' fitter, aw thegether.' 'Losh!' says A, 'ye don't say sae!' 'Yes, indeed,' says he, 'an' in ma spare meenuts A mak oop the wurruks cost sheets.' An' he tould me his company had reduced the staff to 0.00000027 engineer per unit generated on the peak. An' he showed me the station. Mon, it was juist terrible! They had automatic coalcutters which needed nae watchin', for they wurrked mechanically alang the saft coal seams an' rejected the rocks. They deleevered the coal intae conveyors tae fetch it tae the surface, whaur it wes fed direct intae the gas producers by automatic dreeblers. The gas sae generated passed tae the gas turrbines which drove the generators, each of 60,000 kilowatts capacity, at 400 revolutions per second. From them the juice was transmeeted through the air at 13,000,000 volts by means of Merzian waves."

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Practically complete returns to the United States Geological Survey for 1904, as collected by Edward W. Parker, statistician, show that the production of coal last year amounted to 351,196,953 short tons, having a total value at the mines of $445,643,528.

## Central Union Takes Over the United Telephone Company.

A deal has been closed whereby the Central Union Telephone Company has obtained control of the United Telephone Company, a large Independent organization, which held a practical monopoly of the telephone business in Wells, Grant, Blackford and Huntington counties, Indiana. The Independent managers assert that they will immediately enter the field and establish competitive plants in all the cities and towns now occupied by the Central Union through its deal with the United company. The United company operates about 5,000 telephones in the above-named counties, and has toll-line connections with a great many rural companies in the territory covered. It has always been operated strictly as an Independent company and managed by Hugh Dougherty, its president, who has also been a radical and conspicuous opposer of the Bell company's methods.

Mr. S. P. Sheerin, president of the Indianapolis Telephone Company and the New Long-distance Telephone Company, who has worked side by side with Mr. Dougherty in fighting the battles of the Independents against the Bell company, said: "I do not regard the situation as alarming in general to the Independent property. This movement will simply mean that the Independent people will put new plants in these cities, just as they have done heretofore, in Logansport, Muncie, South Bend, Frankfort, Noblesville and Elwood, which, up to this recent purchase, were the only points in the state where the Bell company had bought up the Independents. In all these towns the new Independent plants have on the average quadrupled the business of the old plant, and in these towns, now covered by the United company, history will repeat itself within the next two years."

No recent transaction in the telephone field has attracted so much attention as this deal, for the reason that it was rumored some time ago from the city of Boston that the Bell telephone company had set aside several millions of dollars for the work of developing its work in Indiana and the purchasing of local Independent plants. Immediately upon confirmation of the deal a meeting of Independent telephone men was held in Indianapolis and steps were taken to enter the field lost. It was stated in the meeting that while the situation would temporarily embarrass the Independents, good would result in the end. It was also stated that the city officials in the cities and towns in the territory involved are ready to grant franchises to the Independents.

## NEW COMPANIES.

The Blue Springs Telephone Company has been incorporated in Blue Springs, Mo., with a capital of $10,000.

J. E. Harris and others of Amherst, Kan., have organized the Independent Telephone Company of Amherst.

The United Telephone Company, Kaw, Okla., has been incorporated by R. L. Bristow and C. Bristow of Kaw and D. W. Campbell of Fairfax, Okla.

The Hyde County Telephone Company of Washington, N. C., is a new contestant for business in North Carolina. The capital is $25,000, and B. L. Susman heads the incorporators.

E. Goin, J. W. Walker, J. H. Glines, James Kent and David Rubles have incorporated the Waldport Mutual Telephone Company. The principal place of business is Waldport, Ore.

The Barber Telephone Company of Hazleton, the Crowley County Telephone Company of Winfield and the Cleveland Telephone Company of St. John, all in Kansas, have recently been incorporated.

D. H. Perry of Salt Lake, Utah, is forming a telephone and telegraph company to operate a line from Las Vegas, Nev., to Rhyolite, and from Rhyolite to Goldfield, Nev. The capital stock is $25,000.

The Rural Telephone Construction Company of Monmouth, Ill., is among the recent Illinois incorporations. J. E. Lanphere, W. J. Quiston and R. Lahann are the incorporators. They propose to operate a telephone system.

The Orion Telephone Exchange Association, Orion, Ill., incorporated with a capital of $2,500, proposes to conduct a telephone exchange. F. L. Anderson, F. O. Swanson and N. A. Eckstadt are the incorporators.

The American Telephone Construction Company of Toledo has been incorporated, with a capital of $100,000, by C. F. Chapman, E. H. Winkworth, Frank W. Coughling, W. B. Duck and J. R. Klepfer.

## Telephone News from the Northwest.

O. R. Kohn has resigned as local manager of the Minnesota Central Telephone Company at New Ulm, Minn.

The St. Paul City Council has as yet taken no definite action on the proposed ordinance fixing telephone rates in that city. The Northwestern Telephone Exchange Company is making a vigorous fight over the matter and threatens to cut out all party lines if the measure goes through, putting all telephones on a flat rate, thus making the ordinance work to the detriment of the numerous small users.

The Tri-state Telephone Company has been granted a franchise in Litchfield, Minn., for a local telephone exchange.

The Hughes Electric and Telephone Company will build a telephone line from Bismarck, N. D., to Linton.

The Norman County Telephone Company has been revived at Ada, Minn., and proposes to secure the local telephone exchange by purchase if possible, or building a new one. A system to cover the county is proposed.

The Northwestern Mutual Telephone Company has been incorporated at Ipswich, S. D., to build to Leola.

The Tri-state Telephone Company has made application to the council of Redwood Falls, Minn., for admission to the city for its toll lines.

Waite & Halbower have been granted a franchise into Miller, S. D., for a telephone line.

The Litchfield (Minn.) Telephone Exchange Company will expend $10,000 in rebuilding the local exchange and making extensions and improvements.

The Northwestern Telephone Exchange Company in Minneapolis will test the constitutionality of a city ordinance recently passed which requires telephone companies to cut their wires at their own expense in order to permit houses being moved over the streets.

The Great Northern railway is experimenting with the telephone for train dispatching between Crookston and Moorhead, Minn.

A franchise has been granted at Franklin, Minn., to the Tri-state Telephone Company.

The Citizens' Telephone Company has let the contract for the erection of a new exchange building at Racine, Wis., to A. Jacobson. The building will cost complete about $25,000.

The Vilas (S. D.) Telephone Company has been granted a franchise by that village.

A franchise has been granted to Walts & Halbower to construct a telephone system at Miller, S. D.

The Maquoketa (Iowa) Telephone Company has sold its plant to Otto Wettstein of La Porte City.

The Boone County Telephone Company of Boone, Iowa, is planning extensive improvements in its system and has issued $50,000 worth of bonds for the purpose.

The City Council of Clinton, Iowa, has passed an ordinance compelling telephone wires to be put underground.

The Callender (Iowa) Mutual Telephone Company has been incorporated.

Bills Bros. have sold their interests in the Sioux City (Iowa) Telephone Company to local men, headed by T. A. Thompson. The transfer involves about $300,000 worth of stock.

The Mt. Pleasant (Iowa) Telephone Company will construct a toll line to Burlington. R.

## Ohio Telephone Notes.

From Cincinnati it is reported that the Fitzsimmons Telephone Company is to be increased in size and will operate on a novel basis. According to the report, it is to have a capital stock of $8,000,000, divided into $10 shares. The service will be paid for in accordance with what is used. Telephones in drug stores, hotels and other public places may be used for one cent a call. In flats, residences and other places, the five-cent telephone will be installed, but no guarantee will be required as to a minimum amount for the month or year.

The Kellogg Switchboard and Supply Company of Chicago has been licensed to transact business in Ohio. R. S. Mueller of Cleveland is the Ohio agent of the company for this purpose.

The Northwestern Ohio Toll Line Company, it is reported, has passed into the hands of the Toledo Home Telephone Company. The lines, about 100 miles in all, pass through Henry, Fulton and Defiance counties. In the hands of the Toledo company the lines will remain Independent and operate with the association companies.

Reports are current that a St. Louis concern has an option on the Fitzsimmons franchise in Norwood, near Cincinnati, and that the Bell interests may get possession of the franchise.

The Corning-Elliott Telephone Company of Ringgold has been incorporated with a capital stock of $5,000 by E. W. Gladden and others.

Miss Clara Papcke has brought suit against the Cleveland Telephone Company for $25,000 damages. She says that she was permanently injured and disfigured for life in 1897 by being struck by one of the company's wires which broke and fell across a trolley wire.

The Delaware County Telephone Company will erect a plant at Cheshire. The company was incorporated a short time ago. T. R. Smith is president.

The Ridge Telephone Company of Washington Township, Van Wert County, has been incorporated with a capital stock of $275, by William Alspach and others.

Both the Bell and Independent people have about completed entirely new plants at Bellaire, and it is predicted that there will be lively competition. The Bell company has put its plant into operation and the Belmont Telephone Company will have its exchange ready within a month. New instruments, new exchanges and new wire have been put in by both, and the service will be of the best. C.

## Indiana Telephone Items.

The Milton Co-operative Telephone Company has been incorporated with a capital stock of $10,000. The company proposes to establish and operate telephone exchanges in Wayne, Henry and Fayette Counties. The principal office and exchange will be in Milton. L. W. Beeson, W. E. Williams, W. A. Bragg and W. I. Doddridge are the incorporators.

The College Corner Telephone Company has filed articles of incorporation with the secretary of state, with the declared purpose of establishing and operating telephone exchanges in Union, Fayette and Franklin Counties in Indiana, and Butler and Preble counties in Ohio. The capital stock is $30,000. J. T. Brier, E. E. Hill, C. L. McCray, J. H. McCray and C. L. Quick are the directors.

The Central Union Telephone Company has removed all its telephones from the city offices, including the police stations, in Indianapolis The city refused to pay for the telephones, the contract having expired nearly a year ago, and the company did not longer care to furnish the city free service. These offices will now depend upon the one telephone system. S.

## Southeastern Telephone Developments.

The Burnsville Telephone Company has been chartered to establish an exchange at Burnsville, N. C., with long-distance lines to several nearby towns.

The Southern Bell Telephone Company is building a new line from Leesburg, Ga., to Albany.

The Monroe (N. C.) Telephone Company has announced an increase of rates on account of recent improvements, to take effect June 1st.

The City Council of Nashville, Tenn., has voted down a bill submitting to the people the ordinance granting the Home Telephone Company a franchise to build a conduit and telephone plant.

The Columbus Telephone Company, with principal office in Wilmington, N. C., has been granted a certificate of dissolution by the state upon the request of at least two-thirds of the stockholders of the company. L.

## Chicago Telephone Company Wins Rebate Suit.

The Chicago Telephone Company has won the test rebate suit brought against it by the Illinois Glass Company. The jury in Judge Holdom's court based its decision on the ground that telephone users can agree to take a higher-priced service regardless of ordinances setting the maximum price at a lower figure.

The plaintiff contended that as the ordinances of 1888 set a maximum of $125 for telephone service, the telephone company had illegally collected $50 a year above that figure for a period of five years. Under the court's instructions, however, the jury found that the signing of the contract by the glass company had been entirely voluntary, that there had never been any complaint against the payment of the extra amount, and that the agreement was made for the reason that the higher priced service was a better service. The defendant's attorney contended that the plaintiff might have retained the grounded service at a cheaper rate than the metallic if it had desired.

## MANUFACTURERS AND DEALERS.

The Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., reports having closed contracts for switchboards for the following places: Waverly, Ohio; Seattle, Wash.; Kansas City, Mo.; Scenery Hill, Pa.; Benzonia, Mich.; Albany, N. Y.; Rock City, Ill., and Maynard, Ky.

The International Telephone Manufacturing Company has recently received a contract for increasing the 1,000-line equipped, 2,400-line multiple capacity, lamp-signal central-energy switchboard for the Bloomington Home Telephone Company at Bloomington, Ill. The original installation was made by the International company three years ago and is being increased at the present time with the same class of apparatus, which has proved an entire success.

## Operating Rules for Telephone Exchanges.

The committee report on "Operating Rules" presented to the Ohio Independent Telephone Association on March 30th, and prepared by Messrs. C. Y. McVey of Cleveland, S. E. Ward of Mansfield, George H. Matheany of Lima, J. P. Boylan of Cleveland, C. E. Stinson of Toledo and M. B. Overly of Cleveland, was a complete and meritorious one. While space does not allow of its publication here in full, a few extracts from the earlier part which are of a general character and cointain many valuable hints regarding the operation of exchanges, will be found of interest. The following is taken from the report:

Visitors.—No persons except officers and employes of the company whose duty brings them in connection with the switchboard will be allowed to enter the operating room except by special permission from the general manager. Neither the chief operator nor any of her subordinates shall be allowed to conduct visitors about the operating room.

Busy Trunks.—A record of the number of times all trunk lines between exchanges are reported busy will be maintained during the first week of every month and forwarded to the proper official.

Peg Counts.—Peg counts will be kept on the first and third Monday of each month. In computing lines and stations for peg-count information, the number of subscribers' circuits in use on the switchboard shall constitute total number of lines, and the number of subscribers' telephones, extension sets, and stations connecting with private-branch exchanges, shall constitute the total number of stations.

Service Complaints.—All verbal-service complaints shall be made out on forms provided for that purpose. The telephone number, the date and time reported, and the name of the person who makes the complaint will be recorded. It will not be necessary to enter the subscriber's name or address on this report. The person taking the complaint will sign it in the lower right-hand corner. If complaint is due to operating, it will be forwarded immediately to the chief operator. If it appears to be due to interference on a party-line circuit or any other trouble caused by a subscriber, it will be forwarded to the complaint adjuster, and, if due to mechanical trouble, it will be referred to the wire chief. Any criticism whatsoever of the service will be considered a complaint, and so recorded.

Fire Drills.—The switchboard fire drill shall be held on the fourth Saturday of every month at the time when each division of operators go to lunch. The same rules as those employed for operators going off duty will be observed in the fire drill, with the single exception that the call bell will give three successive taps instead of one when operators are waiting for the signal to leave the room.

Emergency Lights.—In the event of a fuse blowing, or any other emergency occurring which would interfere with the lighting facilities in the operating room, the switch directly in the rear of the assistant chief operator's desk will be thrown, connecting an eight-candlepower battery lamp over each section of the switchboard. This circuit works off the storage batteries and is to be used only in cases of emergency, as stated. The chief operator shall satisfy herself that all of her assistants understand the use of the switch and how to operate it.

Emergency Bell.—A call button located at the assistant chief operator's desk, will operate a large single-stroke gong in the wire chief's office and equipment department. The following signal code will be observed: One tap will indicate that a switchboard man is wanted. Two taps, that a switchboard man is wanted immediately. Five or more taps, will be an alarm of fire.

In the event of a fire call, the various trouble clerks, line testers, etc., will proceed in order to the operating room, each one to his definite task, as assigned him at the latest fire drill.

Damage to Plant.—In case of any emergency at night, such as fire, crossing of lines with conductors of high-potential currents, damage by water, or any accident which would cause a suspension of the service or endanger the plant, the night watchman should be called at once, and also the first obtainable officer of a list, taken in order beginning with the exchange manager and ending with the general manager. In case of any similar emergency at night on the outside, particularly where aerial wires or cables have broken down so as to endanger public safety, the night wire chief will be advised immediately. He in turn will communicate with the district inspector or troubleman living nearest to the location of such trouble, and the inspector, after investigating, will report his findings as soon as possible to the night wire chief by telephone. If it is deemed advisable, the night wire chief will confer with the first obtainable officer, beginning with the general foreman and ending with the general manager.

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Howard Hendrickson, W. A. Hendrickson and H. M. Keys of Albany, N. Y., have incorporated the Adirondack Home Telephone Company with a capital of $150,000 to operate in Clinton, Essex, Franklin, Jefferson, Lewis and St. Lawrence counties.

# CORRESPONDENCE.

## Great Britain.

London, May 10.—An interesting case is now before the court in connection with the Telegraph Act of 1899, which, it may be [illegible] the act that authorized municipalities to erect telephone exchanges. Under the act any local authority may, after receiving a telephone license from the postmaster-general to carry on a telephone system, call upon the National Telephone Company in its area (provided it has a certain number of subscribers) to give facilities for intercommunication between the subscribers to the two systems. In return for having to give these facilities the National Telephone Company in each case in which there is competition by the local authority has its license extended. There is nothing in the act, however, which determines the nature or extent of any such intercommunication between two systems, nor upon whom the expense shall fall. Consequently the National Telephone Company and the Swansea corporation differ over these matters and a decision has been asked for from the Court of Chancery.

The contention of the National Telephone Company is that as the act does actually say that proper intercommunication shall be afforded, each exchange of the company should be directly connected by junction wires with every exchange of the local authority, and that each party should bear the cost of a wire from its exchange to that of the other, thus keeping the traffic originating on each system separate and distinct and confined to one direction. Its reason for this was that the Swansea system was already overloaded with traffic, and without additional wires the business in that town would be disorganized. The corporation, on the other hand, argues that it will be sufficient—at any rate for the present—if the main exchanges of either party are connected, and also two of the most important sub-exchanges, and that all the traffic should be carried over the existing lines through these main exchanges. In fact, it has gone so far as to lay a cable containing 272 pairs of wires between its main exchange and that of the company, and asks for a declaration from the court that the company shall make the necessary connection. The judge, who will deliver his decision later, agreed that the corporation was entitled to some intercommunication, but the extent he would determine in his written judgment. As a matter of fact there was no dispute as to some intercommunication being desirable, because it was forced upon the company under the Telegraph Act of 1899, but whereas the corporation only asked for a limited intercommunication, the company asks for intercommunication of a most complete kind, the expense of which is to be equally borne.

It was mentioned here some months ago that the Dolter Electric Traction Company had received parliamentary powers to construct a system of electric tramways in Torquay upon the Dolter surface-contact system. The corporation in giving its consent stipulated that the company take its supply from the corporation, which was agreed to. The corporation, therefore, finding its existing generating station had an insufficient capacity to deal with the extra load, decided to erect another works, especially as the lighting load was also increasing. Consequently an application was made to the Local Government Board for a loan, but after an exhaustive inquiry this has been practically refused. In the meantime the tramway company has been pushing on with the tramways to such effect that it will be ready in a few months' time, and threatens that should no supply of current be forthcoming as per the agreement with the corporation, it would sue to recover for any loss.

The Dolter Electric Traction Company has recently offered to construct a length of tramway upon its surface-contact system in Edinburgh as a trial for twelve months. If the trial is satisfactory the corporation is to take over the line. The tramways in Edinburgh at present are horse and cable.

The projected electrical exhibition in London next year already appears to give promise of considerable success, as many of the leading British electrical engineering firms have taken space thus early.

The consideration of the many schemes for the supply of electrical energy throughout London was resumed yesterday after the Easter recess. The scheme now under consideration is one by an existing electric-supply company, to-wit, the City of London Electric Lighting, the area of whose operations is 256 square miles, and about half the area of the previous $25,000,000 scheme, of which so much was heard. The capital powers in this case are a negative quantity, as, being a limited-liability company, it can raise any amount of money by the sanction of the shareholders on the question of capital cost; however, this scheme is producing figures lower than those of Mr. Merz in the other scheme. But the end is far off yet, and I will reserve a review of the whole matter for another occasion.

There is still considerable objection being taken to the appointment of a committee to consider the agreement between the postmaster-general and the [illegible] that [illegible] automatically binding upon both parties. G.

## New York.

New York, May 20.—[illegible] vanced a step on Tuesday. Alderman Timothy Sullivan [illegible] ful that the franchises will go through in time to come within the existing laws which are to be altered on June 5th, when Governor Higgins signs the new measures, and the aldermen will more than probably accept the routes finally on May 29th. The plans, as tentatively approved, definitely throw out the moving-platform scheme across town on Thirty-fourth Street, and provide for a four-track subway in its place, to start from the Pennsylvania railroad depot at Seventh Avenue, and to be continued under the East River to Queens. This scheme leaves the Interborough Rapid Transit Company out and gives the Pennsylvania-Metropolitan-New Haven-Brooklyn Rapid Transit interests the control of the situation. The north and south routes definitely provided for are for three complete four-track subways from the Battery to Harlem, following the general lines of Third, Seventh and Eighth Avenues, the Third Avenue line deviating about midway into Lexington and Fifth Avenues.

An order for 22,000 tons of structural steelwork was placed on Thursday for the New York terminal of the Pennsylvania railroad at Thirty-fourth Street. The contract went to the American Bridge Company of Philadelphia.

Tests of the electrical equipment of the Long Island railroad have been made this week, over a five-mile stretch of the trestle across Jamaica Bay, along which electric passenger traffic is expected by June 15th. This will be the first instance of the actual conversion of a steam road to electricity within the limits of Greater New York. The first trial trips were made on Wednesday, with some of the new steel cars, which closely resemble those used in the New York subway. Improved starting and braking devices enable the cars to be started and stopped without jerk or jar. Yesterday's trials demonstrated a speed of 45 miles an hour over the trestle, which is perfectly straight and level. The tests have been made under the direction of L. S. Wells, electrical superintendent of the Long Island railroad, and of Joseph Burke, chief inspector of the Queenes Borough Bureau of Electricity. Current was supplied to the third rail from the new power house at Long Island City, the third rail being specially protected at the stations on the bay.

Vice-president Bryan of the Interborough company announces that there will be through subway traffic all the way from the Battery to Two-hundred-and-fifteenth Street in the fall.

Mayor McClellan on Tuesday signed a bill which will fix the price of gas at 75 cents per thousand cubic feet. The mayor has also approved of the measure to regulate the price of electric current.

The New York Edison Company is giving a daily exhibition at 30 West Thirty-second Street of modern methods of cooking by means of electric cooking apparatus. The company says that cooking by this method is as economical as by any other means.

A poolroom was raided in this city a few days ago in which many highly ingenious electrical devices were discovered by the police. Besides an elaborate system of electrical signaling apparatus, roulette wheels and other gambling devices were so arranged that they disappeared into innocent-looking picture frames on pressing a button.

The Electric Coke Company of New York was incorporated at Albany on May 15th, with a capital of $20,000. The directors of record are F. B. Adams, A. L. Brougham and J. Wallace.

The pending ratification by Governor Higgins of the new laws to regulate franchises has caused the hurried incorporation of several lighting, traction and power companies within the last few days, with an aggregate capital running into millions of dollars. A list of these new concerns is printed elsewhere. D. W. W.

## Dominion of Canada.

Ottawa, Ont., May 20.—The Kingston street railway has been put upon the market, the city of Kingston having declined to buy the road at $125,000. There are nine miles of track, with all equipment, including Lake Ontario Park. The company is open for tenders and will not dispose of the plant until after June next. The company has set a price of $200,000 on the property.

The West India Electric Company of Montreal, Que., has purchased the entire plant and business of the Jamaica Electric Light and Power Company,

doing business in the city of Kingston, Jamaica. By this purchase the Canadian company obtains the entire control of the electric traction and lighting in Kingston and Lower St. Andrew. The price paid was nearly $80,000.

The new Dominion Observatory, which has just been completed here, will supply official standard time to the government here and in other parts of the country. The observatory is equipped with a 15-inch telescope, which was built in the United States at a cost of $15,000.

The committee of the Dominion Parliament which has been considering the bill to incorporate the Fessenden Wireless Telegraph Company of Canada has decided to give the incorporators a charter similar to that of the Marconi company. The location of the lines, however, must be subject to the government's approval. The incorporators are R. A. Fessenden, Washington; Thomas Fyshe, Montreal; E. W. Rathbun, W. I. Gear, F. M. Cole and G. W. Stephen, Montreal. The capital is fixed at $200,000.

By a majority of 453 the property owners of the city of Ottawa, and they were the only persons entitled to vote, decided in favor of the purchase of the Consumers' Electric Company and to operate this plant as a municipal utility. This marks the final round in the fight which has been in progress for the last three years between the Ottawa Electric Company and the citizens. The company, it is well understood, proposed to amalgamate the two electric companies operating in this city and later to add the gas company. The Ottawa Electric Company's bill proposing to give the company power to absorb other companies was defeated at the last session of the Dominion Parliament, but at the present session this bill successfully passed the Commons and is now before the Senate, where, in consequence of the adverse vote referred to, it will probably be turned down. The city of Ottawa is now empowered to purchase the plant and other properties of the Consumers' Electric Company at a price not exceeding $200,000. W.

## Southeastern States.

Charlotte, N. C., May 20.—The city of Norfolk, Va., has appointed a committee to investigate the cost of electric lighting in all cities east of the Alleghanies having a population of 40,000 or more.

Surveyors are now at work making a survey of the proposed electric railway from Nashville to Huntsville connecting the capital of Tennessee with the Alabama town. Right-of-way has been partly secured.

The city of Richmond, Va., is having estimates prepared for a municipal electric-lighting plant, which, it is calculated, will cost about $400,000.

The Tennessee-Alabama interurban electric railway, chartered recently under the laws of Georgia, with $300,000 authorized capital, has been granted the right by the secretary of war to build through Chicamauga Park. Engineers are already in the field to complete the preliminary work.

The Tennessee Coal, Iron and Railroad Company has equipped its mines at Ensley, Ala., with electric haulage at a large cost.

The city of Chattanooga has given official support to the proposition of C. E. James and J. C. Guild to erect an electric power plant on the Tennessee River at a cost of $300,000. The capital needed is in sight and the company will be chartered in the state of Tennessee. A long-term franchise is asked. L.

## Texas.

Austin, Texas, May 19.—An electric street-railway system is to be constructed at Bryan, a franchise having been granted to J. R. Astin and others. An electric-light plant will also be erected and operated by the same company. Under the terms of the franchise the work must be begun within six months and completed within one year thereafter.

A street-railway system to run from Dallas to West Dallas is to be constructed by St. Louis capitalists. T. J. Barry represents those interested.

The San Marcos Valley Interurban Railroad Company has been organized, with a capital stock of $500,000, for the purpose of building an electric interurban road from San Marcos to Luling, a distance of 27 miles. The principal office will be at San Marcos. The incorporators are C. W. Ohrndorf and J. W. Scoot of St. Louis, Mo.; A. T. Fisher of Boston, Mass.; Edward J. L. Green, B. G. Neighbors and C. G. Mead of Luling; G. W. McGrew of Houston; C. R. Smith of Gonzales, Texas, and J. H. Jennings of Martindale, Texas.

A company is being organized by eastern capitalists for the purpose of constructing an interurban electric road from Austin to Lockhart, a distance of 32 miles. The proposed road will go near the towns of St. Elmo, Creedmore, Carl, Lyton, Bluff Springs and other places. Charles W. Ohrndorf of St. Louis, Mo., is one of those interested.

The Galveston Electric Company, organized at Galveston with a capital stock of $2,000,000, is formed primarily, it is said, to take over and operate the existing street-railway system of Galveston. It is reported that the company will also build an interurban electric line between Galveston and Houston, a distance of 51 miles. The incorporators are C. A. Stone, E. S. Webster, G. E. Tripp, Boston; M. M. Phinney, Dallas; Edwin B. Parker, A. W. Q. Birtwell, Houston; John Sealy, Sealy Hutchins, Walter C. Ansell, Ed Cavin, E. M. Robertson, R. B. Wilkins and Ballinger Mills, Galveston. H

## Ohio.

Cleveland, May 20.—At a meeting of the directors of the Cleveland Electric Railway Company a few days ago the proposition of Mayor Johnson to lease the property was turned down on the ground that the proposed leasing company would not have any financial responsibility, but would take the business out of the hands of the owners entirely. The directors expressed themselves as willing to lease the system to a company financially responsible if proper terms can be made, but would not enter into any arrangement with the city which it has no right to make. President Andrews stated in a letter to the mayor that the company was preparing a proposition that would be presented later on. Mayor Johnson has been urging the company to agree to a leasing proposition on the basis of a stock value of 85, and this the company would not accept.

William Hunt, representing eastern bondholders of the Appleyard roads, was in Columbus this week looking into the properties. F. L. Deane, representing the General Electric Company, one of the creditors, was also in the city at the same time. From this circumstance the report has originated that a reorganization of these companies will take place shortly after Mr. Hunt makes his report to the bondholders.

L. A. Ireton, counsel for the Cincinnati Trust Company, has applied for a foreclosure decree and order of sale of the assets of the Miami and Erie Canal Transportation Company, the trust company being trustee for the mortgage holders. This action will be vigorously opposed by the Cleveland bondholders and a number of attorneys were present to fight it.

Four new cars have been purchased by the Columbus, Delaware and Marion, and will be put into service soon. A limited service will be put on this road as soon as the power and new cars are in shape for it.

The City Council of Canton has received an application from the Canton and Youngstown Railway Company for a franchise to operate in the city. The plan of the company is to build a line between Canton and Youngstown. It is the intention to build the road this summer.

It is reported that the Columbus Railway and Light Company will take out all the electrically welded joints in its tracks, put in two years ago, and go back to the fishplate and bolts. The claim is made that the heat generated in welding takes the temper out of the ends of the rails and causes them to become soft. As a result they wear down and cause an uneven track. The cost of the work was large, and the company looks upon this as a loss.

The Interurban Dispatch is the name of a company formed by the officers of the Western Ohio, the Dayton and Troy and the Dayton and Western to operate an express business on these lines, which has heretofore been handled by the Southern Ohio Express Company. An attempt will be made to get the Springfield, Troy and Piqua and the Dayton, Covington and Piqua into the new arangement. It is thought that the Southern Ohio Express Company will handle the business from Dayton to Cincinnati, and there will be a transfer at Dayton.

George B. Kerper of Cincinnati has completed arrangements for checking baggage for long distances and will have his electric cars for the Toledo, Bowling Green and Southern changed to comply with his ideas in this respect.

Plans have been made to enlarge the electric plant of the Youngstown Consolidated Gas and Electric Company, made necessary by the recent consolidations of the electric-railway systems in that section, as announced in the Western Electrician at the time. This plant furnishes current for the system, which is now so large as to need additional power.

The Urbana Electric Light Company of Urbana has arranged to purchase the property of the Urbana Gas Light and Coke Company, having made a contract to light the streets for the next 10 years.

The Youngstown and Southern, which was taken over a few days ago by a number of Youngstown men, will be one of the few electric roads to haul coal extensively. It passes through a good coal field, and a number of manufacturers are now interested in it. There are large factories also in East Liverpool, which will be river terminus of the company. The road will operate on the third-rail system. A portion of it has been operated as a steam road for some time.

The Columbus, New Albany and Johnstown Railway Company has given a mortgage for $450,000 in favor of the Columbus Savings and Trust Company, the proceeds to be used in paying off present indebtedness and completing the line. A mortgage for $200,000 held by the Cleveland Trust Company was cancelled. The new mortgage will secure an issue of 20-year bonds. O. M. C.

## Michigan.

Detroit, May 20.—The Senate committee has reported favorably on the Simpson bill, which gives electric railways the right to own steamship lines and operate them in connection with their lines, the same as steam roads operate boat lines.

L. T. Girdler, formerly superintendent of the street-railway department of the Muskegon Traction and Lighting Company, has been promoted to be assistant to the general manager.

A bill has been introduced in the Legislature giving the railroad commissioner the power to order electric railways to construct fences and to put in the proper form of crossings.

The bill providing a penalty for street railways and steam railroads crossing each other's tracks without the permission of the railroad commissioner, has been made a law.

A new electric line, to run between Cincinnati and Detroit, has been on foot for some time. It will parallel the Big Four railroad almost to Detroit, via Toledo. The company is known as the Toledo, Detroit and Cincinnati railroad, and franchises are being asked for operation by steam and by electricity.

The bill just passed giving the street and interurban railways the right of eminent domain in this state does not give this power except in case a franchise has been granted. It does not permit electric lines to condemn rights-of-way without franchises from towns and villages through which they pass. The public authorities, therefore, still have the power to fix the rates of fare.

The Grand Rapids-Muskegon Water Power Electric Company, which is organized with a capital of $1,000,000, and which is now building a 730-foot dam in the Muskegon River about six miles south of Big Rapids, has closed a contract with the Grand Rapids, Grand Haven and Muskegon electric railway to furnish all the power necessary to its operation. The contract covers a period of 10 years, and is expected to go into effect about December or January next, at which time the power company will be in position to turn on the current. The current will be delivered to the interurban line at Walker, Coopersville and Fruitport, and the power house at the latter place will be done away with. This plant was built four years ago by the Westinghouse company and cost $160,000. It has a capacity of more than 2,000 horsepower. This new power company was organized and is controlled by Muskegon capitalists, the officers being: President, Thomas Hume, Muskegon; vice-president, W. A. Foot, Jackson; treasurer, J. G. Emery, Jr., and secretary, George L. Erwin, both of Muskegon. The dam, which is now being built, will supply 6,000 horsepower and will be one of a series of three in the Muskegon River, to supply power and light in the cities of Muskegon, Grand Rapids and other cities of Western Michigan.

A project is on foot by workingmen of Battle Creek to buy a large tract of land two or three miles from that town, on the Battle Creek and Jackson electric railway, and divide it into five-acre tracts, on which to erect homes and raise vegetables and fruit, start a canning factory and run a store on the co-operative plan.

The freight business of the Detroit, Ypsilanti, Ann Arbor and Jackson electric railway has developed to such an extent that the company now proposes to operate regular freight trains of four cars each, to handle special freight between points on the line, but not into Detroit. A contract has been made to handle about 5,000,000 brick this summer. This road is also considering the advisability of abolishing the five-cent fare between points outside of cities. Either a minimum of 10 cents will have to be charged or stops limited to regular stations. C. G. W.

## Indiana.

Indianapolis, May 20.—The subsidy election held in Troy Township, Fountain County, in aid of the construction of the Fountain-Warren traction line from Covington to Lafayette, failed to carry by a vote of 316 to 247. The farmers opposed the tax, while the citizens of Covington supported the proposition.

The Indianapolis and Northwestern Traction Company has ordered plans for a handsome new terminal station in Lafayette, and new station buildings in Frankfort and Lebanon. The company has just completed a new station at Crawfordsville.

The City Council of Ft. Wayne has granted a franchise to the Lima, Van Wert and Ft. Wayne Traction Company to enter the city. The franchise is to run for 35 years. The road is to be completed this summer.

A subsidy tax has been voted in aid of the Winona traction line from Peru to Warsaw. Perry Township, Miami County, voted $15,000 and Henry Township, Fulton County, $25,000. This insures the building of the road, $75,000 having been voted this company. The subsidies just voted carry the provision that if the Wabash-Rochester interurban line is finished within a year, the Winona company will pay the other company $25,000, as the two townships voted the Wabash-Rochester company subsidies aggregating that amount four years ago.

The provision is intended to stimulate the building of both lines.

Under the new law, railroad companies are required to maintain lights at street crossings in cities and towns, and are now making contracts with local electric light companies in a number of places for the lights. The average price per light is $20 a year.

A space telegraph station will be erected at Michigan City this summer. W. H. Ocker, manager of the American DeForest Wireless Telegraph Company in Chicago, visited the locality last week and was pleased with the site.

The Indianapolis Technical Institute is giving special attention to instruction in its electrical department, under the charge of Frank Seig, formerly of Chicago. The electrical works consists of all kinds of house wirings, and telephone and electric-light installation. The students have installed lights and telephones on the campus grounds and in the institute buildings.

The Dodge Manufacturing Company of Mishawaka, Ind., has secured the contract to furnish all machinery and material for the Lake Charles Lighting and Water Works Company's new plant at Lake Charles, La.

The Indiana Hydraulic Company, recently incorporated at Frankfort, Ind., has selected a site on Wild Cat River, at the mouth of Turkey Run, for the construction of a new power dam. At this point are bluffs on either side 45 feet high, of solid sandstone. The engineer says the dam will furnish a minimum of 1,000 horsepower, and the officials of the company say they will have no trouble in reaching a profiable market for their electricity. S. S.

## Northwestern States.

Minneapolis, May 20.—The new building being erected in Minneapolis on Sixth Street N., near Hennepin Avenue, by the Electrical Engineering Company at a cost of about $25,000, will be ready for occupancy by June 15th.

The Iowa Valley Interurban Railway Company of Belle Plaine, Iowa, has filed articles of incorporation, with a capitalization of $100,000. George W. Voss was elected president and H. R. Mosnat secretary and manager.

The question of granting a franchise at Alden, Iowa, to the Electric Lighting Company will be decided by popular vote on May 29th.

The city of Hastings, Neb., has contracted with the Allis-Chalmers Company for the equipment for its new electric-light plant.

Plans have been completed for the consolidation of the power plants at Lead and Deadwood, S. D. A large power plant is to be constructed at Pluma, S. D., and about $1,000,000 will be invested.

A franchise has been granted to the Creston Mutual Electric Light, Heat and Power Company at Creston, Iowa.

The electric-light plant at Vermillion, S. D., will probably be purchased by the city.

The Hughes Electric Company of Minneapolis has been incorporated by E. A. Hughes and others with a capital of $100,000.

The council of South St. Paul, Minn., has voted to grant an electric-light franchise over the mayor's veto, and work on the new plant is to be commenced at once. The total cost of the system will be about $15,000.

The Missouri Valley Light and Heat Company has sold its system at Onawa, Iowa, to Haukins Bros., the consideration being given at $70,000.

The Rothsay (Minn.) Lighting and Heating Company has filed articles of incorporation, with $10,000 capital. K. K. Peterson heads the list of stockholders. R.

## Pacific Slope.

San Francisco, May 19.—The incorporation of the Ocean Shore Railway Company by Walter E. Dean and associates is regarded as the first move in an effort to secure an electric railway down the ocean shore from San Francisco to Santa Cruz. The company plans to construct an electric railway from China Basin, San Francisco, to Half Moon Bay, Purissina, San Gregoria and Santa Cruz. It is believed that the proposed road is intended to be a feeder for the Western Pacific railroad when that line is built into San Francisco. In answer to this move the Southern Pacific railway people are also planning to put in an electric line reaching practically the same territory, which line will serve as a feeder for the Southern Pacific main lines.

There are a number of other electric-railway propositions centering in San Francisco or the suburbs which also are reported to be projected in the interests of one or the other of the big transcontinental railroads. The latest one of these to assume definite shape is the Oakland and Contra Costa interurban railroad, for the construction of which a company was incorporated a few days ago with an authorized capital stock of $500,000 by John F. Boyd, Joseph Naphaly and others of San Francisco. The company purposes constructing a trolley line between Oakland and the San Ramon Valley in Contra Costa County. Franchises will be asked from the county authorities for Alameda and Contra Costa counties.

The Wasco Milling Company of Wasco, Oregon, is preparing to construct an electric-light and power plant for the purpose of supplying the towns of Wasco and Moro with light and power.

The Big Bend Transit Company has been incorporated at Olympia, Wash., for the purpose of constructing electric railway line in that state. The company has an authorized stock of $100,000. The incorporators are J. W. Sawyer, J. W. Fox and C. S. Turner.

The Sierra Valley Light and Power Company has been incorporated by Henry Gerring, David Berry and others for the purpose of constructing an electric-railway line from Nevada City, Cal., to various points in the Sacramento Valley.

The Rapid Electric Heater Company has been incorporated in San Francisco with a capital of $25,000 by K. C. Hamilton, R. W. Branoff and others.

Frederick A. Brand and others of Benicia, Cal., have secured a franchise to construct street-railway tracks upon the streets of Benicia. An electrically operated railroad will be put in.

The Consolidated Power and Water Company of Modesto, Cal., has been incorporated to take over the electric-power companies controlled by Mr. Tullock. The company will furnish electric-lighting and power to Oakdale and Modesto as well as to a number of mining companies. A.

## Rocky Mountain States.

Salt Lake City, May 20.—As a part of the government's reclamation system in that portion of the state, a power plant will be established on one of the main canals, about six miles from Fallon, Nev., at a cost estimated at $50,000.

George T. Beck of Cody, Wyo., has returned from the East, where he ordered the equipment for an electric power plant which will provide the energy for lighting the city. It is expected that the operations will commence at the plant within the next two months.

Work on its proposed plants at the Augur and the Shoshone Falls, Idaho, has been commenced by the Shoshone Power Company, and it is announced by the engineers that the company will be furnishing power to Salt Lake and other distant points within 18 months.

Articles of incorporation of the Perry Electric Light and Power Company of Perry, Utah, capitalized at $20,000, have been filed with the secretary of state.

The City Council of Ephraim, Utah, is considering a project for the establishment there of an electric power plant.

The Rocky Mountain Bell Telephone Company has been given a franchise to establish an exchange at Hamilton, Mont. G.

## PERSONAL.

Mr. George S. Rice was appointed chief engineer to the Board of Rapid Transit Commissioners of New York city at the meeting last week. Since the resignation of William Barclay Parsons, nearly a year ago, Mr. Rice has been acting chief engineer.

R. P. Leavitt was recently appointed to the position of general mechanical superintendent of the Albany and Hudson Railroad Company, in charge of the car shops and general mechanical repairs. This is in addition to his previous capacity as electrical superintendent, in charge of all electrical matters in connection with both the railroad and lighting departments.

C. W. Ricker has accepted a position with the Interborough Rapid Transit Company of New York city as electrical superintendent of power stations. For the last year he had been in the electric-traction department of the New York Central railroad. Mr. Ricker has been identified with many important electrical installations. He is a graduate of the Massachusetts Institute of Technology, and for six years he conducted a consulting engineer's office in Buffalo.

C. E. L. Brown of the firm of Brown, Boveri & Co. of Baden, Switzerland, was one of the experts who gave evidence before the House of Lords committee in connection with the scheme of the Administrative County of London District Railway Company to supply the whole of London from three contemplated power plants, though he was not appointed as electrical expert by the company, as was stated in the Western Electrician of April 29th. Mr. Brown is an electrical engineer of wide reputation, and his evidence was highly valued by the committee.

Albert S. Ayres, one of the fastest Morse telegraph operators in the country, died suddenly in Cincinnati on May 19th. Mr. Ayers was born in Dayton, Ohio, in 1849, where he became a messenger boy in the telegraph office. After his father's death he held positions in Omaha, Boston, New Orleans, Columbus and Cincinnati. Some time was spent with the Mutual Union and American Union Telegraph companies, and when they were taken in by the Western Union he went to the Baltimore and Ohio as chief operator. Later he went to New York and when the United Press was formed he became chief operator in New York

[illegible] Cleveland Telephone Company at the time of his death [illegible] founded the Cleveland Telephone Company. From this start he became one of the best-known men in the business. Until unable to work, he managed the Cleveland Telephone Company, being vice-president, and he held a similar position with the Erie Telephone Company, which had exchanges in Arkansas, Texas, Missouri [illegible] McKinstry was born in Cleveland January 15, 1842. In 1859 he secured a position with the Lake Shore railroad as a telegraph operator. Five years later he entered the service of the Western Union Telegraph Company in Cleveland, and was later sent to Erie, Pa., where he became manager of the office. In 1879 he joined the Bell telephone people and began the establishment of a telephone system in Cleveland. He was made the general manager and held the position until five years ago. He was a member of the Colonial and Electric Clubs and the Chamber of Commerce, and was a Mason. A wife and six children survive him.

George W. Davenport, third vice-president of the Niagara Falls Power Company, died in the Memorial Hospital on the morning of Thursday, May 18th, following an operation for appendicitis. Mr. Davenport was in his office at Niagara Falls on Friday morning, May 12th, but suffering great pain he went to the hospital, where an operation was performed the following day. He failed to rally from the shock and operation. He is survived by a wife and two children; also one brother, Dr. J. H. Davenport, of Providence, R. I. Mr. Davenport was born at Fall River, Mass., in 1858. In 1883 he entered the Massachusetts Institute of Technology, taking a special course. He entered the factory of the Thomson-Houston Company of Lynn in 1885, later taking up the organization of the Thomson-Houston International Company, which sold Thomson-Houston products abroad. Here he acted as general manager, and traveled widely in foreign countries. After holding various positions of responsibility with the General Electric and other companies, Mr. Davenport was made third vice-president of the Niagara Falls Power Company in 1904. He was also vice-president of the Buffalo Audit Company and of the Niagara Tachometer and Instrument Company, and was third vice-president of the Niagara Development Company and Niagara Junction Railway Company. He was a man of high character, broad-minded and a useful citizen whose influence was always for the good.

## ELECTRIC LIGHTING.

It is reported that J. D. Dennis will install an electric-light plant in his building at Princeton, Ill.

The Lehigh Coal and Navigation Company of Panther Creek Valley, Pa., contemplates erecting a large electrical plant in Lansford, Pa.

The gas and surplus electricity bill pertaining to Chicago, passed by the Illinois Legislature recently, has been signed by Governor Deneen.

Sawyer Bros. of Livingston, Texas, proprietors of the Livingston Ice Factory and Bottling Works, are installing a 250-light electric plant, in connection with its ice plant, for lighting the town of Livingston.

The Savannah Lighting Company, which was recently incorporated with a capital of $50,000, has nearly completed the erection of an electric-light plant, and has applied for a franchise to furnish light in Savannah, Ga.

The Georgetown (Ky.) Water, Light, Heat and Power Company, incorporated recently with a capital of $250,000, has purchased the property of the Georgetown Water, Gas, Electric and Power Company.

Jerome P. Parker, William Bergschicker and R. B. Henderson have been appointed a committee to report on plans for the proposed municipal electric-light plant to be installed in Memphis, Tenn., at a cost of from $750,000 to $1,000,000.

The Red Lion and Windsor (Pa.) electric-light plant has recently been reorganized and recapitalized. Fifty thousand dollars' worth of bonds and $30,000 worth of stock have been issued. The present building will be enlarged, new electrical machinery will be installed, and wires will be

strung to Windsorville, Yoe Borough and Dallastown. Contracts for lighting these towns have been made.

The supervisors of San Francisco, Cal., have appointed a committee, including Chief Hewitt of the department of electricity, to prepare an ordinance regulating the maintenance of electric signs on the roofs of buildings. It is said that the signs hamper the work of firemen.

A committee of the House of Commons of London has commenced the consideration of a bill providing for the installation in London of electric-light and pneumatic-tube systems similar to those in use in America. J. Pierpont Morgan is among the promoters of the company, which has a capital of $20,000,000. Ninety-five miles of double tubing and 172 stations are proposed.

## ELECTRIC RAILWAYS.

The first survey for an electric railway in Linn County, Kan., is being made. The line will connect Paola with Mound City, Fort Scott and Iola.

Among recent Illinois incorporations is the Peoria, Pekin and Bloomington Interurban railway of Illinois, with head office at Pekin, and a capital of $100,000. Jesse Black, Jr., of Pekin is among the incorporators.

The Illinois Traction Company, through its representative, the McKinley syndicate, has purchased the Jacksonville (Ill.) street railway. The same corporation, it is said, has under consideration the purchase of the lighting plant of the Jacksonville Gas Light and Coke Company, one of the most important public utilities of the city.

E. R. and W. H. Sponsler will install at Middletown, N. Y., one 225-kilowatt and one 350-kilowatt Bullock railway generator. These are intended to supply power for the existing lines of the Middletown-Goshen Railway Company, together with its extensions, the whole of which will hereafter be known as the Walkill Transit Company. Mr. Frank G. Brown is the local engineer in charge of the plant.

The Metropolitan West Side Elevated Railway Company of Chicago has sent in an ordinance to the City Council, which went to the committee on local transportation, asking permission to do a general express business, handling mail matter and "milk, baggage, bundles, parcels and all merchandise commonly known as express matter," over all its lines except between the hours of 6:30 and eight a. m. and five and 6:30 p. m.

The Western Illinois Traction Company, which last year graded a right-of-way for an electric interurban line from Monmouth to Galesburg, Ill., is said to have sold its franchise, right-of-way, materials and equipment to the Rock Island Southern Railway Company, recently incorporated, with $1,500,000 capital, for the purpose of building an interurban electric railway from Davenport and Rock Island to Galesburg and Monmouth.

H. R. Newcomb, E. V. Hale, L. W. Prior, G. W. York and Warren Bicknell, all of Cleveland, Ohio, spent a portion of last week looking over a proposed electric railway between Kansas City and St. Joseph, Mo., about 60 miles in length. Mr. Prior and Mr. York have been connected with the enterprise for some time, and the other gentlemen represent other strong financial interests. Mr. Bicknell went with the party as an expert in traction matters.

A system of electric railways has been inaugurated at Malta, with 10 miles of track in use, and soon nearly double that mileage will be worked. The rails came from Pittsburg, Pa., and the motors in use were made at the English branch works of the Westinghouse company. The power house is complete in every detail. Mr. M. D. Jeffs of New York is general traffic manager. The road was constructed and is operated by Macartney, McElroy & Co., and is regarded as an American company, although the headquarters of the company is in London, England.

A bill enabling the city of York, Pa., to enter into an agreement with the York Street Railway Company whereby in return for franchises for the Colonial and Penn Park Street Railway companies and other concessions the company shall perform certain obligations, including the sprinkling and cleaning of streets and the payment of a percentage of its annual gross receipts, has been introduced in the Common Council. This measure was rendered necessary under a ruling of the city solicitor because the municipality, under present statutes, has no authority to enter into an agreement of this kind.

## PUBLICATIONS.

The subject of factory ventilation becomes very vital during the summer months. It has been proved that good ventilation is a good investment from a business point of view. Good ventilation is best secured by means of motor-driven fans and blowers. They afford convenient and economical service. Leaflets 131 and 143-a, which are published by the Northern Electrical Manufacturing Company, Madison, Wis., show numerous applications of Northern apparatus in ventilating and glowing work.

The Chicago Fuse Wire and Manufacturing Company of 120 Randolph Street, Chicago, has issued a new catalogue on its various products, including Union enclosed fuses, Union fuse blocks and various forms of springs and clips.

The Electric Storage Battery Company of Philadelphia has issued an index to all its publications, which will be found useful in looking up the various publications which the company has sent out from time to time.

Well arranged and attractive in appearance, the new catalogue of the Capital Gas Engine Company of Indianapolis at once catches the eye. The sole business of this company is the building of stationary and portable internal combustion engines. The engines which the company offer are of the old and tried four-stroke type. The catalogue contains many good illustrations of various types of these engines.

The Moore Electrical Company of Newark, N. J., is the manufacturer of that interesting illuminant called the Moore "electric daylight," in which current is sent through a gaseous conductor in long glass tubes, which gives off a brilliant light applicable to many purposes. This apparatus is well described in a small pamphlet which is being sent out by the company, and entitled "The Moore Electric Daylight."

To give a few words in general about electric fans is the object of the Crocker-Wheeler Company's latest bulletin. The fans which are illustrated and described in the bulletin are for ventilating purposes. The earlier form of belt-driven fan is now replaced by an electric fan in which the motor forms an integral part of the unit, the motor frame being fastened to the fan ring, while the runner, or revolving part of the fan, is mounted directly on the armature shaft.

The Brownie bulletin of the Kellogg Switchboard and Supply Company of Chicago sets for in an original and entertaining manner the various points of merit embodied in the new Kellogg common-battery desk set. The bulletin contains 12 cartoons drawn by Mr. H. M. Post, in which the "Brownies" apparently go into ecstacies over each new feature which they discover about these sets. The pictures are accompanied by rhymes, on the order of "The House that Jack Built," which are very appropriate.

## SOCIETIES AND SCHOOLS.

Sixteen young men will take the degree of electrical engineer this year at Lehigh University in South Bethlehem, Pa.

Commencement at Purdue will extend from June 4th to 7th. The baccalaureate address will be given Sunday, June 4th, by Herbert Lockwood Willett, Ph. D.

The tenth annual convention of the National Association of Manufacturers closed in Atlanta, Ga., on May 18th. D. M. Parry of Indianapolis, Ind., was re-elected president. Vice-presidents, one for each state represented, were named by the states.

Arrangements for the annual convention in Montreal on June 21st to 23d of the Canadian Electrical Association are rapidly approaching completion. Among the several features arranged for are a luncheon at the Allis-Chalmers-Bullock Company's Works, a smoker-concert and visits to the various sub-stations of the Montreal Light, Heat and Power Company. A trip to Shawinigan Falls is also on the list.

## AUTOMOBILES.

J. Leonard Lang of Amsterdam, Holland, in a review of the trade in automobiles and bicycles, says: "Foreign automobile manufacturers having agencies in the Netherlands are: French, 11; German, three; Belgian, one. American machines are not much seen here, and American manufacturers, with the exception of the Oldsmobile, have no agencies in the Netherlands. American automobiles, as far as known, are found to be too weak for this country. Steam cars of the locomobile type must undergo a change, as the Dutch law does not permit boilers. Of the electrical motor cars, well known in every country, nothing is seen here; as far as known, nobody pushes their sale. Such cars might sell well. The American manufacturer does not further their sale, as a letter with price quotation and a catalogue is the only result of serious inquiries made by well-known Dutch firms."

## TELEGRAPH.

The latest adaptation of the Murray printing-telegraph system is its application to automatic typesetting. The receiving apparatus is so arranged that it can be applied to a linotype machine, and the messages set in type as they are received. The principal advantage over the ordinary printing telegraph is said to be that the compositor is enabled to make corrections while the messages are being received.

The French cable ship Charente has completed the laying of the cable from Cadiz to Tangier provided for by the Franco-Spanish convention. The cable, which is the property of the French government, constitutes another step in the consolidation of French interests in Tangier.

## MISCELLANEOUS.

The Santa Fe railroad is about to build a power house and equip an electric plant in Kansas City, Mo., at an expense of about $50,000, it is said.

The Chicago River and the Drainage Canal were inspected a few days ago as links in a prospective deep waterway from the Lakes to the Mississippi River. Five members of the rivers and harbors committee of Congress made the inspection. They will report their conclusion to the legislative body this fall, when an appropriation for the necessary work may be asked. Isham Randolph, engineer of the Drainage Board, accompanied the party.

A very rich discovery of copper is reported to have been made recently in the department of Yoro, Honduras. Those who have examined it state that the amount of ore is large and rich, running from 15 to 60 per cent. copper. The discoverers have located eight well-defined veins, which can be traced for miles on the surface, two of these being 12 feet wide, one 10 feet, and one 14 feet. It is calculated that the entire body will average 50 per cent. copper.

Reports are current that the Erie railroad is contemplating changing from steam to electric traction on its terminals in New York, in fact, on most of its New Jersey mileage. The road has a large suburban business, and just to it east the Long Island road is installing electric traction and to the north the New York Central will soon be running electric trains. It is rumored that plans under consideration contemplate the immediate expenditure of $10,000,000.

One of the principal deposits of molybdenum ore in this country is at Cooper, Maine. Dr. George Otis Smith of the United States Geological Survey, in Bulletin 260, the Survey's annual publication on its exploits in economic geology, gives some data on the character and origin of the deposit. The ores of molybdenum have been in greater demand since molybdenum has been used in the manufacture of steel to increase its hardness and toughness. The comparative rarity and high cost of the ores have, however, limited its use.

It has been arranged, it is said, by the Navy Department that all merchant ships fitted with space-telegraph apparatus shall make daily weather reports when in touch with the government stations which are now established along the Atlantic Coast, between Portland and New Orleans, and those soon to be completed to Galveston, Texas. All such reports will be forwarded to the Weather Bureau at Washington. These naval wireless stations will furnish the ships, when desired, with weather forecasts which come from the Weather Bureau.

Interest is increasing in the guayule shrub growing on the northern plateau of Mexico, from which rubber is being extracted. New buyers, for purposes of experimentation, are frequently entering the field. Several companies have been formed to construct factories and exploit the product. So far as known to the writer, says United States Consul Le Roy, Durango, Mexico, the methods of extracting rubber are all purely mechanical. Another plant of the arid plateau, which it is claimed will produce a rubber-like extract, is also attracting attention. Torreon is the center of the trade in the guayule, (Parthenium argentatum) and in or near there the factories for the extraction of rubber are being built.

Without a dissenting vote the state Assembly of Wisconsin has passed a bill providing for the taxation of street railways and electric-light, heat and power plants on an ad valorem basis. The bill provides for a state board of assessment, to consist of the commissioner of taxation and his first and second assistants. An annual assessment will be levied. An annual report to the board is required in which all the property, capital stock, bonds and securities, dividends declared, and gross earnings must be included in detail. The taxes will be paid into the general fund of the state, but 80 per cent. is returnable to the towns, cities and villages in proportion to the gross receipts from the operation of the plant in each such town, city or village.

A prominent feature in mining gold, coal, tin, etc., in South Africa has been the remarkable increase in the demand for electrically driven machinery, says the South African correspondent of the London Times. Hauling, lifting, pumping and lighting are fast being accomplished by its use. For lifting purposes a motor of the three-phase in-

duction type, working at a pressure of 500 volts, is a representative one, and is capable of driving 125 horsepower. Where the depth is moderate, 50-horsepower motors are frequently employed. There is just now quite a craze among South African mining engineers for the newest and best electric plants for hauling and lifting purposes. For lighting purposes a vast and ever-increasing supply of plant and fittings are required. Diamond drilling, as a rule, is done nowadays by electricity, on account of the handiness and convenience of the system, the motor being placed wherever desired, as against the inconvenience and loss of power occasioned by old-time methods.

## TRADE NEWS.

Fred B. Carbis has purchased the electrical supply business of C. C. Harding in Salida, Colo.

The Hellyer Electric Company of Zanesville, Ohio, has purchased the stock of E. B. Robbins and has opened a new electric store. Carl Hellyer is the manager of the concern, which will do a general electrical business.

According to the newspapers, fire on May 24th destroyed the foundry, pattern room of the railbond department and warehouse of the Ohio Brass Company of Mansfield, Ohio. The loss is estimated at $150,000, covered by insurance.

J. H. Ward, employed by the Minot Light and Telephone Company, will open an electrical supply store and repair shop in Minot, N. D. Mr. Ward expects to carry a complete line of electrical fixtures and supplies and will make a specialty of wiring buildings for contractors.

A recent Illinois incorporation is the Marquette Electric and Manufacturing Company of Chicago, which, according to the incorporation papers, will deal in electrical appliances, machinery, light and power. The capital is $50,000 and the incorporators are H. A. Weyl, George Schein and L. T. Orr.

On June 1st, or as soon thereafter as possible, advertisement for proposals for furnishing the Signal Corps of the United States Army with telephone apparatus to the value of approximately $75,000 will be issued. Models of practically all of this equipment may be seen in the Signal Corps model room, Washington, D. C., and drawings and specifications are under preparation. Representatives should call upon Major Edgar Russel, officer in charge of the electrical division, Lemon Building, Washington, D. C., for permission to inspect the models.

A comparative trial of dry batteries is being conducted by General Greely, chief signal officer of the United States Army. Some 20 makes of cells are being practically tested with a view to ascertaining the best product obtainable. The signal office purchases a large quantity of the cells every year and makes a rule of getting the best on the market.

J. G. White & Co. of New York announce that they have secured the services of Mr. Hiram J. Slifer as steam-railway expert. Mr. Slifer is a graduate of the Polytechnic College of Pennsylvania and has been prominently connected with mining and railroad work since. He will be responsible for matters relating to the company's steam-railway undertakings.

The Chicago office of the Mica Insulator Company and Eugene Munsell & Co., which is under the management of Charles E. Coleman, has been moved to the twelfth floor of No. 358 Dearborn Street. The new offices cover nearly 2,000 square feet of space and are admirably arranged for the needs of the companies. Mr. Coleman states that business is exceptionally brisk at the present time.

The Navy Department, through the bureau of supplies and accounts, is inviting sealed proposals until June 6th for furnishing eastern navy yards with the following: Schedule 257, incandescent lamps, carbons, dry batteries, switches, wire and miscellaneous electrical supplies; schedule 258, starting panel; schedule 260, motors; schedule 262, motors; schedule 263, insulating tape. Blank proposals can be obtained of the bureau or at the navy pay office in New York city. On June 20th the bureau will open bids for furnishing the Puget Sound and Mare Island navy yards with the following: Schedule 267, incandescent and arc lamps, carbons, tape; schedule 268, incandescent lamps, insulating rings. Blank proposals can be obtained upon application to the bureau at Washington.

## BUSINESS.

The Wilkesbarre (Pa.) Gas and Electric Company has placed an order with the Allis-Chalmers Company of Milwaukee for one horizontal cross-compound Reynolds-Corliss condensing engine, with cylinders 22 and 40 inches in diameter and a 42-inch stroke, for direct connection to a 500-kilowatt 60-cycle 2,300-volt alternating-current generator. It will be designed to run in parallel with a Vulcan

[redacted]

have double its former floor space and much improved shipping facilities.

The Home Electric Company of Wheeling, W. Va., has been incorporated with $10,000 capital stock by J. F. McCurdy, R. V. McCay, W. P. Key [illegible] of Wheeling, J. M. [illegible] of [illegible], W. Va., and George J. Gibson of Greggs, Ohio, to conduct a general electrical construction business.

Dodge & Day, engineers and architects of Philadelphia, Pa., have been commissioned by the Electro-Dynamic Company to make a thorough examination of the existing methods in its shops at Bayonne, N. J., and submit a report as a basis for changes and improvements contemplated by the management. Business of the Dynamic company has increased to such an extent that there has come an urgent necessity of speeding up the shop, or else providing more adequate facilities, or both.

The John F. Walsh Company of Pittsfield, Mass., successor to the K. & W. Company, manufactures a number of compounds, chief among which are the Anti-spark commutator lubricating compound, Perfection polish paste and Nocroso, a substitute for acids, resins and soldering salts or fluids. The company also makes the K. & W. dynamo brush. These products it considers worthy of careful inspection by buyers, and holds that there is none better on the market.

The Westinghouse Machine Company has recently announced substantial extensions in its sales organization. These extensions are the result of the rapidly increasing business, making necessary the more thorough covering of southern and western territories. In addition to the original New York, Boston, Pittsburg and Chicago offices, new branches have been established at Cincinnati, Denver, San Francisco, Charlotte, N. C., and Atlanta, Ga. With these added facilities the extensive mining territory of the West and cotton industries of the South may receive more active attention.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued (United States Patent Office) May 16, 1905.*

789,702. Electric Signal System. Edwin J. Adams, Waco, Texas. Application filed February 13, 1904.

Contact plates and an electrically operated indicating mechanism are mounted upon the vehicle. Means in electrical connection with the indicating mechanism engage the contact plates, and a lamp is connected between the plates.

789,715. Pneumatic Trolley Check. Andrew G. Cassidy, Waltham, Mass. Application filed November 5, 1904.

A drum arrangement for winding and unwinding the trolley cord is controlled by a pneumatic device.

789,716. Telephone Transmitter. Henry P. Clausen, Chicago, Ill., assignor to the American Electric Telephone Company, Chicago, Ill. Application filed August 20, 1902. Renewed April 6, 1905.

A telephone transmitter comprises a main diaphragm, front and back supplemental diaphragms, a ring separating the supplemental diaphragms, a supporting diaphragm connecting the ring with the main diaphragm, electrode-surfaces carried by the supplemental diaphragms and granular carbon interposed between the surfaces.

789,721. Electrolytic Apparatus. Frank A. Decker, Philadelphia, Pa., assignor to the Decker Manufacturing Company, Wilmington, Del. Application filed February 29, 1904.

A cell comprising the containing vessel holds an electrolytic solution, the vessel having an aperture. Another receptacle contains mercury, the receptacle being located in the aperture and having a bottom inclined downwardly and outwardly from the interior of the cell.

789,734. Glow-lamp-socket Holder. Herman T. Hochhausen, Brooklyn, N. Y. Application filed January 28, 1905.

Two oppositely disposed arc-shaped rim flanges and two arc-shaped projections on the cylindrical socket are arranged so that by rotating the flange the parts are locked together.

789,735. Glow-lamp-socket Holder. Herman T. Hochhausen, Brooklyn, N. Y. Application filed February 3, 1905.

An attachment for holding lamp-sockets is described, which, by inserting and turning the socket locks it in operative position relative to the circuit terminals.

789,738. Method of Propagating Wave Forms. Dugald C. Jackson, Madison, Wis. Application filed September 23, 1901.

A method of counteracting capacity in wave-form circuits consists in creating a magnetic field substantially throughout the wire of the circuit, the axis of the field being substantially co-incident with the general direction of the wire and in adjusting the strength of the field to produce inductance to suitably neutralize the capacity.

789,740. Electrolytic Apparatus. Woolsey M. Johnson, Iola, Kan. Application filed August 14, 1903.

The electrolytic apparatus embodies a rotatable disk anode and a cathode, the anode having means for directing a stream of electrolyte against the cathode.

789,748. Code Signaling Telephone. Charles T. Mason, Sumter, S. C., assignor to the Sumter Telephone Manufacturing Company, Sumter, S. C. Application filed February 11, 1905.

A code-signaling telephone call comprises a magneto generator, a signal wheel shaft and mechanism connecting the signal shaft with the generator driving shaft, the mechanism comprising means for disconnecting the shafts when the signal wheel shaft has been rotated to transmit a signal.

789,754. Governor for Non-automatic Electric Motor Controllers. William J. Napier, Leichhardt, near Sydney, New South Wales, Australia. Application filed January 6, 1904.

Combined with an electric motor are a supply-circuit and current controller, mechanism capable of locking the controller at each position of adjustment, means actuated by non-electric energy for operating the mechanism and apparatus responsive to variations of the current in the supply-circuit for controlling the means.

789,778. Signaling System. Joseph A. Wilson, Westfield, N. J., assignor to the Hall Signal Company. Application filed September 13, 1904.

In an electric signaling system are a differential magnet having two coils, a source of current for energizing one of the coils, a track-circuit including the other coil, a current reverser and track magnet and a signal controlled by both of the magnets.

789,799. Pneumatic Dispatch Tube System. William H. Dinspel and Joseph J. Stoetzel, Chicago, Ill., assignors to the Universal Pneumatic Transmission Company, Chicago, Ill. Application filed August 15, 1902. Renewed April 1, 1904.

During the passage of the cartridge along the pneumatic tube a trigger is tripped which closes a circuit which in turn energizes electromagnets for operating the valves cutting off the supply of air behind the cartridge.

789,814. Interrupter. Maurice K. McGrath, Antwerp, Belgium, assignor to the Western Electric Company, Chicago, Ill. Application filed October 21, 1904.

Combined with an electromagnet is an armature arranged to be thrown into rapid vibrations by the magnet. Switch parts adapted to be operated by the armature, and a non-resilient support for the armature and switch parts are provided.

789,822. Automatic Electric Current Regulator. Thomas A. Swarts, Columbus, Ohio. Application filed February 29, 1904.

A potential-regulating device has parallel series of contact points, a feed element being connected to the contact point at one end of one of the series. A solenoid is connected to the corresponding contact of the other series, a core working in the solenoid and co-operating with the series of contact points. Means regulate for changes in the load, having parallel series of contact points with a contact point of one series connected with the solenoid and a conductor leading away from a contact point of the opposite series. A solenoid is connected to the feed element and has a core working between and in co-operative relation with the second-mentioned series of contact points.

789,832. Canopy Insulator. Edmund E. Bechtold, Chicago, Ill. Application filed October 20, 1904.

Insulating material is located on the canopy surrounded by a band, and having an inturned flange to engage the band.

789,877. Relief Valve for Storage Batteries. David F. Perry, Chicago, Ill., assignor to the Vesta Storage Battery Company. Application filed May 22, 1903.

A valve for allowing the escape of gas from storage batteries is the basis of the patent.

789,886. Lightning Arrester. Guy H. Short, Stillwell, Ill. Application filed August 1, 1904.

A lightning arrester comprises a base, a clip secured to the base, a local line wire supported by the clip, a ground wire also supported by the clip and provided with a terminal loop arranged in parallel relation to the local wire, and a clamping screw engaging the clip for securing the wires.

789,914. Electric Switch. Frederick Huffer, New York, N. Y. Application filed October 31, 1904.

In an electric switch is a movable contact element, the element having notches in its periphery. A casing surrounding the element and a disk outside of the casing has a pawl, adapted to engage the notches, and rotate the element by the rotation of the disk.

789,925. Coin-controlled Telephone System. Charles W. Mahon, Chicago, Ill. Application filed September 6, 1904.

A receiving-circuit provided with interlocking relays has means whereby the relays will be interlocked upon the making of a call. The interlocking makes the transmitting circuits inoperative. The deposited coin releases the interlocking device. (See cut on next page.)

789,951. Rock Drill. Thomas E. Adams, Cleveland, Ohio, assignor to the Adams Drill Company, Cleveland, Ohio. Application filed December 4, 1901.

The device comprises a pivotally mounted, longitudinally

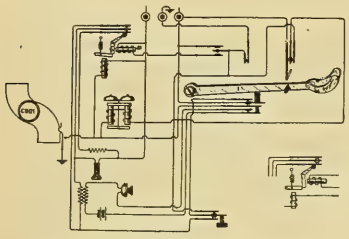
movable drill body, a drill rod and operating mechanism for the drill rod carried by the drill body. An electric motor independent of the drill body is mounted to rock freely and drives the drill rod.

789,975. Electric Switch. Gustave L. Herz, New York, N. Y. Application filed October 7, 1904.

In an electric switch are a suitable base, a contact-plate and a removable plug included in the circuit. Means removably engaged with the plug slide it into and out of engagement with the plate without removing the plug.

789,985. Telephone Cut-off. Herbert Manring, Weatherby, Mo. Application filed July 14, 1902. Renewed February 14, 1905.

In a multiple-bridged system of combined automatic and manual cut-offs for telephones on multiple branches there are combined with each telephone receiver a system of circuits and an auxiliary cut-off for each receiver. A receiver arm is arranged in parallel relation to the receiver and in close proximity, having upon its under side insulated material. An auxiliary cut-off is pivotally mounted in proximity to the arm and provided at one end with a handle and at the other end with a lateral projection disposed beneath the arm to engage the insulating material. (See cut.)



NO. 789,925.—COIN-CONTROLLED TELEPHONE SYSTEM.

790,055. Centrifugal Apparatus for Electrolytic Purposes. Ralph V. Heuser, Erie, Pa. Application filed September 17, 1904.

Combined with a revoluble vessel are an anode of substantially annular form mounted therein, a cathode mounted within the vessel and encircled by the anode, the cathode being provided with perforations, and means for causing the vessel to revolve.

790,095. Electric Signaling System. Samuel M. Young and Fitzhugh Townsend, New York, N. Y. Application filed October 18, 1904.

An automatic signaling system for railways consists of a source of power current, a source of signaling current and a trackway divided into block sections, one of the rails of the trackway continuous and common to all of the sections, and the other rail made up of a series of independent rails each having the length of a block. Ironless bonds are introduced between the opposite ends of the independent rails of each section and the continuous rail.

790,100. Safety Device for Motor Starters. Frederick G. Bill, Long Island City, N. Y., assignor of one-half to Francis H. Murphy, New York, N. Y. Application filed February 21, 1905.

A circuit closer, comprising a lever and an electromagnet in operative connection therewith is associated with a rheostat, an arm therefor and devices in operative connection with the arm for completing a circuit through the electromagnet when the arm is in its normal position.

790,103. Combined Annunciator and Jack for Telephones. Daniel W. Campbell, La Crosse, Wis., assignor to the Vought-Berger Company, La Crosse, Wis. Application filed July 25, 1903.

A shell having a magnet and a pivotally supported armature is provided with a latch bar secured to the armature and a pivotally mounted drop formed with a shutter near its front end. A downwardly-turned portion at the inner end, a vertical lug to engage the free end of the latch bar, and an insulating block in the path of the connecting plug on the face of the depending inner end of the drop are the other parts.

790,107. Trolley. John H. Clark, Urichsville, Ohio. Application filed March 3, 1905.

In a trolley are a harp, and combined oil and bearing boxes removably engaged in the harp members.

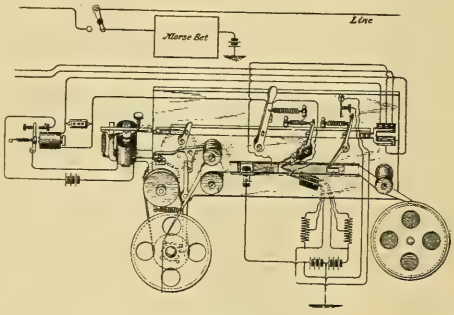
790,152. Incandescent-lamp Socket. Guy H. Proctor, Somerville, Mass., assignor to the Bryant Electric Company, Bridgeport, Conn. Application filed May 10, 1904.

An incandescent lamp socket comprises in its construction a supporting block of insulating material in two parts, a circuit-controlling key, a plate having bearings in its opposite ends for the key, the plate being fastened at one end to both of the parts, and springs to act on the key near the other end.

790,155. Electric Time Switch. Jerome Redding, Boston, Mass., assignor to the Redding Automatic Time Switch Company, Boston, Mass. Application filed May 21, 1904.

A clock movement having adjustable actuators controls mechanism for the switch motor comprising a device for releasing the motor. Another device stops the switch motor. A rotatable controller has removable points, each of which actuates the devices in succession, while a ratchet operated by the actuators successively rotates the controller.

790,179. Wireless Telegraphy. Ferdinand Braun, Strassburg, Germany. Application filed November 4, 1904.

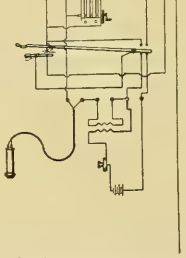



NO. 790,193.—AUTOMATIC TELEGRAPH APPARATUS.

In a transmitter for wireless telegraphy are an aerial conductor excited by a closed oscillating circuit containing several spark gaps in series, and condensers between the electrodes of the neighboring spark gaps.

790,189. Electric Alarm System. Hippolyte M. Cooper, Coopers Plains, N. Y. Application filed October 15, 1904.

An electric arm system comprising an initial circuit and a primary circuit, and a parallel circuit has means controlled by the initial circuit for closing the primary and parallel circuits. Means controlled by the primary circuit cause the actuation of an alarm, while other means automatically break the primary circuit. Devices controlled by the parallel circuit permit the continued actuation of the



NO. 789,985.—TELEPHONE CUT-OFF.

parallel circuit permit the continued actuation of the alarm after the breaking of the primary circuit.

790,193. Telegraphy. Patrick B. Delany, South Orange, N. J. Application filed June 30, 1902.

An automatic telegraph contains a recording receiver adapted to be automatically started and stopped by current received from a distant station and comprising recording devices, an electromagnetic starting device included in the normal circuit of the line, an electromagnetic stopping device normally disconnected from the line circuit, and a switch and circuit connections which, when the receiver is started, operate to cut the starting device out of and introduce the stopping device into the line circuit in series with the recording devices. (See cut.)

790,226. Electric Furnace. Isedore S. Prenner, Scranton, Pa., assignor of one-half to Gus N. Brown, Scranton, Pa. Application filed March 21, 1903.

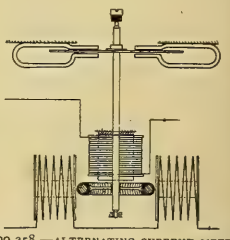
Adjustable electrodes extend into a closed chamber, so as to form an arc within the chamber. Gearing moves the electrodes toward or away from each other. Means controlled by the arc current regulate the strength of the current of the electrically operated gear controlling means.

790,241. Antiseptic Mouthpiece for Telephones or the Like. Walter Wright, San Francisco, Cal. Application filed May 12, 1904. Renewed April 21, 1905.

An antiseptic mouthpiece for telephones comprising an outer shell, an inner shell, absorbent material between the shells, and a ring around the outer shell has a bayonet fastening with the inner shell.

790,250. Apparatus for Increasing the Discharge Energy of Electrical Vibration Systems. Ferdinand Braun, Strassburg, and Ragnar H. Rendahl, Berlin, Germany. Application filed April 22, 1904.

An electrical oscillating system embodies an oscillating circuit containing several spark gaps and electrical means of good conductivity for the charge potential. Other means of small conductivity discharge vibrations shunted to the separate spark gaps for distributing the charge potential over the separate spark gaps.



NO. 790,258.—ALTERNATING-CURRENT METER.

790,258. Alternating-current Meter. Albin May, Berlin, Germany, assignor to the Internationale-Elektrizitäts-Zähler Gesellschaft M. B. H., Berlin, Germany. Application filed July 29, 1903.

Main-current coils, a rotary annular iron body located between them and completely inclosed by the lines of force of the main-current field, and a stationary shunt field directed perpendicularly both to the main-current field and the axis of the rotary body, its lines of force being conducted peripherally in several distinct paths by the rotary body, are the principal features. (See cut.)

790,262. Indicating Dial for Electric Switches. Charles G. Perkins and Nathan W. Crandall, Hartford, Conn., assignors to the Perkins Corporation, Hartford, Conn. Application filed October 19, 1904.

In combination with a circuit-making and breaking contact mechanism are a protecting metallic cover inclosing the mechanism, a non-conductive cup-shaped lining fitting within the cover, a chamber between the top of the lining and the ceiling of the cover and a dial in the chamber rotatably supported by the lining and provided with means for engaging and coacting with a rotatable member of the making and breaking contact mechanism.

790,267. Electric Clock System. John Stein and Albert N. Stein, New York, N. Y., assignors to the Universal Electric Clock Company, New York, N. Y.

A spring-actuated primary clock is associated with an electrically operated secondary clock. The primary clock closes an electric circuit periodically, the current impulses passing to an electromagnet in the secondary clock, the armature of which operates a pawl and ratchet to move the clock hands.

## EXPIRING PATENTS.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on May 22, 1905:

383,096. Anti-induction Composition for Electric Cables. D. Brooks, Jr., Philadelphia, Pa.
383,097. Support for Electric Wires. D. Brooks, Jr., Philadelphia, Pa.
383,098. Covering for Electric Wires and Cables. D. Brooks, Jr., Philadelphia, Pa.
383,105. Electrophorus. J. D. Culp, San Felipe, Cal.
383,113. Dynamo-electric Machine. J. W. Easton, New York, N. Y.
383,114. Automatic Tightening Device for Armatures of Dynamo-electric Machines. J. W. Easton, New York, N. Y.
383,140. Manufacture of Incandescent Electric Lamps. O. A. Moses, New York, N. Y.
383,150. Secondary Battery. S. Russell, Brooklyn, N. Y.
383,152. Combined Gas and Electric Light Fixture. S. B. H. Vance, New York, N. Y.
383,184. Electrical Apparatus for Purifying Water. A. R. Leeds, Hoboken, N. J.
383,193. Secondary Battery. J. S. Sellon, Sydenham, County of Kent, England.
383,216. Secondary Battery. L. Epstein, Martinkenfelde, near Berlin, Germany.
383,220. District Telegraph Call Box. J. B. Gill, San Francisco, Cal.
383,263. Galvanic Battery Excitant. T. P. Whittier, East Saginaw, Mich.
383,269. Telephone Conveyor. S. R. Ballard, Pittsburg, Pa.
383,271. Battery Zinc. J. Beattie, Jr., Fall River, Mass.
383,273. Electrical Tramway. H. T. Blake, New Haven, Conn.
383,274. Electrical Tramway. H. T. Blake, New Haven, and C. Sterling, Bridgeport, Conn.
383,320. Dynamo-electric Machine. L. N. P. Poland, Cincinnati, Ohio.
383,324. Mechanical Telephone. G. F. Shaver, New York N. Y.
383,332. Combined Gas and Electric-light fixture. S. B. H. Vance, New York, N. Y.
383,377. Fusible Coupling for Electric Fire-alarm Circuits. G. G. Smith, St. Albans, Vt.
383,411. Electric Lamp. E. C. Ohmart, New York, N. Y.

## SPECIAL MENTION.

The Keystone Express, the popular low-fare train over the Pennsylvania Lines, leaves Chicago daily at 10:05 a. m., arriving at New York at three o'clock the next afternoon—coaches, Chicago to New York, for both first and second-class passengers. Through sleeping cars are on this train and the fare is as low as that over any other line. Passengers should ask for tickets via the Pan Handle Route in order to secure the low rate. C. L. Kimball, assistant general passenger agent, No. 2 Sherman Street, Chicago will furnish full particulars upon application.

The Great Northern Railway Company says that it is surprising what an interest is manifested in the Lewis and Clark Exposition by the people of the East. "They see in the exposition an opportunity to visit the western country at a greatly reduced expenditure of money, and not only see the exposition itself, but view the wonders of our western scenery, and witness the great resources of the Northwest and the opportunities afforded. The Great Northern railway passenger department has been flooded with inquiries as to the exposition, and it augurs well for a big travel through the Northwest this year." The company also issues a booklet, "Business Openings," which adequately and comprehensively describes the needs of the many towns along its line and contains a detailed list of the business openings afforded the man with limited means, as well as the big investor.

# WESTERN ELECTRICIAN

**EVERY SATURDAY**

Vol. XXXVI. CHICAGO, JUNE 3, 1905

## Colorado: Its Attractions and Its Opportunities, Electrical and Otherwise.

By John Craig Hammond.

"The Past."

NOW that I am here, what are you going to do for me? What shall I see? What shall I learn?

It may be supposed that visitors who have traveled perhaps thousands of miles to attend the twenty-eighth convention of the National Electric Light Association, to be held in Denver and Colorado Springs on June 6th to 11th, inclusive, will ask questions such as these. And in attempting to answer these questions the writer hopes to present information and pictures that will likewise be of general interest to all readers of the Western Electrician.

To repeat, then, "What are you going to do for me?"

Give you a good time; let you bask in sunshine that doesn't grow any other place as it does in Colorado.

Take you to a "broncho-busting" contest; whirl you through the finest streets of houses in this country; let you gaze at the mountains a hundred miles away; land you among them; show you scenery that can't be duplicated in all this world.

Show you things electrical that are wonders even in the wonderful electrical era; take you a mile into the earth, where men are bringing forth virgin gold; walk, pull or let you ride to the top of Pike's Peak; show you where the finest trout can be caught; where the deer and bears run wild; give you a peep at Elitch's Gardens, a wilderness of flowers and foliage set in a large tract of prairie and boasting one of the finest summer theaters in the country.

And—but it would take hours to tell you about all the things that will be done for you.

First, a word about Denver.

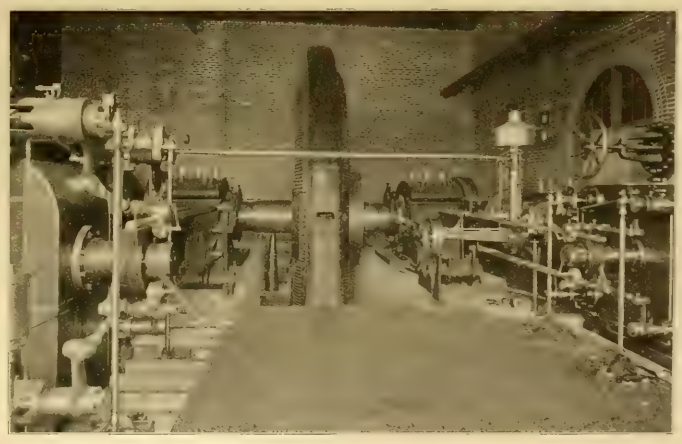
The moment you step off the train you will be glad; you will be overjoyed; you will feel at home immediately. If, in the evening, a myriad of electric lights will almost intone with their rich effulgent rays of warmth, "Welcome." Yes, a hearty welcome to Denver will be extended you in this and other ways by the citizens of the city, who are using extraordinary efforts to entertain the electrical men and their friends properly.

You will be surprised when you proceed up Seventeenth Street to your hotel; somewhat pleasurably stunned to think that this city, modern in its architecture, its general appearance and its entire "atmosphere," should be situated on the wild, undulating prairie at the foot of a chain of snow-capped peaks that lift themselves into the heavens like countless cathedral spires.

### The "City of Lights."

You will see a city of lights—a blazoned tribute to the business ability, sagacity and energy of Henry L. Doherty, president of the Denver Gas

EAST STATION OF DENVER GAS AND ELECTRIC COMPANY.



A 1,500-KILOWATT UNIT IN WEST STATION OF DENVER GAS AND ELECTRIC COMPANY.

[illegible] he had formulated to make Denver the "City of Lights," but he went at the difficulties with the fighting spirit, and his indomitable energy soon removed every obstruction.

The result? Scarcely a day passes without some strong comment in the press advocating more lighting. In fact the phrase, "Boost for the City of Lights," which is the offspring of Mr. Doherty's spirited lighting campaign, is on nearly every lip.

But visitors will see for themselves why Denver is becoming widely known as the "City of Lights." It is not a wild prediction to say that they will go away feeling that Denver people are justified in their pride of having one of the best lighted cities in the country.

The symmetry of Denver's streets will impress the newcomer. On the ground where scarcely half a century ago Indians were at warfare with the invading paleface there stretches out for miles a street system that will please the eye of the most fastidious engineer. From the dome of the Capitol Building in the heart of the city there is unrolled a scene which excites admiration from every spectator—a view of Denver, with its wild and rugged background of mountainous country looming up against the blue Colorado sky.

Denver has sprung up almost like a mushroom, but it is, nevertheless, solid and secure. Its streets are lined with substantial structures which testify to an enduring growth in the short period of time that spans the history of the city. And the piston of progress is kept well oiled. Capitalists have faith in the future of the place. They are investing their money in its real estate. On all sides one may observe pronounced building activity.

In 1859 Denver had only a few rough log cabins and not more than 100 pioneers, who had fearlessly crossed the plains in the face of the greatest dangers.

The city is now crowding the 200,000 mark. It is leaping to the front because it draws its wealth from a country whose hidden treasures and wonderful resources have hardly been tapped.

The man who comes to a new country is severely tested. He gets a school-

VIEW OF DENVER, LOOKING NORTHWEST FROM DOME OF CAPITOL, SHOWING ROCKY MOUNTAINS IN THE DISTANCE.

ing that a settled community cannot give him for obvious reasons. His hardships teach him to do a whole lot of thinking.

The substantial men of Denver are men who went west when the country was new. They had work before them that was nearly as arduous as the labors of the pilgrims who came over in the Mayflower. They had the pluck of the early Puritans, and that is why they won out.

Denver is built on a solid business foundation that these hardy men have made. There are no shifting sands, and that is why the future of Denver has so much promise.

The city has a good city government. It will be better. R. W. Speer, a practical business man, is the mayor. He is hard-headed, has a wide knowledge of the needs of an up-to-date municipality and has the nerve and courage to tackle a proposition of any kind that looks to the betterment of the city. When he completes his term of office three years from this time there will be even more reason to praise Denver as "the city beautiful."

### The "City of Millionaires."

After spending a few days in Denver the convention visitor will be placed on a special train bound for Colorado Springs. Two mammoth engines, constructed especially for the rough traffic in the mountains, will puff and drive with their combined energy in making the climb of a 2,000-foot grade to Palmer Lake, a distance of 50 miles, and then drop 1,000 feet to Colorado Springs.

Everyone likes this "City of Millionaires" that nestles at the foot of Pike's Peak. Its beauty is entrancing. As you wander about with rolling masses of mountain chains greeting the eye on all sides you will feel as if you had suddenly come into a region of enchantment; that nature was disposed to exercise all the magic of her witchcraft when she wrought the wonders created within these walls of mountains.

Lariat Curve Around Yankee Doodle Lake on Moffat Road. Georgetown Loop on Colorado and Southern.

Cog Railroad on Pike's Peak. The Royal Gorge on the Denver and Rio Grande, Showing Famous Hanging Bridge.

SOME MOUNTAIN SCENERY IN COLORADO.

### Colorado as an Electrical Field.

And then Colorado the great.

You will regret it if you do not see many of the Colorado towns—towns in the mountains that are reached by half a dozen railroads that are eloquent testimonials to the advanced development of railroad engineering.

Denver and Colorado Springs—all Colorado, in fact—have united to entertain and interest the members of the National Electric Light Association during the convention week and for as much more time as the individual members will spend in the state. A great deal of hard work has been done in arranging for the convention and the entertainment features directly connected with it. Work and time have been required to provide the interesting features—those that will interest electrical men—but this work has not been done for the purposes of the convention. It is the result of years of planning and careful toiling to build up great electrical systems—in many cases under difficulties not found in other section of the country. These are the interesting features—the plants and systems—to the man interested in electrical development.

What Colorado offers to those interested in the electrical field is illustrated by the progress that has been made. Denver and Colorado Springs do not offer the only examples. They are scattered over the entire state. Great central plants are in operation in many points. They furnish power for mines, mills, smelters and manufacturing concerns as well as railways of all kinds, from the tramway in the mine to the heavy suburban electric railway.

Yet there is room for more—room measured only by the broad expanse of the state, rich in mineral and agricultural resources, a green field for manufacturing enterprises. That is why Colorado interests. It is one of the younger states, primarily depending upon the hidden natural treasures for prosperity, progress and recognition, now offering to the world agricultural possibilities unexcelled and industrial opportunities gauged by the markets of a dozen neighborhood states, all looking to her as the keystone of the great Rocky Mountain region. So Colorado interests the capitalist, the electrical capitalist, and the engineer—for what offers better opportunities for electrical development than mines, mills and manufacturing enterprises.

Just a glance into the future—a glowing future. This means a look at the immediate possibilities in the way of electrical development in the state—what is promised, including much that is assured.

### Traction Systems.

To the public the most important of the developments of the immediate future is that of traction systems. Colorado bids fair to have scores of these. Already two companies have been organized and surveys made for systems intended to reach the exceedingly rich agricultural and stock districts of the northern portion of the state. These lines will connect dozens of small communities; they will bring to the ranchman's door the most modern means of transportation. They will enrich the country; then the country will enrich them.

Another phase of the transportation problem is that involved in projected suburban lines about Denver and Colorado Springs. The most important of these is the plan of the Colorado and Southern railroad, which has begun the work of rebuilding preliminary to the installation of electricity on lines to towns distant as far as 40 miles. Both Denver and Colorado Springs now have excellent suburban systems. With regard to this construction the conditions are peculiar, because the country offers countless obstacles in the way of the builders.

A prominent railroad official connected with a Colorado road said recently that the date was not far distant when all of the railroads would be using electric locomotives. This gentleman declared that the success of these powerful engines had been demonstrated by the New York Central, and that the immediate future would see them in service in the terminals in Colorado. That would be the first step, declared this railroad official, toward the general use of these locomotives on the railroads in the state.

Included in the traction question is that of transporting ores and supplies in and about mines—a big feature in Colorado. Scores of mines now use electricity exclusively. Scores of others, including the great coal mines of the Colorado Fuel and Iron Company, will be using this form of power in the near future. Mills and smelters use it in most instances. Along this line the influence of electricty has been great, and will be greater. Many mines so situated—piercing a bald cliff or at an altitude that precluded the possibility of supplying fuel—that they could not be operated with any power but electricity, sent to them through a slender copper strand, now turn out their streams of precious metals.

### Irrigation and Power Transmission.

But most important of all in the way of possibilities is the application of electricity to increase the agricultural wealth of the state, its productive capacity. This field has been only touched. It really has gone but little beyond the experimental stage; not because the experiments were not a success, but purely for lack of time. In this field the state finds limitless possibilities for production, and the capitalist and electrical engineer find a field that offers sure returns.

Irrigation is the vital question to agriculture in Colorado. Water must be had to raise crops, except in some sections. Natural sources have yielded abundant supplies through careful management and through the husbanding of the resources. This has been irrigation. Now, a step farther must be taken. The supply of water must be increased. Water must be obtained for districts that cannot get it from streams or even from reservoirs in the mountains. How? This has been the question. Again electricity comes forward, the central plant comes forward. Pump the water from the ground is the answer; pump it by electricity generated at a central plant and supplied to each individual landowner.

Applying electricity to each step in industrial development it is found to pump the water to raise the crops, do much of the mechanical work on the ranch, haul the products to market, and then supply the power to drive the machinery that converts the raw product into a manufactured article.

This brings the development to the question of manufacturing. Colorado has many factories of all kinds, but she needs more. Figures show that she buys back in manufactured form enormous quantities of the raw material she has produced. Here again electricity offers a solution of an unfavorable condition for Colorado that means an opportunity for the men interested—the electrical capitalists and experts. That the development of this feature will come and that electricity will play an important part in the progress all agree. Projects now under way insure an immediate start along this line—the business of operating central plants to supply power to many communities for all purposes.

In the past the most difficult problem has been the operation of high-tension lines through rugged mountain country, storm-swept during several months of the year and subject to the most adverse weather conditions. This has been complicated by the enormous expense. The problem has been solved; plants are in operation and many others are projected. One of the big plants in operation is that at Victor, which sends current at 40,000 volts through the mountains to Pueblo,

driving the street railway and supplying power for light. The Denver Gas and Electric Company transmits at 11,000 volts 18 miles to Golden, supplying the whole town and furnishing power en route.

The application of electricity to irrigation is a success now. It has been tried by the government and by individuals. This brings forth the possibility of utilizing the great quantities of underground water known to exist. It means a transformation of the entire irrigation system. The method is simply the pumping of water by electric power [illegible] of underground trolley and soon will have more.

In the [illegible] district soon will have a notable example of the central-station plant supplying power for a great many mines. The Animas Canal, Reservoir, Water Power and Investment Company is installing a plant that will make possible the operation of a great many properties now out of reach of the eager miner because of natural conditions. This

Denver's jump in electrical development is inter-

Sixteenth Street Northwest from Welton Street.

Seventeenth Street Northwest from Welton Street.

STREET SCENES IN DENVER.

It offers so many possibilities because the individual can have his own water supply and obtain it at a small expense. What this means is shown in the statement that water is more precious than gold in a great many sections of Colorado.

The question of water naturally brings to the fore the query of utilizing it for power purposes. This has been a serious problem to Colorado. It creates a peculiar condition. Whereas electricity means much to irrigation through the utilizing of the underground flow, the water question is a bar to electrical development as far as making the streams drive the electrical plants is concerned.

With enormous falls in her streams Colorado naturally would be considered admirably suited to waterpower development. This is not the case. There are several reasons. One of the most important is that few of the rivers and streams contain water throughout the year. Another reason is the demand for the water for irrigation. It is stored in enormous reservoirs for this purpose, but those owning the water guard it like a great treasure, and it cannot be obtained for driving machinery. The quantity required would be too great.

Engineers of the big companies in Denver and throughout the state have tramped the mountains over in search of waterpower. They have not found it available in the vicinity of Denver, although in other sections a number of these plants are projected.

Two of the largest of these projects are located on the Grand River near Glenwood Springs. Men connected with the companies planning these say that the work will begin soon. They assert that the problem of water supply has been solved and that the enterprises will be a success. The chief obstacle is climate. In the winter the mountain rivers freeze solid. By installing a stream plant to supplant the waterpower when the water is frozen this obstacle can be overcome.

A successful waterpower plant, and one that is exceedingly interesting, is that of the Pike's Peak Hydro-electric Company, near Manitou. This is operated with water having a fall of 2,300 feet and with a pressure of 1,100 pounds at the nozzle. It was one of the most costly enterpirses in the country.

### Electricity in Mining.

Electricity in mining has made enormous strides in the last few years. This has been its greatest field for development in Colorado, and the progress that has been made surpasses the growth in all other fields. The big mining companies have adopted electricity to such an extent that it can be said that all of the great operations in this line are dependent upon electrical power, both in the actual mining and the reduction work. Practically all of the mines in the Cripple Creek district, the greatest gold mining camp in the world, are operated by electricity. Leadville also uses electricity, and Telluride, Silverton and the Clear Creek district now have the power [illegible] Newhouse tunnel, at Cripple Creek, [illegible] of underground trolley and soon will have more.

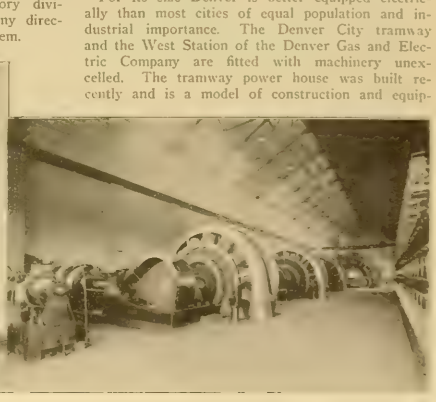
In the [illegible] district soon will have a notable example of the central-station plant supplying power for a great many mines. The Animas Canal, Reservoir, Water Power and Investment Company is installing a plant that will make possible the operation of a great many properties now out of reach of the eager miner because of natural conditions. This company will have 1,400 horsepower as a starter. It will transmit the current through mountainous districts at a pressure of 50,000 volts.

The mining industry in Colorado furnishes an unusual instance of the use of electricity. This consists in two giant dredges, working on Clear Creek, between Denver and Golden. These powerful machines require 600 horsepower each. They are supplied from the high-tension line of the Denver Gas and Electric Company. The machines are engaged in digging out the soil, carrying it to other machines on the boats, where it is washed for gold. This is placer mining by machinery exclusively. Each cubic yard yields only a little gold, but only two men are required to operate the dredges and the current is bought at such a figure that the operation pays satisfactory dividends. The dredges dig their way in any direction, the water following and floating them.

esting. When "Bill" Barker, who is now superintendent of electricity for the Denver Gas and Electric Company, landed in Denver 25 years ago, there was but one dynamo in the town. "Bill" was the pioneer electrical man, but for a time he could find little play for his wide knowledge of electricity outside of running the only dynamo in the town. But he harbored the "fires of young ambition," and he talked so much about the virtues of electricity that people began to listen to him. He was just as unrelenting in his convictions in those old days in Denver as he is today when he is at work closing up a contract, and much credit is due to this stalwart of the Denver Gas and Electric Company's forces for building the foundation of one of Denver's important industries.

For its size Denver is better equipped electrically than most cities of equal population and industrial importance. The Denver City tramway and the West Station of the Denver Gas and Electric Company are fitted with machinery unexcelled. The tramway power house was built recently and is a model of construction and equip-

The New Power House.



Engine-generator Units and Switchboard.

POWER PLANT OF DENVER CITY TRAMWAY COMPANY.

An advanced application of electricity to mining is that in the great coal mines at Leyden, near Denver. Machine coal cutters operated by electricity are being used. These consist in moving knives that have the effect of saws, cutting out great sections of coal, and doing the work of a great many men.

### Light and Power Plants in Denver

Denver and Colorado Springs, the cities in which the convention will be held, are electrically of importance. Each has several large generating stations, and both have made wonderful strides along the lines of electrical development in the last few years. They afford good illustrations of the hustle of the West in quickly grasping everything ment. The electric company's plants have been enlarged from time to time and contain machinery of the highest class.

The other two stations are the East Station of the Denver Gas and Electric Company and the plant of the Lacombe Electric Company, which supplies the street lighting. These plants are not as large as the two others, but are well equipped.

Ten thousand horsepower is the output of the plants of the Denver Gas and Electric Company, which supplies power for all purposes. This represents practically the entire commercial business of the city. The power is sent into the adjoining country and towns as far as 14 miles distant. In the business district the service is double or in duplicate—a condition made possible by the

two plants, and big consumers are assured power under any conceivable circumstances.

Following is a list of the generators of the Denver Gas and Electric Company:

Two 1,500-kilowatt, three-phase Bullock generators, direct connected to Filer-Stowell engines of 3,000 horsepower each.

Four 600-kilowatt Bullock alternating generators, belted.

One 250-kilowatt General Electric, belted.

Nine 100-light Brush arc machines, two connected to a De Laval steam turbine of 150 horsepower and 3,000 revolutions, the remainder belted.

One 60-light Brush arc machine, belted.

One 300-kilowatt Bullock, direct-connected.

One 400-kilowatt Bullock, direct-connected.

One 400-kilowatt General Electric, belted.

Two 100-kilowatt General Electric, belted.

One 500-kilowatt General Electric generator running as a three-phase synchronous motor connected to two 100-kilowatt direct-connected generators.

One 250-kilowatt Walker, direct connected.

The engines for belted machines are three Allis-Chalmers, 800 horsepower each. There are also—

Two Reynolds-Corliss, 700 horsepower each.

One Westinghouse, 500 horsepower.

One Hamilton-Corliss, 1,000 horsepower.

### Denver Tramway Power House.

The plant of the Denver Tramway Power Company, which furnishes the power for the Denver City Tramway Company, is situated at Fourteenth and Platte streets in the city of Denver, on a tract of land facing the tramway lines on Platte Street and extending to the Platte River, having a side-track connection with the Colorado and Southern railway. The building is of fireproof construction, 288 by 103 feet, having substantial concrete foundation, with brick walls, and steel concrete floor and roof.

INTERIOR OF WEST STATION OF DENVER GAS AND ELECTRIC COMPANY.

The coal is handled automatically by a conveyor manufactured by the John A. Mead Company of New York. It is automatically carried from the railroad track to the coal bins, situated over the boilers. The bins have a capacity of 1,100 tons of coal, and from the bins the coal is delivered to the automatic stokers. After passing through the stokers the ashes fall into the ash bins and are moved and delivered to the cars by means of the coal conveyor. The movement of coal and ashes is therefore automatic and accomplished by machinery entirely.

The boiler room is equipped with the Stirling boilers, capable of operating engines of 12,000 horsepower. These boilers are provided with the Stirling chain-grate stokers and with superheaters. The steam pressure carried is 175 pounds. The engines are situated within 15 feet of the boilers and connected with ample steam pipes. The engines are five in number. Three are each capable of delivering a maximum of 2,000 horsepower; two are each capable of delivering a maximum of 3,000 horsepower. They were manufactured by the International Power Company of Providence, R. I., and the Allis-Chalmers of Milwaukee, Wis. These engines are designed to be used with superheated steam and are of the cross-compound condensing type and guaranteed to deliver a horsepower-hour with a consumption not to exceed 12½ pounds of steam.

On the mainshaft of the engines are carried the generators, which are manufactured by the General Electric Company of Schenectady, N. Y. The generators are capable of delivering 8,250 kilowatts. The auxiliary apparatus in the station, such as other pumps and other machinery, is electrically driven by means of motors supplied with current from the main units. The station is equipped throughout with the most modern labor-saving devices. The main chimney rises 230 feet above the ground. Flue gases before passing to the chimney pass through a Green economizer, which is used to heat the feed water. The station, being placed on the Platte River, has an abundance of water supply, and being located on both the tracks of the Tramway company and the Colorado and Southern railroad the fuel facilities are abundant.

### Colorado Springs' Electrical Interests.

There are few cities in the country, big or little, that can boast of better electricity service than Colorado Springs. Every provision has been made to guard against the effects of accidents, and the public is well satisfied with the service.

Four institutions produce all the electricity for the city. They also supply Colorado City and Manitou, towns situated but a short distance from Colorado Springs. The Cripple Creek district, some 25 miles away in the mountains, is fed to some extent by Colorado Springs electric power.

One of the largest plants is operated by the Colorado Springs Electric Company. The plant is modern in every respect and distributes current for both power and lighting in Colorado Springs, Colorado City and Manitou.

The main generating station is located six miles northeast of Colorado Springs at a point called Austin Bluffs. The coal supply is secured at a mine about 1,500 feet from the station. The water supply is secured from a large pipe line that runs from a reservoir in the mountains to the north.

The three units are up-to-date and are capable of developing a total of nearly 5,000 horsepower. The engines are directly connected to alternating-current generators, each of which is capable of generating current for an equivalent of 18,000 incandescent lights. The current is generated at a voltage of 6,600 volts and is transmitted over the feeder lines to a sub-station, where it is reduced through transformers to 2,200 volts. The system of feeder lines employed is excellent and earns the unstinted admiration of all visiting electric-light and power experts.

The street-car system in Colorado Springs is really a creation of the late Winfield Stratton—a prospector who walked from Colorado Springs to Cripple Creek in the early '90's and dug a fortune of $25,000,000 out of the mountains. When Stratton determined to make his residence in Colorado Springs he decided to employ some of his money to give the city a good street-railway system. He acquired all the rights and franchises of the old companies operating all the lines in the city. The lines were rebuilt and relaid with 65-pound rails, and today the company is running its cars over 38 miles of track.

The entire equipment is the finest that could be purchased. The cars are provided with the most improved appliances. Every provision has been made to keep the rolling stock in prime condition by the maintenance of a system of shops fully equipped with electric machinery of modern type. These shops not only take care of all repair work on the cars but turn out new cars the equal of those manufactured anywhere in the country.

The sanitary condition of the cars is all that could be desired. They are "blown out" every night with air compressors and are given periodic scrubbings.

The lighting company at Manitou was organized about 15 years ago and until a few years ago maintained its own power station. It is now receiving its power from the Colorado Springs Electric Company.

The Pike's Peak Hydro-electric Company operates a generating station in Engleman's Canyon, near the Half-way House. Its machinery is operated by the Colorado Springs water system at a head of 2,300 feet. It is the only plant in the United States and Canada operated at this head. A 20-inch steel main is used to convey the water to the turbine. The station is provided with three 750-kilowatt generators. The company sells its electricity for lighting and power in Manitou.

## Lacombe Lighting Station in Denver.

The Lacombe arc-lighting station in Denver was put in operation on April 1, 1901. C. F. Lacombe was the chief promoter, and he, with a few other men, succeeded in obtaining a franchise from the city, which was followed up by a 10-year contract for street lighting at a price of $90 an arc per annum.

GENERAL IRVING HALE, PRESIDENT LACOMBE ELECTRIC COMPANY.

The station is located in West Denver, on the Platte River, where an abundance of condensing water and good track facilities are afforded. A small amount of commercial lighting is supplied, but by far the greater part of the plant is made up of the arc-light apparatus, a brief description of which follows.

In the plant there are installed five separate belt-driven units, consisting of five 250-horsepower heavy-duty tandem-compound engines, made by the Ball Engine Company, each driving two Western Electric arc dynamos, which provide energy for over 1,250 arcs. A Wheeler condenser is provided which is equipped with independent air and circulating pumps. The switchboards and gauge boards are of marble, and are a notable feature of the plant. The generator leads are enclosed in rubber hose and laid in conduits under the cement floor.

Steam is furnished by a battery of three Heine safety-tube boilers, each having a capacity of 375 horsepower. Water is taken from the Platte River through a perforated conduit laid in gravel, which discharages into a well 20 feet in diameter and eight feet below the bottom of the river. From the well the water is elevated to a 12,000-gallon tank, where it is allowed to settle before being pumped into the boilers.

A feature of interest in connection with the generator equipment is the use of compressed air to keep the machine free from dust. A five by five by six-inch steam-driven air pump forces the air into a three by six-foot receiver, from whence it is piped to all the generators, and successfully employed to blow the dust from the machines.

All high-pressure mains, both for steam and water, are extra heavy to stand a working-gauge pressure of 165 pounds. On each end of the steam main there is a T with a short length of pipe to form a pocket for condensation, which drains

into a separate tap, thence into the hot well. There are three exhaust mains, one leading from the main engines to the atmosphere, one from the main engines to the condenser, and one from the auxiliary engines and pumps to the heater, and thence to the atmosphere.

The pole line is constructed in a substantial manner, and some of the finest poles ever brought to Denver, it is said, were used in its construction, many of them being 80 feet long with 10-inch tops. In the downtown district the lamps are suspended by ornamental mast arms, and in the residence district by steel mast arms, bolted to the wooden poles.

The president of the company is General Irving Hale; the vice-president, James Williams, while the secretary, treasurer and manager is O. B. Kohl. The office is at 1532 Stout Street.

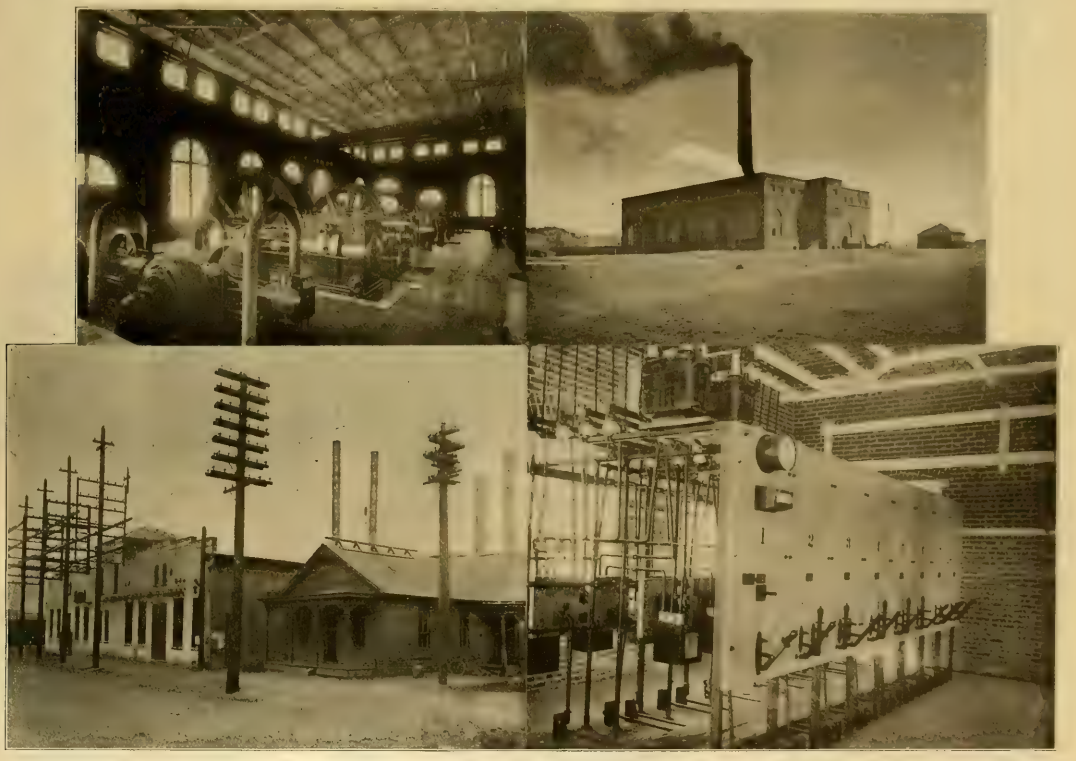
## Pueblo's Lighting and Street-railway Interests.

A visit to Pueblo, Colo., will prove of much interest to the electrical man. The Pueblo and Suburban Traction and Lighting Company owns the car tracks entering the building from the street. It has a storage capacity of 50 feet of double-truck car. The storage batteries building and pump house are adjoining the main power house.

The boiler room is 65 by 130 feet and is equipped with eight Cahall highpressure water-tube boilers of a rated capacity of 2,600 horsepower. The coal is unloaded from the cars in front of the boiler.

The engine room is 60 by 140 feet. The machinery consists of five engines, with a rated capacity of 2,700 horsepower. Three of these engines are tandem-compound, manufactured by McIntosh, Seymour & Co., Auburn, N. Y.; one is a tandem-compound manufactured by A. L. Ide & Son, Springfield, Ill., while one is a cross compound Rice & Sargent engine, manufactured by the Providence Engineering Works, Providence, R. I. They are all direct connected to General Electric railway and lighting machines, with a rated capacity of 1,700 kilowatts, with separate exciters. The entire engine room is covered by a 15-ton traveling crane.

The switchboard is built of polished slate for the railway and power circuits and blue Vermont marble for the lighting circuits. It is equipped with



Engine Room in Austin Bluffs Power House. Sub-station A and Heating Plant.

Main Power House at Austin Bluffs. Interior of Sub-station B.

POWER HOUSE AND SUB-STATIONS OF COLORADO SPRINGS ELECTRIC COMPANY.

electric-light, power and street-railway systems of the city. The greater portion of the property has been rebuilt within the last few years, and its physical condition will compare favorably with any similar property in the country. Considerable valuable property is owned by the company in the central portion of the city, and the power house, the car barns, the storage-battery building, machine shop, electric repair shop, storeroom and general offices are located at this point.

The power house is located within 200 feet of the Arkansas River, from which water is secured through a 16-inch pipe for condensing and other purposes. On account of the central location, power can be distributed in all directions from the power house with but a slight loss of energy. The main power-house building is 125 by 140 feet and is constructed of brick and stone, with structural steel and tile roof. The floors are cement. The building is fireproof.

The main car house, which is situated south of the power house, is 115 by 165 feet and has 10 modern instruments of the Weston and General Electric type.

The storage-battery room has storage accumulators for service of the railway and power circuits, consisting of 264 cells, with a capacity of 320 amperes, 550 volts on the hour rating. This battery is used to carry the peak of the railway load and to regulate the fluctuations of the railway and power lines. A booster is used in connection with the battery. The battery was furnished by the Electric Storage Battery Company of Philadelphia.

The street-railway system has 24 miles of trackage. About one-half of the track is laid with 35-pound and about one-half with 75-pound steel T rail. The small rail is replaced by the large pattern as fast as it wears out. The track is bonded with Brown-Edison amalgamated and wire bonds, all of which are put under the angle joints. Overhead railway trolley and feeder lines are used.

The car equipment is very complete. Besides a large number of single-truck, nine and 10-bench open cars, the company has 26 new double-truck

[illegal or illegible]

power stations when completed will furnish 10,300 horsepower. One of the stations furnishes current at the present time for power and light to mines, mills, trolley systems, etc., of the Cripple Creek district, as well as supplying the towns of Victor, Goldfield, Altman, Gillet, Anaconda, Cameron and Lawrence, where the company holds franchises.

The dam and [illegible] miles north of Station "A." This is said to be the largest steel-faced, granite, back-filled dam in existence, being 405 feet in length along the cap, 220 feet in length at the base, 148 feet in cross-section at base and 20 feet in cross-section at cap. The upper slope or steel face is 30 degrees from the vertical and the lower slope 50 degrees. The height of the dam from bedrock to spillway is 70 feet, with spillway 60 feet in width. The steel face is built of sheets measuring five by 15 feet, from one-half-inch at base to one-quarter inch in thickness at cap. The construction of the reservoir has taken over three years, during which time 52,000 yards of granite back-fill was required. It is proposed to add 18 feet to the present height of the dam, which, when completed, will give a reservoir with a surface area of 140 acres, containing 193,467,640 cubic feet of water. The reservoir system of the company is very picturesque, and will be well worth a visit from all the delegates to the electric-light convention.

The council of the town of Prairie Grove, Ark., has granted a franchise to C. L. Cummings & Son for putting in an electric-light plant.

## Arrangements for the Denver-Colorado Springs Electric Light Convention.

The twenty-eighth convention of the National Electric Light Association will be held in Denver and Colorado Springs on June 6th to 11th inclusive. It promises to be a noteworthy convention in every respect. Denver headquarters will be at the Brown Palace Hotel. The officers of the association, from President Davis down, have worked hard to make the gathering the success it promises to be. These officers are:

President, Ernest H. Davis, Williamsport, Pa.; first vice-president, William H. Blood, Jr., Seattle, Wash.; second vice-president, Arthur Williams, New York; secretary and treasurer, Dudley Farrand, Newark, N. J.; assistant secretary and treasurer, H. Billings, New York; master of transportation, George F. Porter, New York.

Executive committee—A. C. Dunham, Hartford, Conn.; P. G. Gossler, New York; H. T. Hartman, Philadelphia; Louis A. Ferguson, Chicago; Harry Bottomley, Fall River, Mass.; Alex Dow, Detroit; Samuel Scovil, Cleveland; A. J. De Camp, Philadelphia; W. F. White, St. Louis.

Wm. H. Blood, Jr., Seattle, Wash., First Vice-President.

Arthur Williams, New York, Second Vice-President.

Dudley Farrand, Newark, N. J., Secretary and Treasurer.

OFFICERS OF NATIONAL ELECTRIC LIGHT ASSOCIATION.

General Programme and Local Committees.

When it was decided that the convention would be held in Denver and Colorado Springs, Henry L. Doherty, president of the Denver Gas and Electric Company, was chosen by President Davis of the association to direct the important work which had been entrusted to the care of the local committees. He called a meeting of the central-station men of the state. "We must make this the greatest convention ever held in the history of the association," he told them. "We must make this trip of the delegates and their friends to Colorado memorable—something that they will always look back to with pleasurable recollections." The men he talked to are men who do things in Colorado. They went to work on the labors assigned them in the interests of the convention. They "enthused" the business men of Denver, who will extend a hospitality that will not soon be forgotten. The same may be said of Colorado Springs. In fact every city or town in Colorado where there are men interested in the work of the association has been affected by the preparations for the convention.

Following is the general programme:

Monday, June 5th.

Arrival of delegates—An informal reception, with music, will be held at the headquarters, the Brown Palace Hotel, on Monday evening.

Tuesday, June 6th.

Morning—Business session in ordinary of Brown Palace Hotel. Addresses of welcome by Governor McDonald of Colorado, Mayor Speer of Denver and Mayor Hall of Colorado Springs.

Afternoon—Business session.

Evening—Theater party for delegates and ladies at Elitch Gardens (a summer garden with a first-class stock company); the play for the evening to be announced later.

The entertainment for the ladies on Tuesday consists of a tally-ho ride to the new Country Club, where luncheon will be served, with a drive about the city afterward.

Wednesday, June 7th.

Morning—Business session.

Afternoon—"Broncho-busting" contest at Denver Athletic Park. This contest will be one of the events of the convention, being a typical western scene of cowboys and bronchos.

Evening—Business session until 10 p. m. At 10:30 p. m. "athletic smoker" at the Democratic Club or Coliseum Hall under the direction of Mr. Gallagher.

The entertainment for the ladies will include the "broncho-busting" contest in the afternoon. In the evening the ladies will be taken to the Orpheum Theater.

Thursday, June 8th.

Morning, afternoon and evening—Business sessions.

In the evening the George W. Cook Drum Corps will serenade the delegates. This is the celebrated drum corps that has traveled all over the United States in connection with the Grand Army. It is one of Denver's crack organizations.

The ladies will be taken for car rides on the afternoon of Thursday.

Friday, June 9th.

Morning—The entire party will be taken to Colorado Springs on special trains, arriving there before noon.

The afternoon will be devoted to drives to points of interest about Colorado Springs, the party being divided into four sections, one taking the trip to Glen Eyrie (General Palmer's beautiful estate), through the Garden of the Gods, returning via Colorado City and the reduction mills of the United States Reduction and Refining Company. Another party will be taken on a trip over the Bear Creek Canyon Road to Bruin's Inn, returning to Colorado Springs via North Cheyenne Canyon, Stratton's Park, Ivywild, etc. Another party will take a trip to the power plants of the Colorado Springs Interurban Railway Company and the Colorado Springs Electric Company at Austin Bluffs, including a visit to the Curtis Coal Company's lignite mines. The fourth party will take a trip to the Pike's Peak Hydro-electric Company's hydraulic plant, operating at a head of 2,200 feet, located at Manitou, and from this point the delegates may visit Pike's Peak over the "Cog Road."

In the evening the party will be taken to Broadmoor Casino to attend a concert and have a dancing party. Light refreshments will be served.

ERNEST H. DAVIS, WILLIAMSPORT, PA., PRESIDENT NATIONAL ELECTRIC LIGHT ASSOCIATION.

Wm. J. Barker, Denver Gas and Electric Company.

John A. Beeler, Denver Tramway Company.

John Brannan, Lacombe Electric Company, Denver.

C. Y. Breck, Telluride Electric Light and Power Company, Telluride, Colo.

S. W. Cantril, Denver Tramway Company.

Fred. P. Dewey, United Light and Power Company, Georgetown, Colo.

Henry L. Doherty, Denver Gas and Electric Company.

F. W. Frueauff, Denver Gas and Electric Company.

John Craig Hammond, Denver Gas and Electric Company.

E. S. Kassler, Montrose Electric Light Company. Montrose.

Wm. Mayher, Greeley Power and Light Company, Greeley, Colo.

SOME OF THE CENTRAL-STATION MEN OF DENVER AND NEAR-BY

SATURDAY, JUNE 10TH.

On Saturday the delegates and guests will be taken to Cripple Creek and return on special train which will leave about 10 a. m., returning about six p. m. of the same day. Lunch will be provided on the train.

SUNDAY, JUNE 11TH.

Sunday, June 11th, will be devoted to taking the trips mentioned for Friday afternoon, as it will be impossible for a delegate to take all of the trips in one day.

This will conclude the convention and entertainment proper, but the local committee has arranged with the Moffat and the Colorado and Southern roads for special excursions on Monday and Tuesday, and will arrange for escorts to take any of the party who may care to take these trips.

The general arrangement committee that planned this typically western entertainment is made up as follows:

Orson Adams, Grand Junction Electric and Gas Company ........ Grand Junction

[illegible]

John Martin, California Gas and Electric [illegible]

A. Pollok, San Francisco Gas and Electric [illegible]

F. E. Warren, Cheyenne Light and Power Company [illegible]

[illegible]

William T. Wallace, Colorado Electric Power Company [illegible]

Herman R. Webber, La Belle Electric [illegible]

C. H. Peters, Durango Light and Power Company [illegible]

George B. Tripp, Colorado Springs Electric [illegible]

Charles Neely, Fremont Electric Light Company [illegible]

[illegible]

Gen. Fred Walsen, P. O. Box [illegible]

H. R. Wray, Chamber of Commerce [illegible]

J. F. Vail, Electric Light Company [illegible]

E. J. Temple, Electric Light Company [illegible]

[illegible]

John Doss, Electric Light Company [illegible]

C. Y. Brock, Telluride Electric Light and Power Company ........ Telluride

Nelson Rhoades, Arapahoe Electric Light and Power Company ........ [illegible]

W. F. Jones, Gold Belt Consolidated Electric Company ........ Victor

J. B. Wiggenhorn, Florence and Cripple Creek Company ........ Cripple Creek

G. E. Sethman, Meeker Light, Heat and Power Company ........ Denver

C. W. Badgley, Crested Butte Light and Water Co. . Denver

Irving Hale, General Electric Company ........ Denver

O. B. Kohl, Lacombe Electric Company ........ Denver

John Brannan, Lacombe Electric Company ........ Denver

William B. Iliff, 221 Equitable Building ........ Denver

C. K. Durbin, 221 Equitable Building ........ Denver

J. H. Waters, Midland Terminal Railway Company ........ Cripple Creek

S. W. Cantril, Denver Tramway Company ........ Denver

George W. Cook, The Shirley ........ Denver

J. A. Beeler, Denver Tramway Company ........ Denver

J. J. Hernan, Hotel Men's Association ........ Denver

N. M. Tabor, Hotel Men's Association ........ Denver

Armour C. Anderson, Real Estate Exchange ........ Denver

John McNamara, Real Estate Exchange ........ Denver

J. S. Temple, Chamber of Commerce ........ Denver

Arthur Williams, Chamber of Commerce ........ Denver

T. B. Stearns, Stearns-Rogers Manufacturing Company ........ Denver

[illegible]

W. J. Barker, Denver Gas and Electric Company ..... Denver

[illegible]

J. Charles Andrews, Denver Gas and Electric Company ... [illegible]

[illegible]

J. F. Callbreath, Chamber of Commerce ........ Denver

A. R. Hall, Capital Electric Company ........ Denver

C. H. Speers, Colorado Midland Railway ........ Denver

H. L. Woolfenden, Gilbert Wilkes & Co. ........ Denver

L. M. Cargo, Westinghouse Electric and Manufacturing Company ........ Denver

J. J. Nunn ........ Provo, Utah

Executive Committee—Henry L. Doherty, chairman; F. W. Frueauff, vice-chairman; George B. [illegible]; H. R. W[illegible]; J. A. Beeler, T. B. Stearns, J. F. Callbreath, Armour C. Anderson, Gen. Fred Walsen; Frank C. [illegible].

Transportation Committee—George W. Cook, chairman; J. S. Temple, Major S. K. Hooper, J. F. Vallery, J. C. Ferguson, H. R. Wray, C. L. Wellington; George F. Porter, master of transportation; N. [illegible] secretary.

Finance Committee—R. B. Sullivan, chairman; George B. Tripp, vice-chairman; George W. Gano, Gen. Irving Hale, T. W. Stearns, C. K. Durbin, J. A. Beeler, J. J. Hernan, J. F. Callbreath, Gen. Fred Walsen, John Craig Hammond, L. M. Cargo, George W. Cook, J. H. Waters; Frank C. Farrar, secretary.

Entertainment Committee—Philip Cross, chairman; F. W. Frueauff, William E. Bridgeman, T. B. Stearns, George W. Vallery, George B. Tripp, H. R. Wray, R. W. Speer, Gen. Fred Walsen, C. W. Humphrey; Frank C. Farrar, secretary.

Advertising Committee—John Craig Hammond, chairman; John McNamara, T. E. Fisher, S. K. Hooper, J. F. Vallery, N. M. Tabor, David H. Hoops, J. I. Joslin, D. C. MacWatters, Charles B. Sloat; Frank C. Farrar, secretary.

Hotel Committee—W. J. Barker, chairman; J. J. Hernan, J. J. Cooper, J. F. Vail, S. W. Cantril, H. L. Woolfenden, Philip Cross; Frank C. Farrar, secretary.

Colorado Springs Local Committee—George B. Tripp and H. R. Wray.

BUSINESS PROGRAMME.

The programme of the business sessions of the Denver-Colorado Springs convention of the National Electric Light Association, which are to be held in the Brown Palace Hotel in Denver, is now completed and is as follows:

TUESDAY, JUNE 6TH.

Morning—Address of welcome, by the mayor of Denver; president's address, by Ernest H. Davis, Williamsport, Pa.; report of progress, by T. Commerford Martin, New York; "The Paramount Importance of Choosing Standard in Preference to Special Machinery," by David Hall, Cincinnati, Ohio; "Insulation Testing—Apparatus and Methods," by C. E. Skinner, Pittsburg, Pa.

Afternoon—"Automatic Synchronizing of Generators and Rotaries for Lighting and Power Systems," by Paul MacGahan, Pittsburg, Pa.; "Notes on Rotary Converters and Motor Generators for Lighting and Power Systems," by Louis E. Bogen, Cincinnati, Ohio; "The Organization of Working Forces in Large Power Houses," by W. P. Hancock, Boston, Mass.; report of committee on steam turbines, by W. C. L. Eglin (chairman), Philadelphia; "Operating Features of the Curtis Steam Turbine," A. H. Kruesi, Schenectady, N. Y.

WEDNESDAY, JUNE 7TH.

Morning—"Series Alternating-current Motors for Industrial Work," by Clarence Renshaw, Pittsburg, Pa.; "A New Type of Single-phase Motor for Elevator Work," by S. Percy Cole, St. Louis, Mo.; "Long-distance High-tension Transmission in California," by John A. Britton, San Francisco, Cal.; report on "Present Methods of Protection from Lightning and Other Static Disturbances," by Alex Dow, Detroit, Mich., and Robert S. Stewart; "The Nernst Lamp, Its Present Performance and Commercial Status," by E. R. Roberts, Pittsburg, Pa.; "The Choice of an Insulated Cable," by Wallace S. Clark, Schenectady, N. Y.; "The Tantalum Lamp," by Louis Bell, Boston.

Evening (8 p. m.)—"Some Investigations of Induction Losses," by E. P. Dillon, Colorado Springs, Colo.; "Mercury Arc Rectifiers," by P. D. Wagoner, Schenectady, N. Y.; report on "Advertising Methods," by Percy Ingalls, Newark, N. J.; report on "Sign and Decorative Lighting," by La Rue

Chas. Neely, Fremont Electric Light Company, Florence, Colo.

J. J. Nunn, Provo, Utah.

Chas. H. Peters, Durango Electric Light Company, Durango, Colo.

Allan Pollok, San Francisco Gas and Electric Company.

W. E. Renshaw, Seaton Mountain Light Company, Idaho Springs, Colo.

Eugene Y. Sayer, Denver Gas and Electric Company.

George B. Tripp, Colorado Springs Electric Company.

E. J. Temple, Boulder, Colo.

Wm. T. Wallace, Colorado Electric Power Company, Canon City.

F. E. Warren, Cheyenne Power Company, Cheyenne, Wyo.

F. C. Webber, Leadville Gas and Electric Company, Leadville, Colo.

Herman R. Weber, La Belle Mill, Water and Power Company, Goldfield, Colo.

Henry R. Wray, Colorado Springs, Colo.

STATES WHO ARE MEMBERS OF COMMITTEE OF ARRANGEMENTS.

Vredenburgh, Boston, Mass.; "Free Signs and Flat Rates," by C. W. Lee, Newark, N. J.

THURSDAY, JUNE 8TH.

Morning—Report on "Progress of Electric Heating," by James I. Ayer, Boston, Mass.; report on "Purchased Electric Power in Factories," by E. W. Lloyd, Chicago, Ill.; report of committee on district steam heating, by W. H. Blood, Jr. (chairman), Seattle, Wash.; "Wrinkles," by H. C. Abell (editor), New York city.

Afternoon—Report of committee on relations with kindred organizations, by James I. Ayer (chairman), Boston, Mass.; executive session; report of committee on rates and costs, by Charles L. Edgar (chairman), Boston, Mass.; report on "Municipal Ownership," by Arthur Williams, New York, N. Y.; "Question Box," by Homer E. Niesz (editor), Chicago, Ill.

Evening—Executive session; report of secretary and treasurer; report of executive committee; report of committee on relations between manufacturers and central-station companies, by Henry L. Doherty (chairman), Denver, Colo.; report of committee on standard rules for electrical construction and operation, by Charles L. Edgar (chairman); election of officers.

Morning sessions begin at 10 o'clock, afternoon sessions at two o'clock, and evening sessions at eight o'clock.

RAILROAD AND HOTEL ARRANGEMENTS.

Unusually low rates have been authorized by the railways to the Denver-Colorado Springs meeting. From all points in the Western Passenger Association territory a rate of one fare plus 50 cents for the round trip has been granted; this to apply only where one-way rate is $12 or more. The Transcontinental Passenger Association has authorized a rate from California to Denver and return of one fare. The New England Passenger Association and Trunk Line Association have authorized a rate of a fare and one-third from the respective points in their territory to Chicago and St. Louis plus the rates authorized in Western Passenger Association, namely, $30, Chicago to Denver and return.

A special train will be run from New York and Chicago to Denver over the Pennsylvania and Burlington routes. It will leave New York at 10:25 a. m., Eastern time, on Saturday, June 3d; Philadelphia, 12:40 p. m.; Pittsburg, 8:15 p. m., Central time, arriving at Chicago at 8:25 a. m., Sunday June 4th. At Chicago another section will be added, and the two will proceed west over the Burlington route, leaving the Union Station at 11:15 a. m. on Sunday. They will arrive in Denver at 2:30 p. m., Mountain time, on Monday, June 5th. The fare from New York to Denver and return, going by this train, will be $56.70; from Chicago, $30. Sleeping-car berths, one way, are $11 from New York to Denver and $6 from Chicago to Denver. A car will leave the Terminal Station at Boston at 7:45 p. m. on Friday, June 2d, to be attached at New York to the special convention train.

George F. Porter, 136 Liberty Street, New York, is master of transportation for the association; Frank L. Perry, 510 Marquette Building, Chicago, is assistant master of transportation, and C. H. Hodskinson of Boston is acting master of transportation for New England. In Chicago F. E. Bell, city passenger agent of the Burlington, 211 Clark Street, is in immediate charge of the arrangements for the special train.

Judging by the reservations, this train will carry 165 or more persons to the convention—90 from New York and contributing points and 75 from Chicago and contributing points. It will have two dining cars west of Chicago, and each baggage car will be accessible to passengers. The special train will be abandoned at Denver, so that travelers may return at their own convenience.

As already stated, the Brown Palace is the hotel quarters at Denver. But this hotel will not accommodate all delegates and visitors, many of whom will be housed elsewhere. But Denver has good hotel facilities, some of the other hotels being the Adams, Albany, Savoy, Metropole, Oxford, St. James and Shirley. In Colorado Springs the Antlers is the largest and perhaps the best-known hotel, but the Alamo, Plaza and other hotels are also good houses.

The local hotel committee in Denver, of which W. J. Barker is chairman and Frank C. Farrar of 405 Seventeenth Street is secretary, has worked hard to place every body satisfactorily and will continue to do so until the last delegate is located.

L. M. Cargo, Westinghouse Electric and Manufacturing Company, Denver.

John J. Cooper, Mountain Electric Company, Denver.

Alvin R. Hall, Capital Electric Company, Denver.

R. D. Marthens, Nernst Lamp Company, Denver.

Ralph E. Miller, Crocker-Wheeler Company, Denver.

E. R. Pool, American Steel and Wire Company, Denver.

Gen. Fred. Walsen, Denver

H. L. Woolfenden, Gilbert Wilkes & Co., Denver.

DENVER SUPPLY MEN AND OTHER MEMBERS OF ARRANGEMENT COMMITTEE.

## Points in Electric Library Lighting.

That the electric light is superior to all other means of illuminating libraries can be doubted by no one who takes the trouble to compare various installations in which the equipment has been laid out with skill. It is not too much to say that the use of gas is a serious mistake in any library where electricity is available, and that the relative prices of the two should have little weight in determining which illuminant to use.

Favorable conditions of atmosphere are a fundamental requisite where intense mental work is to be performed, and in no gas-lighted room can the purity of the air be compared with the atmosphere of an electrically illuminated chamber, with any possibility of better conditions in the former case, granted the same ventilation facilities in each. It is well known, also, that the depreciation of books and pamphlets is much greater in the vitiated air of a gas-lighted apartment than in the room lighted by electricity, so that in the long run it is poor economy to use gas, even if its price in some cases is considerably lower than the charges for current. This is because many of the acquisitions of a progressive library cannot be replaced when they become worn out, and every effort to prolong the useful life of a book is therefore to be commended.

Another feature of the greatest importance in library work is the maintenance of uniform illumination. There is no doubt that the brilliance of new Welsbach mantles is attractive in this respect, but the extremely rapid depreciation from which these mantles suffer should condemn their use in the exacting requirements of the library. It is only necessary to compare an incandescent and a gas installation after a few weeks of use to see where the superiority lies. The ghastly appearance of a depreciated mantle burner does not lend itself to effective illumination, or permit the satisfactory examination of fine print and delicately executed plates and engravings.

Two kinds of illumination are ordinarily required in libraries—general and special. The former provides for the convenient movement of persons and books from place to place and the easy consultation of volumes upon shelves, determination of titles, numbers, etc. The latter is of a concentrated nature, enabling exacting eyework to be done in certain specific places, such as reading and study tables. For all library work it is probable that the incandescent lamp will in time be recognized as capable of being best fitted to meet the most varied conditions. In large public libraries the use of magnificent marble decorations constitutes a common feature of the architecture, and the requisite designs of ornamental electric lamps now available for such work far surpass in beauty anything that gas illumination has to offer. In fact, the equipment of such a building as the Congressional Library at Washington or the Public Library in Boston with gas lamps is practically inconceivable. Even the stacks demand the clean and flexible electric bulb, due care being taken to provide swinging lamps with guards as a prevention against fire.

It would be difficult to name an installation where the application of electric lighting to library work equals that of the Congressional Library. In decorative effects and brilliance of illumination the layout deserves the admiration of every electrical engineer and central-station man who visits Washington. One of the most interesting features is the method of lighting the periodical reading room. This room is rectangular in shape, with brown-tinted walls, white window casings and no obstructions whatever between the ceiling and reading tables. A rough estimate of its dimensions is: Length, 240 feet; width, 40 feet; height, 20 feet. It is lighted entirely from the ceiling by 14 parallel rows of lamps, each row containing 17 16-candlepower incandescents. The illumination is apparently faultless, it being easy to read the finest newspaper print at the tables. Here both general and special illumination are combined.

In Bates Hall at the Boston Public Library separate 16-candlepower lamps with green shades are mounted upon the reading tables adjoining each position, and the result is eminently satisfactory.

In all cases of library lighting there must be some protection of the eyes against the direct rays, and it must never be forgotten that illumination, particularly in reading rooms, is but a means to an end. Wherever a gas-lighted library exists in the same town with a central station, it should be the constant effort of the manager to add the library lighting to his load.

## Southwestern Electrical and Gas Association.

The annual convention of the Southwestern Electrical and Gas Association was held at Woodlake, a pleasure resort near Denison, Texas, on May 18th, 19th and 20th. The convention was called to order by President J. F. Strickland of Dallas. An address of welcome to the visitors was made by Judge W. M. Peck of Denison. The response was delivered by President Strickland, who reviewed the history of the organization in an interesting manner. At the conclusion of this address the convention held a business session, which was edified by an address by George H. Cushman of San Antonio on the subject of "The Ratio of Value of Coal and Oil as Fuel." There were other addresses and papers delivered, read and discussed at the afternoon session. At night the visitors were tendered a reception at the Elks' Club.

At the opening of the second day's session of the convention President Strickland appointed the following committee on membership: Messrs. Leggett of Beaumont, Kelly of Hillsboro, Brooks of Dallas and McLendon of Fayetteville, Ark. R. B. Stichter of Sherman then read a paper on the subject of "The Relation of Gas to the Servant-girl Question," which was prepared by W. S. Rathel, superintendent of the Waco Gas Company. The paper dealt with the question in two ways—first, the comfort of the wife when it was necessary for her to go into the kitchen, and second, the necessity of educating the servant girls to the use of gas.

W. J. McCorkindale of the Sherman Gas, Light and Fuel Company had prepared a paper on "The Relation of the Gas Man to the Gas Consumer," which was read. It dealt with the troubles of the gas man and asserted that meter troubles were the cause of all friction between the gas man and consumers.

At the forenoon session of the third day of

the convention the following officers were elected for the ensuing year: President, M. M. Phinney of Dallas; first vice-president, J. W. McLendon of Fayetteville, Ark.; second vice-president, E. W. Dunaway of Paris; third vice-president, J. P. Crerar of Fort Worth; secretary, J. P. Duffy of Beaumont; treasurer, A. E. Judge of Tyler. Executive committee: J. F. Strickland of Dallas, F. N. Drane of Corsicana, W. S. Rathel of Waco; R. B. Stichter of Sherman, Wilbur H. Young of Austin, Frank P. Duffy of Beaumont, A. E. Judge of Tyler. Finance committee: George H. Cushman of San Antonio, C. A. Shock of Sherman, F. M. Lege of Beaumont. Advisory committee: J. E. Farnsworth of Dallas, H. M. Littell of San Antonio, J. W. Shartell of Oklahoma City, F. L. Wells, Jr., of Marshall, J. K. Jackson of Oklahoma City, H. S. Cooper of Galveston, F. M. Haines of Fort Worth, T. H. Edgar of El Paso, J. D. Oliger of Cleburne, W. H. Chapman of Houston, F. W. Gilman of Norman, Okla., C. W. Ford of Oklahoma City, J. B. Earle of Waco, C. W. Roberts of Abilene, H. H. White of Muskogee, I. T., Arthur Chase of Amarillo, E. D. Kelly of Hillsboro, E. M. Cooper of Wilburton, I. T., W. J. McCorkindale of Sherman, F. E. Seville of Laredo, Texas.

A number of interesting papers were read at the forenoon and afternoon sessions. These papers were generally discussed.

The reports of the secretary and treasurer and the finance committee were read and approved.

Acting upon the recommendation of the president a committee on relations was appointed consisting of H. F. McGregor of Houston, W. S. Rathel of Waco, E. W. Dunaway of Paris, and T. H. Edgar of El Paso. This committee suggested that Dallas be made the permanent headquarters of the association. The suggestion was adopted. Invitations were received to hold the next annual convention in Galveston, Oklahoma City and San Antonio. These invitations were read and referred to a committee which will decide upon the place for holding the convention later.

## A Small Alternating-current Plant in Colorado.

By W. H. Banes.

On November 3, 1902, the small but very complete electric-light and power plant in Eastern Colorado, described herewith, was put into operation. The plant is located at Las Animas in the southeastern part of the state, in the heart of the cantaloupe district, on the main line of the Santa Fe railway and six miles west of old Fort Lyon, which saw so many Indian fights and buffalo hunts in the early '60's and '70's.

The building is constructed entirely of native stone (which was quarried about 12 miles south of Las Animas) and in size is 50 by 56 feet, with a front 23 feet high and a fire wall separating the engine and boiler rooms, which are on the same floor level. The advantage of an engine and boiler room on the same floor level is quite apparent to one who has had experience in operating a small plant single handed. A four by eight-foot opening, closed by a sliding door, connects the engine and boiler rooms, which are 27 by 47 and 24 by 47 feet in floor dimensions, respectively. The stack is built on a six by six-foot stone foundation at the rear of the building and is built "upside down." By this is meant that the sections are fitted together with the bottom of one section sliding into the top of the section below it. It is guyed by three sets of four guys in each set. The value of this method of guying was shown in August, 1903, when nearly every other stack in the city went to the ground during a heavy wind, hail and rain storm. The stack is 83 feet high and three feet in diameter and is made of steel.

W. H. BANES.

The building cost over $4,000 and contains 112 cords of stone. The Geary water-tube boiler is rated at 150 horsepower. A Marsh deep-well engine draws water from an 8¼-inch well 153 feet deep, delivering it to a 100-barrel galvanized-iron tank located over the 50-ton coal bin in front of the boiler. A Deane simplex boiler-feed pump draws water from a 150-horsepower Cochrane open feed-water heater and purifier at a temperature of 205 degrees (Las Animas has an altitude of 4,000 feet), indicating quite high efficiency in the heater. The boiler is also equipped with a hand-cock inspirator for emergency. There is a fire hose in direct connection with the boiler-feed pump, which has a cold-water connection for use in emergency. Refuse oil drains and boiler blow-off pipes are connected to a sump in the rear of the building.

Surface water is very hard in the Arkansas Valley, and it was necessary to go quite deep in order to obtain an ample supply of good soft water. This water is highly charged with soda but very soft, the surface water having been cased out by an 8¼-inch steel casing driven to bed rock.

The boiler supplies, through an eight-inch asbestos-covered steam main, a Vilter tandem compound 10 by 15 by 30-inch non-condensing Corliss engine

FLOOR PLAN OF LAS ANIMAS POWER HOUSE.

with a 10-foot flywheel, which drives by means of a belt a 75-kilowatt Warren alternator. The engine is regulated by a Rites inertia governor and equipped with an automatic stop. The engine weighs about 21 tons and rests on a rock foundation 27 feet long, nine feet wide and seven feet deep, weighing 62 tons. The speed of the engine is 90 revolutions per minute and is regulated to within 1½ per cent. above or below normal-load speed. The steam pressure used is 110 pounds. The switchboard is made of blue Vermont marble and supports volt and ammeters, switches, ground detectors, fuses and choke coils. There are three station and 13 Garton line-lightning arresters, which have been very effective in protecting the apparatus from injury by heavy static discharges which sometimes occur in this part of the country. Quite heavy discharges have been noted by the writer, with not a cloud in sight, and telephone service has been materially affected at these times.

POWER HOUSE AT LAS ANIMAS, COLO.

The primary current is 2,300 volts, 60-cycle, the secondary being 110 volts. The 10 street lights are the late-type Adams-Bagnall enclosed arc lamps, and are supplied by separate transformers. One transformers supplies four lamps, another two, while the remainder are supplied by single transformers. The lamps are supported by Cutter's devices from a half-inch cable suspended between two 35-foot poles at the street corners, and each lamp rope is locked to its respective pole. The lamps are operated on the [illegible] schedule.

There are 25 Maloney [illegible] laminated core transformers of [illegible] kilowatt capacity connected to the [illegible] method of operating the street lights is novel from the fact that instead of running a separate circuit for their current supply there was simply a "switch wire" run back to the station, and [illegible] all the transformers feeding the lamps [illegible] on this switch wire, making a saving of about [illegible] miles of wire. There are on the lines about 15 miles of copper wire, ranging in size from No. 2 to No. 10, and about 300 poles, all of Idaho cedar, 30 and 35 feet, straight as an arrow, and with seven and eight-inch tops. Standard three and five-foot cross-arms are used, bored for two and four 1½-inch oak pins. The arms are lagged and braced to the poles and the pins support extra heavy deep-groove double-petticoat glass-teat insulators.

The five-foot cross-arms carry two primary wires on the outside and two secondary wires on the inside pins, while the street-light switch wire is carried on a bracket in line with the roof of the pole.

POLE CONSTRUCTION AT LAS ANIMAS.

The line is remarkably free from trees, being located almost entirely in alleys, service from pole to customer being made much shorter and without the use of unsightly wires in front of the buildings.

In digging the pole holes five and 5½ feet deep, water was found in nearly every hole, so close is the water to the surface of the ground. There are over 1,500 P. & S. porcelain, key, keyless and keywall sockets in use in this installation, and not a single instance has ever occurred to regret the adoption of the porcelain socket, which is easy to wire, safe to handle and easily kept clean.

There are over 75 Thomson recording and inductive wattmeters in use, and a meter deposit of $15 is required, which is returnable upon return of the meter to the station. The meters are tested once a year. The rate is 16 cents per kilowatt-hour, with a minimum of $1. The flat rate is $1 a month for 16-candlepower incandescent lamps and $12.50 a month for arcs.

There are in operation about 25 enclosed arc lamps and 1,200 16-candlepower incandescent lamps. A very complete system of bookkeeping and records is kept by the company, which deals with every point in the operation of the plant from the cost of fuel, labor, etc., down to the maintenance of the entire plant.

The designing of the plant and supervision of construction were placed in the hands of the writer (who came to Las Animas in June, 1902, from Villisca, Iowa, where he had been associated with the Villisca Electric Company as manager) by Mr. Tom J. Gardner, who was the originator of the idea of an up-to-date light plant for Las Animas. Mr. Gardner has a large lumber yard and extensive holdings in Las Animas and has been the foremost man in all large business and public enterprises in that city. The Las Animas Electric Company was incorporated on October 25, 1902, and the following-named officers chosen: President and treasurer, Tom J. Gardner; vice-president, Harry L. Lubers; secretary and manager, W. H. Banes. The board of directors consists of Tom J. Gardner, H. L. Lubers, James M. Parker, P. G. Scott and R. C. Thayer.

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The governments of Switzerland and the grand duchy of Baden have agreed to grant a concession to the cable works of Velten and Guillaume, Mühlheim, near Cologne, and to the Swiss Electrical Company of Berne to erect works at Laufenburg to utilize the falls of the Rhine for producing electric energy. The works are to be built on a large scale and are intended to furnish 50,000 horsepower.

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## DATES AHEAD.

National Electric Light Association (annual convention), Brown Palace Hotel, Denver, June 6th, 7th and 8th, and Colorado Springs, June 9th, 10th and 11th.

American Institute of Electrical Engineers (annual convention), Battery Park Hotel, Asheville, N. C., June 19th to 23d.

National-Interstate Telephone Association (first convention of consolidated telephone associations), Auditorium Hotel, Chicago, June 20th and 21st.

Canadian Electrical Association (annual convention), Montreal, June 21st, 22d and 23d.

National Electrical Contractors' Association (fifth annual convention) and Electrical Exhibition, Mechanics' Hall, Boston, Mass., July 15th to 22d.

Ohio Electric Light Association (annual convention), Hotel Victory, Put-in-Bay, August 16th to 18th.

International Association of Municipal Electricians (annual convention), Erie, Pa., August 29th, 30th and 31st.

Old Time Telegraphers' and Historical Association (annual meeting), New York city, August 29th to September 1st.

American Electrotherapeutic Association (annual meeting), Academy of Medicine, New York city, September 19th, 20th and 21st.

American Street Railway Association (annual convention), Bellevue-Stratford Hotel, Philadelphia, September 25th to 29th.

IN VIM, vigor and enthusiasm, Colorado does not take a back seat for any state in the union. The electrical men of that community share with their fellow citizens the disposition to do things in a free-handed, enterprising and energetic way, and the fact is shown by the preparations for the Denver-Colorado Springs electric-light convention, set forth in this issue. The convention itself, with its elaborate and instructive business programme and the hospitality and scenic attractions of Colorado to enhance its drawing power, promises to be a very successful one. The Western Electrician devotes considerable space in this number to the electrical plants and other features of the Centennial State; and these articles, we believe, will be of general interest to all readers as well as of particular value to those who attend the convention.

SUBMARINE torpedo boats possibly had something to do with the crushing defeat to the Russian fleet under Admiral Rojestvensky administered by the forces under Admiral Togo's command. The Japanese appear, from the meager details at hand, to have made very effective use of their swarm of torpedo boats, and although the conditions were apparently unfavorable for their employment, it is not impossible that attempts were made to use submarine vessels in this form of attack. There is not, we believe, an authenticated instance where submarine boats have been employed in actual warfare; but it may be that the tremendous battle in the Corean Straits has furnished the first instance. The Japanese are very secretive in military affairs, and no doubt rightly so from a strategical point of view; but it is hoped that, in due course of time, it will be made to appear what part, if any, was played by the submarines in this great naval fight. Electrical men know that the storage battery and motor can be relied upon in the underwater runs; but the objections hitherto urged to this modern development in naval design are quite apart from the method of propulsion used when the boats are submerged.

MAGNETIC ore separation has been in use for several years, but a process has been invented recently in which static electricity is used in a novel and interesting manner. The ore, suitably crushed, is run over a charged roller, where the particles receive charge according to their electrostatic capacities; the different attractions between the roller and the various particles results in giving different paths of motion to the high-capacity and the low-capacity particles. This gives a preliminary separation, and by passing the tailings through a second and a third similar process a satisfactory separation is obtained. The concentrators which have been built are about 12 by 12 by seven feet in size and weigh about 5,000 pounds each. Mica-plate electrostatic generators are used for supplying the charging potential. No great difficulty has been found in running these generators continuously in 24-hour service in concentrating mills. It is pointed out, however, that many difficulties arise in the application of the process, such as leakage of charge, mutual repulsion of the ore particles, the mechanical handling and feeding of highly charged particles, etc., which do not appear, so far, to have been completely overcome. Static electricity is, in fact, but little used in the arts. We remember an ingenious bottle-labeling machine, in which each successive label in a pile was to be attracted by an electrostatic charge, but the practical difficulties in the way of the actual operation of the machine appear to have precluded its employment on an extended commercial scale.

MR. DALRYMPLE of Glasgow, now in Chicago on the invitation of Mayor Dunne to give the benefit of his advice in the matter of municipal operation of street railways has become, perhaps to his own surprise, something of a celebrity, thanks to the lion-hunting proclivities of the American daily newspapers. From all accounts he appears to be a modest and worthy gentleman, disposed to learn as well as to impart the results of his own experience. In extending a cordial welcome the mayor will be joined by all citizens of Chicago, including the faithful minority who on principle oppose the municipal operation of industrial enterprises. For one thing, we notice with pleasure that Mr. Dalrymple is reported as agreeing with us, and that early in his stay in Chicago, that double-deck cars are not suited to the conditions of street-railway traffic in American cities. He notes the climate and the speed at which the cars here are operated as objections, but there are also others which he might have named, such as the difficulties in collecting fares on crowded cars, in loading and unloading quickly, in making stops at every street intersection if demanded, and in clearing the elevated railways, which are important. We also think that the zone system of fares is not well adapted to American conditions, although theoretically it is the most equitable method of charging for street-railway transportation. But the flat fivecent rate encourages the long haul, and the long haul of the modern electric street railway has done much for American workingmen in enabling them to live in the fresh air and improved surroundings of suburban districts. In matters other than rolling stock and fares, the Glasgow tramways do not differ much, in design and main features of operation, from those of most American cities.

IT IS a continued satisfaction to observe that the electrical exports of the United States still exhibit a steady growth and a general condition of health and strength. The most recent figures available are these: For the 10 months ended with April, 1905, the value of electrical exports from the United States, including electrical machinery and electrical appliances (the two classifications of the government), was $9,915,100; for the corresponding 10 months ended April, 1904, similar exports were $8,722,957. At this rate the value of the electrical exports of the United States for the fiscal year ending June 30, 1905, should be about $12,000,000, and be the largest in the history of the country. For the calendar year 1904 the figure was $11,039,758, which was the largest up to that time. In April, 1905, the value of American electrical exports was $1,008,361, compared with $841,716 for the corresponding month of last year.

Considering the 10-month periods, the increase of that ended with April, 1905, over that ended April, 1904, is due to the swelling of the exports of electrical machinery by over $1,300,000. On the other hand, the exports of electrical appliances (which include telegraph and telephone instruments) decreased slightly. The exact figures are given:

| | Ten Months Ended April 30, 1904. | Ten Months Ended April 30, 1905. |
|---|---|---|
| Electrical machinery | $4,520,307 | $5,884,974 |
| Electrical appliances | 4,193,650 | 4,060,126 |
| Total | $8,722,957 | $9,915,100 |

But comparing merely the months of April of this year and of last year, increases are shown in both classes of electrical exports, that in electrical appliances being the larger. Here the statistics show: April, 1904—Electrical machinery, $530,276; electrical appliances, $311,440; total, $841,716. April, 1905—Electrical machinery, $564,883; electrical appliances, $443,478; total, $1,008,361.

Japan continues to be a leading customer, and in April last took more of our electrical machinery than any other nation. However, in the 10 months ended with April, 1905, it was exceeded by British North America. In this period Japan was second, the United Kingdom third and Mexico fourth.

## Some Attempts to Utilize Atmospheric Electricity for Industrial Purposes.

By C. Domar

In a paper read before the Agricultural Society of the Agronomical Institute of Novo-Alexandria in Poland and published in the Russian paper Electritchestvo, Mr. Michkin gives an account of his experiments aiming at the utilization of atmospheric electricity.

The considerable development of industry in the present century must inevitably lead to the exhaustion of fuel, such as wood and coal; our attention must therefore be directed toward other sources of energy.

Everyone knows the numerous advantages realized from the waterfalls, which are insufficient in number as well as in output to supply the tremendous amount of energy required daily by the necessities of modern industry. Some eager investigators, after the example of Prometheus of the olden times, looked up to the sky, and as a consequence, not long ago, news was scattered all through the world, announcing that Mr. Figueros, in Las Palmas, had succeeded in capturing from the clouds a quantity of electricity which enabled him to operate a power plant containing a motor of 200 horsepower, besides lighting a house.

Without being skeptical as to that result, we will follow here the new experiments of Mr. Michkin.

Everyone knows, says the author, that during a storm, clouds are carrying a considerable quantity of electricity, which, under ordinary conditions, is scattered through the whole atmosphere. Some vague idea of that state of the atmosphere is given to us by electric discharges in thunderbolts and lightning, which often manifest themselves by heat effects.

While discharging a battery of condensers by a properly adapted wire we can not only make the wire glow, but even bring it to a melting point, and numerous cases are known of the volatilization of a considerable length of a telegraph wire.

In 1887, near Lüttich, in Austria, lightning brought complete destruction to a bronze conductor 1.4 millimeters in diameter and 800 meters long. In April, 1902, there occurred a case of melting by lightning of a steel wire eight millimeters in diameter and 3,500 meters long, at the meteorological laboratory of Pavlovsk, in Russia during the ascension of kites for experiments, which were undertaken by an international meteorological commission.

At the time the accident took place there was only a slight tendency toward stormy weather in the atmosphere. Kohlrausch has also shown that copper wire five millimeters in diameter can easily be melted by lightning, and he calculated that, to produce such an effect, a current of 52,000 amperes must flow through the wire for 0.001 of a second, or else a current of 9,200 amperes during 0.03 of a second. According to this, he admitted that the quantity of electricity accumulated in the cloud, at the moment preceding the discharge, could be represented by a number comprising between 52 and 270 coulombs, while the intensity of current which passes through a conductor connecting the lightning arrester to the ground may reach 10,000 amperes. These results were also confirmed by numerous experiments carried out by Pokkels. A fragment of the basaltic rock, being placed in the neighborhood of the passage of an electric current, gives evidence of the intensity of the current, by particular magnetic properties which it acquires. Thus, examining the basaltic rock, with trees growing upon it, which were struck by lightning, Pokkels found that the intensity of the current in one case was of 6,450 amperes, while in another it amounted to 10,800 amperes. During a series of researches undertaken by Kohlrausch in Austria and in Italy, fragments of basaltic rock were placed near the conductor of a lightning arrester, in a position shown by the scientist, and in three cases of atmospheric discharges the current intensity was shown to be, respectively, 5,600, 8,600 and 11,000 amperes.

In assuming our average value between 52 and 270 coulombs for such a discharge, Michkin proceeds to calculate the quantity of electricity contained in a cloud under ordinary atmospheric conditions. Let us suppose then an average charge of 100 coulombs and the size of the cloud to be such that in the space between the cloud and the earth there be a potential difference of 1,500 volts on every square meter, the distance from the earth's surface to the cloud being 300 meters. Cases could be shown in which at a much higher distance the potential difference [illegible] on every meter.

According to this, the [illegible] energy accumulated in a [illegible] which is equivalent to [illegible] gram-meter. If the [illegible] could utilize the amount of energy [illegible] power equal to 2,293,000 [illegible] hour.

Pallatz has also shown that the amount of energy comprised in a cubic kilometer [illegible] at the moment which precedes the discharge, is equal to 40.18[illegible] kilogram-meter.

These data show how many thousands of [illegible] could be available, if practical means could be found to utilize for industrial purposes the amount of energy stored in clouds, and which otherwise is wasted during atmospheric discharges.

The author thinks there is enough evidence to show the great interest of researches in that realm, and he is confident of a good result in the near future.

A charge of 52 to 270 coulombs can set up in a conductor a current of several thousands of amperes for a very short time. If the discharge be slow there would practically be no current, and the question therefore turns upon the fact of finding a motor which could be set to work with a very small expense of current.

While experimenting to determine the influence due to hysteresis of the electric field upon a dielectric, Professor Arno succeeded in constructing a motor revolving in an electrostatic field and designed on a principle, which, previously to that, was utilized by Professor Ferraris in the construction of his induction motor.

Unfortunately, the motor of Professor Arno, due to its low efficiency, is of interest only from a theoretical standpoint.

The motor invented by Mr. Michkin is based on a different principle, and it differs also in details from that of Professor Arno. That principle is the rotation of a dielectric in a field of electrified sharp points. The design of the motor is very simple. A series of ebonite disks is placed, one beside the other, on a metallic axis, and can freely rotate in front of two combs which have their teeth perpendicular to the diameter of the disk. The motor is set in motion by charging one of the combs, either with positive or with negative electricity, the other being connected with the ground. The following table furnishes some data. In the table, Type I. corresponds to a motor weighing 69 grammes; Type II. to another type of 667 grammes. The values of V are given in hundreds of volts. N is the number of discharges of the condenser a minute and W the number of revolutions a minute of the axis.

| Type. | Comb Charged (+). | | | Comb Charged (−). | | | One of the Combs Charged +, the Other [illegible]. | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | +V. | N. | W. | −V. | −N. | W. | +V. | +N. | V. | −N. | W. |
| I. | 152 | 46 | 1880 | 158 | 43 | 2050 | 68 | 46 | [illegible] | 43 | 2260 |
| I. | 174 | 80 | 2600 | 176 | 83 | 2750 | 83 | 80 | [illegible] | 32 | 2900 |
| I. | 180 | 141 | 3500 | 184 | 132 | 3680 | 93 | 141 | 76 | 132 | 3950 |
| I. | 182 | 189 | 3900 | 189 | 155 | 4200 | 98 | 189 | 78 | 155 | 4750 |
| II. | 176 | 50 | 770 | 179 | 46 | 850 | 106 | 50 | 89 | 46 | 1060 |
| II. | 180 | 141 | 1000 | 184 | [illegible] | 1280 | 131 | 141 | 108 | [illegible] | 1870 |

This table shows that maximum velocity takes place where the combs are charged with electricity of different signs; it becomes less when one of the combs only is charged, while the other is grounded. If one of the combs be charged negatively while the other is grounded, the speed increases. This, however, seems to depend on the surface of the teeth.

The quantity of electricity between two consecutive discharges of the condenser was $243.10^{-8}$ coulombs; the current intensity was only several millionths of an ampere, while the tension reached 20,000 volts.

The efficiency of the motor, as measured by the Prony brake, gave the following results:

| | | |
|---|---|---|
| Revolutions a minute | [illegible] | |
| Length of the arm | 6.5 | Cm. |
| Pressure on the arm | 0.57 | Grammes. |
| Potential difference between the two combs | $232.10^2$ | Volts. |
| Current intensity | [illegible] | Amp. |
| Outside temperature | [illegible] | C. |
| Hydrometric coefficient | 48 | Per Cent. |

It can be seen from the above figures that the motor could supply work to the amount of 0.038 kilogram-meters a second, with an expenditure of energy equal to 0.076 kilogram-meter, which is equivalent to an efficiency of 50 per cent.

The motor can be set to work only with continuous current, the alternating current showing on it no effect whatever; one can, however, by means of Crookes tubes, transform the alternating current, and the motor could then be started by an induction coil, the negative terminal of which [illegible] electrode. In the [illegible] a static machine.

[illegible] with.

The author feels that the motor he invented is of great help to the solution of the problem. The atmospheric electricity can set to work the motor, which [illegible] tension current, easy to be utilized.

The first part of the problem can be considered as being already solved; according to the author, there remain some improvements as to details. In 1899 the author presented a paper on that subject to the Society of Natural History in Russia and he has also published several volumes, but could not succeed in finding the necessary money, and the experiments were carried out at the author's own expense. The first part of these experiments were started in 1902 at the Agronomical Institute of Novo-Alexandria, and they were continued at the fortress of Ivangrod, in Russian Poland, where the author was allowed to use captive balloons. Special collectors were then sent into the air, with the steering rope attached to one of the combs of the motor. The rope was soon replaced by an insulated wire, which could then be used as a conductor. The collectors were of two kinds. Some of them were composed of circular tin sheets, provided with a number of sharp, steel points, while others were cylinders having plates, each of which was provided with 15 sharp points.

Collectors of this kind were also used by the author for measuring the current intensity, in respect to the height of the ascension of the kite and to the number of points which the collector was carrying.

The sheet collectors, being very light, were generally sent by means of Rotch's kites, and steered by an insulated wire five millimeters in diameter, wound on a drum, which was placed on an ebonite stand and connected with a series of binding posts, as well as with a micrometer, to measure the length of the spark. The kite was propelled in a horizontal plane at a speed of three to four meters per second, while two kites were steered by the same wire. Later on the Erickson Company of Warsaw furnished a wire which could resist a tension of 75 kilograms.

Having invited several persons, who showed much interest in the experiments, Mr. Michkin went to the mountains near Novo-Alexandria, and as soon as the kite had risen to a point 50 meters above the level sparks began to appear in the micrometer. The spheres of that apparatus were then moved apart and the wire loosened. The sparks, which at first appeared every three to five seconds, changed then into a continuous stream. The motor being connected to the spheres of the micrometer, the spark disappeared, but the motor started at a speed of about 5,000 revolutions a minute, and stopped only after one hour's work, due to the fall of the wind. As soon as the wind rose the motor worked again successfully for about one hour, until rain interrupted the experiments. [illegible] sheltered. The maximum of the ascension of the kite was 120 meters and the speed of the motor was 4,[illegible] [illegible] 22,000 volts. The same experiment was afterward repeated [illegible] of 20 plates, and the speed of the motor was 4,200 revolutions [illegible] gram-meter a second.

[illegible] experiment the kite could have been set up higher, [illegible] supply [illegible].

He also quotes the following passage from a

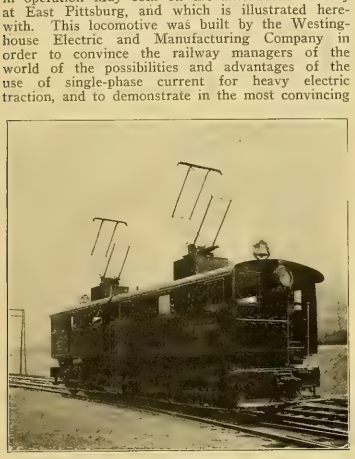
memoir presented by Roma to the Academy of Sciences at Paris some 150 years ago:

"Imagine flashings of light from nine to 10 feet long, accompanied by a noise similar to that of a shot from a pistol. During less than one hour I succeeded in obtaining 30 of such flashes, to say nothing about many others of a smaller size."

The author invites all those who are in a position to contribute to the progress of industry to join their efforts for the realization of the problem of utilizing atmospheric electricity.

## Single-phase Locomotive for Heavy Railroad Service.

Of the many interesting exhibits of railway appliances prepared for the inspection of the delegates to the International Railway Congress one of the most novel and important in its bearing on the use of electricity as a motive power for heavy railroad service was the Westinghouse-Baldwin single-phase alternating-current locomotive shown in operation May 16th on the Interworks railway at East Pittsburg, and which is illustrated herewith. This locomotive was built by the Westinghouse Electric and Manufacturing Company in order to convince the railway managers of the world of the possibilities and advantages of the use of single-phase current for heavy electric traction, and to demonstrate in the most convincing



SINGLE-PHASE LOCOMOTIVE FOR HEAVY RAILROAD SERVICE.

manner possible the ability of the company to supply the necessary apparatus. It was shown in operation first running light and then hauling a train of 50 new steel gondola cars weighing approximately 1,200 tons.

From the various details which are given below it will be seen that a number of new features are embodied in the construction of this locomotive and that claims of priority may be made for it in a number of respects. It is, for instance, the largest alternating-current locomotive in the world, the largest to be operated by single-phase current, and it is equipped with six of the largest single-phase motors ever built. It is the first alternating-current locomotive for use in America and is designed for the highest trolley voltage ever used in this country. This locomotive is also the largest ever operated by means of overhead trolleys, is the first on which forced ventilation is used in the motors and is unique in many other similar ways.

The weight of the locomotive complete is 135 tons. It is built in two halves, each having one six-wheel truck with rigid wheel base. These are coupled together and are intended to operate normally as a single unit, but each half may be operated separately if desired. The locomotive is approximately 45 feet long over all and nine feet nine inches wide. The total height above the rail with trolleys lowered is 17 feet. The wheels are 60 inches in diameter and are mounted on eight-inch axles, with six feet four inches between centers. The side frames of the truck are of cast steel and are spring-supported in the usual manner, the weight on the two inside axles of each truck being equalized. The cabs are built of sheet steel with angle-iron supports, and the entire cab as a whole is removable from the truck.

Each axle carries a 225-horsepower, single-phase series motor of the single-reduction-geared type, making a total of six motors for the locomotive. One side of each motor is supported directly on the axle and the other is suspended by spiral springs from the locomotive body. The motors are of the same general construction as the standard Westinghouse alternating-current railway motors of smaller size. They are so arranged that forced ventilation may be used and increased output thus secured.

The locomotive is designed for a current of 25 cycles and a trolley voltage of 6,000, and one of the most striking points of the exhibition to those who have been accustomed to the enormous currents required in heavy direct-current traction work was the sight of so large a locomotive accelerating a 1,200-ton train over a third of a mile in length and receiving its entire power supply from a single No. 000 trolley wire.

The 6,000-volt current is collected from the trolley wire by a pneumatically operated pantagraph trolley on each half of the locomotive, and is carried through a suitable oil switch and circuit breaker to an auto-transformer in each cab. These transformers reduce the voltage to 325 for use at the motors. The trolleys may be raised or lowered from the cab by a suitable air valve.

The three motors on each half of the locomotive are connected permanently in parallel and are controlled by means of an induction regulator, which, under the direction of the operator, varies the voltage at the motors from about 140 to 325. The induction regulators are driven by small series motors of the same general type as the main motors. Both regulators are controlled by the multiple-unit system from a master switch at either end. They may be stopped at any desired point in their travel, and thus the locomotive may be run at any speed with the same facility and economy as a steam locomotive.

Forced ventilation is used with the auto-transformers and induction regulators as well as with the motors, the necessary air being supplied by suitable motor-driven blowers. Water-driven air compressors are also used.

The locomotive is designed for slow-speed freight service, this type having been chosen because the design of series-alternating current motors for very slow-speed service presents many more problems, and is much more difficult, than the design of equal capacities for the ordinary conditions. This problem having been solved, the production of similar locomotives for passenger service becomes a relatively simple matter. With the motors working at nominal full-load output the locomotive will develop a draw-bar pull of 50,000 pounds at a speed of approximately 10 miles an hour. On several occasions, however, when hauling the 50-car train referred to above, steady draw-bar pulls of from 60,000 to 66,000 pounds have been recorded on the dynamometer and momentary efforts as high as 100,000 pounds have been obtained with no sign of slipping of the wheels. With lighter loads the locomotive may be run at higher speeds up to a maximum of about 30 miles an hour.

## Arrival of James Dalrymple from Glasgow.

James Dalrymple, general manager of the municipal tramway service of the city of Glasgow, Scotland, arrived at New York on May 27th on the steamship Campagnia, on his way to Chicago to consult with Mayor Dunne, at the latter's invitation, and by consent of the lord provost of of Glasgow. He was met by James O'Shaughnessy, representing Mayor Dunne, and he was immediately taken in charge by a representative reception committee. During the day he saw the subway and other traction systems and in the evening he was dined at the Hoffman House by the Municipal Ownership League. At the subsequent reception, which was prefaced by street processions, music and a Scots' bagpiper, there were several speeches.

J. C. Phelps-Stokes, vice-chairman of the reception committee, welcomed Mr. Dalrymple as one who had "demonstrated the feasibility of municipal operation and ownership." Mr. O'Shaughnessy made a short address in which he said that "before the two-year term of Mayor Dunne has expired there will be municipally owned street cars turning their wheels in the city of Chicago, there will be municipal electricity supplied to private consumers, and there will be 75-cent gas." General Henry Edwin Tremaine also made a short welcoming speech.

Mr. Dalrymple responded by thanking the committee for the courtesies shown him and said that he was not here to discuss the principles of municipal ownership, simply to tell the story of Glasgow's street-railway system, which has been operated by the municipality for 11 years and during which time, he said, the service has been made exceedingly popular. "It is quite possible," he said, "for a municipality to make a terrible mess of the operating service, and it is quite possible for a company to give good service, and also for the municipality to give good service. The city of Glasgow would not go back to private ownership. Any company could do as well as Glasgow, but, of course, the end in view is somewhat different. You have shareholders to consider; we have not. You will find people in Glasgow today who will tell you the car service financially is not a success.

"We are deriving as much revenue and half the fare is taken, and our average fare is considerably under two cents. It has cost about $15,000,000 altogether from first to last, which we have expended in installing our system, and our debt today is only about $8,500,000."

Mr. Dalrymple arrived in Chicago on the morning of May 29th and was met by Mayor Dunne and the committee appointed to guide and entertain the Glasgow expert while in Chicago. He has already taken several inspection trips on the street cars, but has refrained from making comment on the traction system. "Glasgow cars are clean," was a significant remark made by Mr. Dalrymple as he entered a North State Street car for his first ride. After taking several rides he said: "I hardly think our double-deck cars would do in your American cities. First, your climate is not adapted to the upper-deck plan, and then, too, the speed at which you run your cars would make it out of the question."

## High-speed Long-distance Electric Traction.[1]

By Charles A. Mudge.

As is generally known, these tests [Berlin-Zossen] were made under the direction of a company organized for the special purpose and known as the "Studiengesellschaft für Elektrische Schnellbahnen." The object of the tests was to make a study of many of the heretofore incompletely and in some cases wholly unknown factors entering into electric traction at speeds never before attempted.

The track selected for the experiments parallels the main line running south from Berlin toward Dresden and is used by the ministry of war for giving instruction to the railway corps of the army. The car barn was located five miles from Berlin, at Marienfelde, where the tests were started toward Zossen, 14½ miles distant over a track having only two decided curves of 1¼ miles in radius each. The first one occurred 3⅛ miles from the car barn, the second seven miles further on, leaving 4⅜ miles to Zossen. This practically divided the line into three parts—four miles at each end for acceleration and seven miles for running in the middle—with almost no grades; conditions about ideal for the tests contemplated.

Power was supplied from a central station seven miles distant to a cable house on the line a little over one-half a mile from the car barn, where it was connected directly to the trolley wires through automatic circuit-interrupting devices.

The apparatus installed in the Allgemeine car differed quite materially from that installed in the Siemens & Halske car, and my remarks will refer only to the apparatus used in the Allgemeine car.

The car body was 69 feet long and 9¼ feet wide and was divided into three compartments by a so-called machine room 12 feet long in the middle, which contained the starting rheostat and high-potential switches, and was not allowed to be occupied while current was on. The other two compartments were utilized for measuring instruments and for passengers and were connected by a narrow passage through the machine room.

Three-phase current was used and the highest recorded voltage in the car during any test was 14,150.

The weight of the complete car with 50 passengers was 100 tons (2,000 pounds to the ton), which was increased four tons in the last year of the tests by alterations necessary to accommodate the new trucks, and by balancing weights.

The first year, September, October and November, 1901, was what might be termed a "try-out" period. The entire installation, with the exception of the permanent way being new, it was necessarily handled with greater caution than it would have been if the apparatus had been of more standardized construction. Before the car was taken from the works all apparatus was thoroughly tested, and for this purpose a stationary iron bed-plate having four run wheels was arranged under each truck, the wheels on the bed-plate having profiles similar to rails and made wide enough for brake straps of dynamometers. In this manner the motors were run up to speeds corresponding to 200 kilometers, and the power required was measured with the dynamometers.

Very elaborate tests were also made on bearing frictions at high speeds, and interesting data were collected on the properties of different lubricants under severe conditions of pressure and speed in connection with different metals and alloys.

From the results of these tests the rolling friction was estimated to be about 10 pounds per ton at 125 miles per hour, which was somewhat in excess of the values found during the actual operation of the car.

After all apparatus had been given as thorough a shop test as possible the car was hauled approximately 500 miles by a steam locomotive in order to loosen it up. After this many different runs were made, the maximum speed obtained during this year's tests being 100 miles per hour.

During the progress of these preliminary runs it was shown conclusively that no trouble would be experienced, as had been anticipated, from collecting currents large enough to run the car at 125 miles per hour, with voltages up to 14,000, provided the car could be made to run smoothly enough. Some trouble was experienced in keeping the sliding bows on the trolley wires, but this was mainly due to the vibrations of either the car or the trolley wires rather than to any fault in the design of the trolleys themselves.

The second year of the tests, September, October and November, 1902, was occupied mainly in

1. Abstract of a lecture delivered before the New York Electrical Society on May 24th. Mr. Mudge was formerly chief engineer of the railway department of the Allgemeine Elektricitäts Gesellschaft in Berlin.

determining the train resistance at different speeds, in measuring the power required for different loads and speeds, in determining the losses in the transmission line, in collecting the necessary braking data for computing the coefficients of friction for different speeds, and in determining the alterations necessary to be made in the car and the permanent way to allow us to run up to 125 miles per hour.

These tests were conducted up to a speed of only 75 miles per hour, as the observations of the previous year showed that the permanent way would not stand much higher speeds.

The tests of the third year, which were the most elaborate and formed a reliable check on the previous tests, have given us a substantial basis upon which high-speed work may be attempted.

In the first place they showed us that it was practically possible, from an engineering point, to move from place to place at least twice as fast as we are at present accustomed to.

Data of very great value were secured on the much-discussed question of air resistance, and although the formula may not be straightened out to suit everybody, we know positively that if we run our car, for instance, 50 miles per hour, we can expect a maximum air pressure of about seven pounds per square foot at the front of it; and if we double the speed we will get four times this pressure, and if we triple the speed we will run into trouble and get nine times this pressure. If we shape the nose of our car properly we will be able to reduce these figures 10 per cent. Also if we run our 1,000-ton car 50 miles per hour on a level track without paying much attention how the front of it is shaped, it will take about 150 horsepower. When we double the speed it will take six times this amount of power; but if we attempt to triple the speed, i. e., to run at 150 miles per hour, we would have to supply about 18 times the amount of power it takes to run at 50 miles per hour.

These facts are not so serious as they seem when we consider that the amount of power necessary to drive a car or train at 100 miles per hour, with which we would be content at present, can easily be applied to the axles without any alteration in the standard gauge, and in fact with very little, if any, change in the standard-truck construction.

The braking results of this year were most interesting and showed very distinctly that it is a difficult matter to keep the retardation a constant value with the braking apparatus at present at our disposal. The curve of retardation instead of being straight has a most undesirable peak at each end, showing that for ideal conditions it is necessary to increase the brake pressure a few seconds after it has been applied and then to leave it in charge of an automatic device which decreases it as the speed decreases and as the coefficient of friction increases.

The enormous brake pressures needed at high speeds to give a compartively low retardation show very plainly that our familiar friend, the coefficient of friction, is not going to help us in the same proportion that he is doing at present; but if he doesn't, electrical means will most likely help us out. For instance, it was found to take about seven-eighths of a mile to stop the car when running at 110 miles per hour, the initial brake pressure being 150 per cent. of the weight of the car. If we had some means of keeping the retardation constant we could have stopped the car in three-quarters of a mile by using the same pressures. Under the most favorable conditions the car could not have been stopped in less than one-half mile when running at 110 miles per hour, which would require a retardation of 3¼ miles per hour per second, which is about the limit of braking with this type of brake apparatus. The pre-eminent value of the braking system employed lay in the fact that it never failed in its operation during all tests made and the feeling of security which its absolute reliability inspired.

The few details of the more important pieces of apparatus which made the collection of such valuable data possible are of interest to us as showing not only how these particular results were accomplished but in giving us an idea upon what lines to base our calculations in similar undertakings. The designs of the individual pieces of apparatus themselves may or may not meet our fancy, but as an aggregation of parts working together for a single purpose they did their work admirably.

In looking over their weights and dimensions we are struck with their magnitude and liberal margins, and the idea of "better too strong than too weak" seems to have been rigidly adhered to. This was purposely followed in all constructions of the more important pieces of apparatus throughout the car, as it was not intended to use these exact designs for future equipments. They give us, however, a most valuable precedent with the assurance that they will work, which is a valuable asset in estimating on similar projects. Basing our ideaas upon some of the observations and experiences gained in these tests, we would make use of the following points in approaching a similar problem:

(1) Keep the car body as near the rails as is possible.

(2) Arrange all heavy pieces of apparatus so that their centers of gravity lie in the center of the car, or are symmetrically placed [illegible] the earth as possible.

(3) All apparatus mounted [illegible] should be as light as good design [illegible]

(4) Make the overhead trolley [illegible] car in preference to the side of the [illegible]

(5) Support the motor [illegible] of the trucks.

(6) Give the front end of the car [illegible] shape.

(7) Support the car body on the truck [illegible] some distance from the center [illegible] flexibility in a line at right angles to the track, independent of the truck.

(8) Make the total wheel base of the truck of ample dimensions and not less than 20 per cent. of the length of the car.

(9) Build the road as straight as possible, and where more than one track is used, make them further apart than our present practice would suggest.

(10) On curves make the approaches of the elevated side of the track longer than usual.

A German engineer of considerable prominence has advocated lowering the floor of the car between the trucks in order to make it ride steadier, utilizing the space above the trucks for second and third-class passengers or for freight and baggage. Although this might be too radical a change in designs of our standard practice, and would not harmonize as well with conditions here as with those abroad, it would undoubtedly give good results.

The transformers, which weighed 3½ tons each, were mounted on either side of the center line of the car body just behind each truck; and a line connecting their centers of gravity did not coincide with either the transverse or the longitudinal center line of the car. This gave rise to a torsion movement, which produced a dangerous swinging of the car when running above the speed referred to, which was overcome by placing weights of about one ton each on the side opposite to that on which the transformer was mounted. The fact was thus confirmed that heavy pieces of apparatus should be mounted in the center lines of the cars for high-speed service, as they run smoothly only when their weight is equally distributed upon the wheels.

The idea of having the trolleys on six separate poles does not seem to be the best. The scheme of two poles might be better, as the trolley bows would lie directly above each other, and in taking curves and supports they all would strike together, making it easier to keep on the wires as the car turns. This may necessitate stronger supports, as the blow from the trolley would be much greater, being all delivered at the same instant instead of one after the other, as is the case with our construction. This construction is not good on account of having three separate poles connected through worm and gear and supposed to turn in synchronism; but, due to the play and wear in gears, they do not press the bows on the wires with the same degree of intensity. One will be pressed hard upon its conductor, the second not so hard, and the third possibly not at all. The method of adjusting the trolleys is not good, as they cannot be seen when being turned toward the wire. It would be better if a porthole, through which one could see all trolleys, were arranged, and if adjusting wheels were placed near at hand with a signal bell to the driver instead of trying to make him do the work of two men.

This suggests some of the trouble we had before getting the trolleys to work properly, much of which might have been avoided if it had been possible to place the contact wires above the roof of the car.

If the motors are direct connected to the axles, a part, at least, of their weight should be flexibly connected to it. Motors of this power—250 horsepower normal rating—weigh heavily, and, both on account of the permanent way and the truck, as much of their weight as is possible should be flexibly supported on the axles. This flexibility need not be great, and can be had through the medium of heavy springs. There is a certain oscillation given to all the parts on a car moving at such high speeds, and it often occurs, through the uneveness of the roadbed, slight inequalities in the rails or the motion of the car itself, that a certain oscillation of a heavy piece of apparatus will be met out of step. For instance, the motor will be going down just as a part of the rail is coming up, and a severe blow will be the result.

A little flexibility of these parts will greatly reduce the force of this blow. At speeds over 100 miles per hour it very often seems as if the rolling friction were taking a rest and that we were actually floating for short distances, after which we notice very distinctly that gravity has not forsaken us, and we can almost hear the rails groan under their extra burden.

Giving the car a wedge-shaped construction may not be possible when using the vestibuled type with multiple-unit control, and no definite end relation, in which case it may be advisable to have a portable wedge-shaped engineer's cab on wheels capable of being quickly attached to the front of the car in making up the train.

We found that it was a very good thing to hold the car body firmly to the truck frame at points equally distant from the center pin; also to allel with [illegible]

[illegible]

The track [illegible] greater distance from the main-line track than is customary to place parallel tracks in this country, and consequently the air pressure effects of trains moving in opposite directions as well as in the same direction [illegible] It was evident, however, that there was a slight disturbing influence in the smooth running of the car whenever it passed another train. What this would have amounted to if the tracks had been placed nearer together it is impossible to say, but it is a point that would have to be considered in building new lines, and we suggest placing the tracks further apart than is our present practice.

The two curves of 1¼ miles radius were built with an elevation of 3⅛ inches of the outer rail, the outer approaches of which were 165 feet long, according to the standard practice of the state railways. These approaches were found to be too short, as the car gave a decided lurch in taking them when traveling over 90 miles per hour, so they were increased to 330 feet, or twice their original length, after which the car rode over them smoothly.

In passing stations at 125 miles per hour it was not possible to recognize persons standing upon the platforms, and only those at a distance of 50 feet and over could be approximately identified. On dark and rainy days it was quite impossible to read signals at this speed, except when of large dimensions or of very pronounced color.

This would suggest placing the signals in the car itself, operated electrically either by direct contact or through inductive means. Such a system was tried at Zossen and worked perfectly, even at the highest speeds.

An insulated piece of angle iron was placed alongside of the rail, it and the rail constituting two poles of an electric circuit. As the car passed over this section, contact was made with the angle iron by a brush which led current through a magnet in the car, releasing a spring and allowing a disk to fall in front of the motorman, the circuit being completed through the wheel.

A system on similar lines could easily be arranged to ring different bells or to operate different colored disks in the engineer's cab, thus relieving him of the strain upon the eyes caused by passing so many objects which naturally distract his attention.

If all the runs, of which over 300 were made, no difficulties were met with or even suggested that the skill of the engineer did not or could not overcome, and this great triumph in a branch of industry which has done more than any other to lift the human race to a higher degree of intelligence should serve as a stimulus to us, who are anxious to have trains in regular service running at this, the highest speed ever attained by any device used for human transportation, 131 miles an hour.

### Discussion (in Abstract)

Frank J. Sprague, New York: It seems to me that there are two questions suggested by the Zossen experiments:

(1) To what extent will the commercial possibilities warrant speeds anything like those attained?

(2) Assuming that for long distances alternating current be used, shall it be by the polyphase method as at Zossen, or in a single-phase development?

One thing must strike everyone who has followed Mr. Mudge's most interesting description, and that is the extraordinary difficulties which had to be met, and the great increase of power as the speed approached the higher marks. My own impression is, taking into account all the practical conditions surrounding trunk-line construction and operation, a maximum speed [illegible] that we can reasonably, for a time, at least, try to reach. Not that cars cannot be operated at higher speeds; but the difficulties which must always stand in the way [illegible] tials of trunk-line operation seem as yet to hardly warrant the commercial use of such speeds. This is a feeling which I have had for a number of years, and I believe it is one which is generally shared by both electrical engineers and steam-road operators whenever they have fully studied the matter.

C. O. M[illegible], New York: It seems to me that these tests [illegible] all that was intended. In regard to the selection of systems, when it comes to trav-

eling over 50 miles an hour electrically, while it seems as though we should use some alternating system, I am not prepared to say which should be used. The single-phase has not yet been developed to sizes which will do what the large polyphase motors can do. Before we can authoritatively say what would be the best method, further experimentation will be required. I do not think that that point will be reached immediately. The experiments now being made on the New York Central and Pennsylvania roads will give us some valuable data. I am not prepared to say, and I don't think any person is, that they will bring about any real general solution. They are, in reality, what mathematicians term "particular solution." We have something to learn before the electrification of steam roads in general is an accomplished fact. We shall have to proceed gently. I believe that it is going to come, but by evolution rather than by revolution; not tomorrow, or in 10 days, nor, possibly, in 10 years. I believe there will still be steam locomotives 25 years from now. The subject is of the greatest interest and it is a rare treat and a great privilege to be allowed to listen to such a presentation of the subject as has been made this evening.

Mr. Sprague: I quite agree with the general statements which have been so clearly made by Mr. Mailloux. We are not on the eve of the immediate conversion of steam-operated roads. It is interesting to note that some of the difficulties met with on the Zossen line at high speeds were encountered in the earlier tests on the New York Central locomotive. Notwithstanding the fact that it had leading trucks, there was a distinct "noseing," caused by the lateral sway, which was periodic,

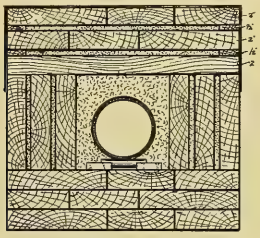


FIG. 1. PIPE-LINE INSULATION OF THE KEWANEE HEATING PLANT.

i. e., corresponding to the length of the rails, and resulting in some displacement at 30 feet intervals. It was thought at one time that possibly the low center of gravity was the cause of this; but this, apparently, did not prove to be the case; for, by using side springs, and subsequently, in addition friction plates, to retard the free action between the body of the locomotive and its pilot trucks, this "noseing" was made to entirely disappear, even when traveling at a rate of 82 miles an hour. Had the potential been raised I have no doubt that speeds of between 90 and 100 miles could have been easily made.

Speaking, however, of the general problem, we must bear in mind that what is being done in New York relates to congested terminal operation, and there are many local conditions which have dictated the use of electricity without necessarily putting it on all points on a directly competitive basis with steam operation. One of the earliest applications of electrical operation on miscellaneous roads is likely to be due to the recognition of the fact that in many cases the concentration of grades and electrical operation, in whole or in part, at such grades may prove cheaper than the making of costly detours. In such cases both continuous and alternating-current motors can be used, and which shall be the better is a matter to be decided by local conditions. In spite of the admirable work which has been done abroad with the polyphase system, and granted its possible desirability in certain special cases, I cannot but feel that, speaking generally, the multiplicity of conductors will stand as a bar to any general application to trunk-line service, and that the later developments in single-phase operation offer, on the whole, more promise of final adoption where alternating currents are used.

Mr. Shepard: We have a locomotive in operation at East Pittsburg upon a specially equipped track, about four miles long. We last week put this locomotive in operation, pulling a 50-car freight train, for the benefit of the visiting members of the International Railway Congress. This locomotive is designed for the heaviest work. Its weight is 135 tons, its capacity 1,600 horsepower, the maximum drawbar pull being 80,000 pounds. This has been registered on the tests already made. The overhead construction is the catenary type and the voltage in use is 6,600. The control of this is by induction regulator. This is quite the ideal control for such service. The tests demonstrate fully the practicability of the single-phase motor of this capacity; the results were fully up to expectations. The tests seem to show that this type of locomotive will find its field in heavy service where concentrated powers are required, as, for instance, on pusher grades, which under steam service are most expensive to operate. In order to secure concentrated power with electrical operation the track conditions need be no more severe than for comparatively light steam locomotives—this by reason of the facility for distribution of the motive power over different axles. I agree with Mr. Mailloux and Mr. Sprague that the adoption of electricity on steam railroads will be gradual: at first, in such special applications as this locomotive is fitted to meet and such terminal propositions as local conditions determine, and ultimately the expansion of these installations will be quite readily accomplished where the high-voltage single-phase system is used.

## Central-station Steam-heating Plant at Kewanee, Ill.

The warming of buildings by radiation from a central station has grown so rapidly in the last few years, and its real worth has become so fully appreciated by the people in general, that it seems

FIG. 2. ANCHORAGE OF PIPE LINE IN KEWANEE HEATING PLANT.

entirely safe to predict that within another five years central-station heating will have passed the stage of a luxury and be regarded almost as a necessity.

One year ago the Kewanee Light and Power Company, at Kewanee, Ill., decided to serve the people in the business portion of the city with steam for heating stores, offices and buildings of various kinds. The system, as installed at Kewanee, was designed with a view of getting the highest possible efficiency throughout, first cost being a secondary consideration.

Fig. 1 shows how the pipe line was insulated. It will be seen that it has at least nine inches of insulating material surrounding it on all sides. The method of anchoring the pipe line is shown in Fig. 2. These anchors are placed on an average of 120 feet apart and hold the pipe line rigidly in place at these various points. Fig. 3 shows a vertical longitudinal section through the center of the insulation and a manhole. Midway between each

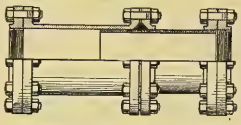


FIG. 4. EXPANSION JOINT USED IN KEWANEE CENTRAL-STATION HEATING PLANT.

anchorage point is placed a special metallic-packed expansion joint, to take care of the variation in the pipe line, due to change of temperature. A manhole with a double cover is placed over each expansion joint and shut-off valve, so that they may readily be inspected.

The expansion joint, as shown in Fig. 4, has met the requirements satisfactorily and apparently has solved the problem of contraction and expansion of underground mains. As will be seen from the cut, it has no fibrous packing of any sort, thus eliminating any possibility of leakage. The packing ring is made of a composition metal which expands and contracts in harmony with the surrounding metals.

Fig. 5 illustrates the simple method of installing

FIG. 5. METHOD OF INSTALLING UNDERGROUND WORK OF KEWANEE CENTRAL-STATION HEATING PLANT.

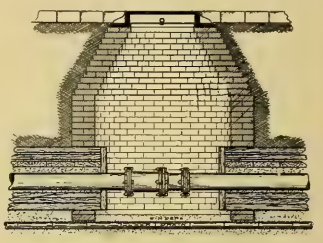


FIG. 3. VERTICAL SECTION THROUGH MANHOLE AND DUCT OF KEWANEE HEATING PLANT.

the underground system. The bottom of the trench, after being graded, is covered to a depth of from four to six inches with cinders or gravel, in which is laid a three-inch drain tile. On this strata of cinders or gravel is laid the bottom section of the insulation, which is six inches thick. The rollers for the steam mains, after being placed in the roller saddles, are then spaced upon this bottom section of insulation, and the pipe line laid in place with the anchors, expansion joints and service tees.

After the construction of the underground system up to this point the mains are thoroughly tested under a cold-water pressure of 100 pounds. The pipe is then wrapped with heavy asbestos paper, which makes it ready for the side and top sections of the insulation.

The entire process of construction makes it possible to do each part of it in the best workmanlike manner, thereby insuring the best insulation as well as the best construction in every detail.

The plant was designed and installed by W. H. Schott of Chicago for the Kewanee Light and Power Company, of which Mr. Xenophon Caverno is president and general manager.

## New Home of the Electric Appliance Company.

Again, as the result of energy and fair dealing, the Electric Appliance Company of Chicago has been forced to larger quarters to accommodate its constantly growing business. The friends and patrons of this company will be pleased to know something of the details of the fine new six-story home in which the company is now doing business, and in which it will be able to continue to better advantage its policy of prompt shipments of high-grade electrical supplies and specialties.

Fifteen years ago, when there were among the electrical supply houses of the country unscrupulous dealers who would substitute and split up orders to suit their convenience and who would charge their customers as much as it was believed they would stand when open orders were sent in, Willard W. Low and Thomas I. Stacey decided that there was room for a supply house which would be conducted strictly on business principles, and which would adopt as its policy honest dealing, prompt and complete shipments, and the best goods on the market.

On December 1, 1891, the Electric Appliance Company began business in a very small way indeed. It occupied a single floor at 242 Madison street, Chicago. Among the first supplies which the company handled were Packard incandescent lamps. Paranite rubber-covered wire, O. K. weatherproof wire, Packard transformers, Whitney instruments and Gutmann wattmeters. The conspicuous success to which the company achieved with these supplies as leaders bears out the correctness of the ideas of its founders.

Soon after commencing business the company added the basement of the building which it occupied, and later the two upper floors were secured. But having already made a reputation by fair dealing and the quality of its supplies, the business continued to grow, and six years ago the company engaged the five-story building and basement at the corner of Van Buren and Jefferson streets, into which it moved its stock. An illustrated description of this establishment was printed in the Western Electrician of April 1, 1899. The new quarters were ample for about two years, when warehouse No. 2 was established for the accommodation of cross-arms, insulators, electrogalvanized conduit and other heavy and bulky material.

It was not long until the men who built this large business began to realize that to maintain its reputation for prompt shipments still larger quarters would be necessary. Accordingly, last summer, architects for the company were given instructions as to what was required to make a model supply house handling so large a volume of business and allowing also for a considerable increase. The

building at 146-148-150 West Jackson Boulevard, which the Electric Appliance Company has occupied since May 1st of this year, and which is illustrated by the accompanying picture, is the result.

The building is six stories high and includes a large basement, having a frontage of 100 feet on Jackson Boulevard and 100 feet on Desplaines Street. Immediately in the rear of the building is the right-of-way of the Metropolitan Elevated railway, offering uninterrupted access to the shipping department for delivery wagons.

The front part of the first floor is the city sales department. The company aims in this department to fill orders over the counter more quickly than it has ever been able to do before, believing it will only be a short time when its reputation in the city will be unexcelled. Every convenience for handling and conveniently storing goods and keeping account of the stock in hand has been provided. The receiving department also occupies the first floor.

The general offices of the company occupy the entire second floor, one-half being given to the sales department and the other half to the auditing department. Special provision has been made for the comfort of out-of-town customers and a cordial invitation is extended for inspection of the new quarters.

On the third floor is found the telephone department. Here is a large and commodious shop where the telephones are assembled. Provision has also been made in the way of tools and machinery for repairing, wire winding, etc. Part of this floor is also used as a stock room.

Quarters have been provided at convenient places for the shipping, stock and receiving clerks, and ample provision was made for convenience in the packing room.

The balance of the building is given up entirely to the large stock which the company carries. On each floor, except the second, besides those entirely reserved for the purpose, space has been reserved for stock. The stock is so placed as to require the minimum amount of labor in filling orders and shipping.

The basement is a model for convenience and light. Here what is said to be the largest stock of weatherproof wire west of the Alleghany Mountains is carried. O. K. weatherproof wire has such a demand among central-station men that the stock has to be replenished weekly.

Willard W. Low, President.

NEW HOME OF THE ELECTRIC APPLIANCE COMPANY.

Galvanized telephone wire is also carried in the basement, and heavy material such as cross-arms, electrogalvanized conduit, etc., is carried on the first floor.

Two freight elevators facilitate the handling of material and a "dummy" elevator is found convenient in handling small stuff. The location of the building is in close proximity to nearly all the freight depots, and the company is better fitted than ever to make prompt shipments. Besides a private telephone exchange which connects with the outside the company has installed an intercommunicating telephone system of its own. The building is exceptionally well ventilated and has excellent light.

In addition to the large stock carried by the company in Chicago, the branch house located at San Francisco carries as large a stock as there is on the Coast. This branch house was established last year, and the business has been very satisfactory. Mr. C. C. Hillis, who occupied the position of auditor for the company in Chicago for a number of years, is general manager of the Pacific Coast branch, assisted by Mr. F. J. Cram, who represented the company in that territory before the branch house was opened. The same policy that has made the company a success in Chicago is being pursued in San Francisco.

Prior to the establishment of the San Fran-

[illegible] Brooke, who is well known in the Southwest, having [illegible] stock, at [illegible] time [illegible] it was [illegible] care of the business.

In its new home the Electric [illegible] pany, which is one of the largest [illegible] houses in this country, will be able to continue its policy of prompt shipments and still have room for further growth, which, judging from its past record, is sure to come. President Low and Secretary Stacey are two of the most capable electrical dealers in the country, and they have reason to be proud of their new quarters and of the success which they have achieved.

## Third Rail in Brooklyn.

Borough President Martin Littleton of Brooklyn, N. Y., caused the arrest recently of a foreman engaged in laying the third rail of the Long Island railroad on the surface of Atlantic Avenue on account of possible danger to the public. The railroad asserts the right to lay the rail, as it owns the property in the street in fee. Officers of the electricity department have inspected the elec-

1. Auditing Department.
2. General Sales Manager's Office.
3. [illegible]
4. Fourth Floor Stock Room.
5. Packing Room.
6. [illegible]
7. Fifth Floor Stock Room.
8. Basement Stock Room.
9. First [illegible]

NEW HOME OF THE ELECTRIC APPLIANCE COMPANY.

trification work of other parts of the Long Island system and paid particular attention to the double-sheathing of the third rail, which is so protected that no one can get a shock unless he wilfully kneels down on the tracks and inserts his hand beneath the guards.

## Interurban Problems in Ohio.

The Ohio Interurban Railway Association at the monthly meeting at the Hollenden Hotel in Cleveland on May 25th declared in favor of a straight fare of two cents a mile. Resolutions which were passed declared that a demand for improved service on interurban electric railways has very largely increased the operating expenses and the present prevailing low rate of fare on most interurban railroads will not permit of such improvement in service. This matter was discussed at length by prominent members of the organization and it is the general belief that people will use the electric cars in preference to the steam roads even if the fare is the same.

In opening the meeting President Spring read a telegram announcing the death of Dr. Lowes of Dayton. He spoke for several minutes upon the life and character of the man who has done so much for the interurban business in that section of the country.

It was announced that the management of the Appleyard properties had decided to use the interchangeable mileage book. This relieves the situation in the central part of the state, as these lines were really the key entering Columbus from Springfield and Dayton and connecting all that portion of the state with other lines running out in various directions. A significant move in the direction of extending the use of the mileage book as well as the promotion of uniform rates is the appointment of Mr. H. A. Nicholl of the Union Traction Company of Indiana as a member of the transportation committee.

Mr. Van Valkenburgh of E. C. Van Valkenburgh & Bro., an advertising firm of Chicago, spoke briefly of the advantage of having a map and general guide for electric roads so that travelers may study their connections and have the same advantages as on the steam roads. He also said that a conservative newspaper advertising campaign would pay well. S. A. Cosgrove of the Drummond Detective Agency also spoke for a short time on his work in connection with railroads and electric lines. He said that he believed that an accident bureau should be maintained so that a record of all accidents could be kept for reference. Men have been known to make a business of getting injured in order to secure damages from the roads.

Records show that the association now has 115 railroad men as members. In all there are a great many more, as material men and others who are in a way connected with the electric roads have been admitted to membership also. Eight new members were taken in at this meeting.

The advantage or disadvantage of stub switches on single-track roads at all points other than regular meeting points were discussed, and while there was considerable difference of opinion regarding the matter, quite a number of the members favored the stub switch because of the safety it offers in many ways. However, many preferred the spring switch—open at one end and closed at the other.

The question of lights on switch stands received considerable attention. The use of oil lamps was mentioned in opening the discussion, but further than that received little attention. The cost of maintaining them seems to be the greatest obstacle. It developed that most of the roads prefer electric lights. Mr. Abbott of the Roberts & Abbott Company suggested that a lens of a great degree of convexity on the target lamps would increase the power of the rays, or direct them, so that a flame would be seen by the motorman. With a lamp of small candlepower this would doubtless make it much more useful. Lamps of 16 candlepower are used largely for this purpose.

An important subject taken up was whether it was advisable to charge passengers paying cash on the train a greater fare than those buying tickets. Two short papers were read on this subject to open the discussion. The points in favor of charging a higher fare for cash was that the more people who have tickets the more time the conductors will have to look after other matters and the less temptation there is to turn in a short account. But what to do with passengers who get on at street crossings and out in the country is the question. It was admitted that it is hardly the right thing to make them pay more. A coupon book, the cost based on the round-trip fares, was suggested. There were some objections to this. The original idea was to give a receipt to the passenger which would entitle him to the difference when presented to the office, but some thought this would be little improvement over paying the same in cash as for a ticket. From the expressions made by different members it could be inferred that the cash fares collected average from 25 to 33 per cent. of the entire passenger traffic receipts. Some plan to reduce this would be welcomed, yet there is no intention to be unfair with anyone.

Limited tickets also came in for some notice. It seems to be the practice of some roads to make the going coupon of a round-trip ticket good for the day of purchase and the following day and the return coupon good for from 10 to 30 days. It was argued that tickets once purchased should be good at any time.

The next meeting will be held at Cedar Point on June 22d. As this will be the closing meeting for the season the ladies will be invited to be present.

## Changeable Electric Signs.

The value of an electric sign for advertising purposes in which the lettering may be changed from time to time, as convenient, is readily apparent. Lighting companies are thus enabled to lend their signs to patrons without fear of lost investment. The customer, on the other hand, can change the reading of the signs to advertise new goods; merchants, if they own the signs, can sell them with their business, and through every branch of electric sign lighting the changeable feature appeals in some way to the user.

The accompanying pictures illustrate the Mobile changeable signs as manufactured by the Mobile Electric Company of Newark, N. J.

The unit of the Mobile sign is a galvanized-iron box containing two frames or grids of parallel brass bars, insulated and held apart by porcelain

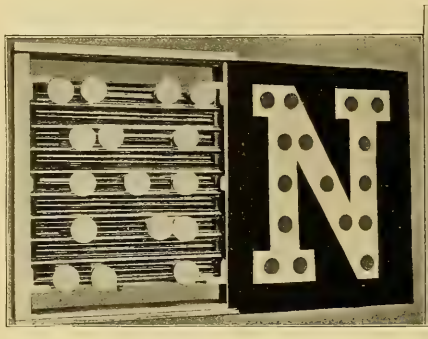


Fig. 1. Steel Face Plate for Covering Unit.

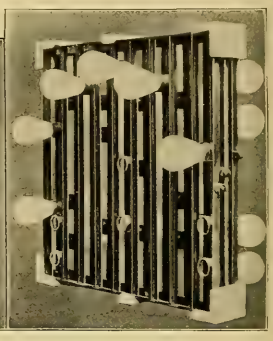


Fig. 2. Double-face Unit.

CHANGEABLE ELECTRIC SIGNS.

corner and side pieces. The upper grid is constructed to form horizontal tracks for a specially devised lamp holder or socket, suitable for Edison-base lamps. The lower grid forms a series of ridges directly beneath the center of the tracks in the upper grid. Thus a lamp screwed down through the open bottom of the socket forms a contact with the ridge in the lower grid and completes the circuit.

This makes a wireless electric sign, the only wires used being the connections from the bottom of each grid, which are carried out the entire length of the sign through ingeniously arranged conduits made part of the box construction. By using these conduits no iron pipe is needed to conceal the connections, nor are any wires exposed to view.

Sockets or holders are made in one piece, of heavy brass, drawn and threaded to hold a lamp securely, and are bent on the sides to form slots which engage the tracks in the upper grid. These holders are easily sprung in, in any desired number, and at any point in the grid, and when in place, slide horizontally on the tracks, and can thus be properly placed to form any letter.

Double-face units, as shown in Fig. 2, are made of three grids, the two outside grids form tracks for lamp sockets, and the center grid has ridges on both sides, against which the bases of the lamps rest. Thus a different letter can be formed on each side of the unit, and the sign read from two directions.

Over each Mobile unit or base is fitted a steel face plate, as shown in Fig. 1. These are perforated for lamps and heavily enameled with a white letter on a background of blue or black. The face plates are held by grooves at the top and bottom of the unit, and can be easily slipped in and adjusted, and when in place, fit securely, protecting the interior from the elements.

Two types, A and B, are made, the former with letters 15 inches high, and the latter with letters 18 inches high. The standard construction for type A contains an average of nine lamps to each letter, and for type B, 13 lamps. Standard face plates are made of the best steel, heavily coated with baked porcelain enamel. The complete sign is made up of a series of the units described.

One of the particular fields for Mobile sign lighting is the making of attractive signs for theaters, an instance where a fine effect is produced being the New York Hippodrome.

The superintendent of the Mobile Electric Company is Daniel H. Rich and the secretary Earl E. Whitehorne.

## New York Franchise-tax Law Held Valid.

The special New York state franchise-tax law of 1899, under which the franchises of many public-utility companies are subjected to ad valorem taxes, has been held valid in a decision handed down by the United States Supreme Court at Washington, D. C., on May 29th. The law has been in litigation since its passage and none of the larger corporations involved has paid its taxes in the interim.

This decision affects wealthy corporations in New York city to the amount of about $32,000,000 of unpaid taxes, not counting those which have lapsed through the operation of the three-year limit. Among the amounts due and the corporations concerned are the following: Consolidated Gas Company, $324,194; Brush Electric Company, $5,403; East River Gas Company, $85,500; Edison Electric Illuminating Company, $96,296; New York Gas, Electric Light and Power Company, $26,239; Mutual Gas Light Company, $53,298; Standard Gas Light Company, $68,824; United States Electric Light and Power Company, $15,373; Consolidated Telephone and Electric Subway Company, $46,655; Manhattan Railway Company, $965,921; Metropolitan Street Railway Company, $388,418; Third Avenue Railway Company, $243,913; Broadway and Seventh Avenue Railroad Company, $146,216; New York and Harlem Railroad Company (city line), $145,332; New York and Harlem Railroad Company, $232,905; New York Central and Hudson River Railroad Company, $29,675; Western Union Telegraph Company, $9,222.

## The Institute Convention.

An unusually profitable and pleasant convention of the American Institute of Electrical Engineers is anticipated at Asheville, N. C., from the 19th to the 23d of this month. The headquarters will be at the Battery Park Hotel. The entertainment of the visitors is being arranged for in true southern spirit by the local committee, composed of Charles E. Waddell of Biltmore, N. C. (chairman), J. H. Finney of St. Louis, A. M. Schoen of Atlanta and I. P. Keeler and E. W. Stone of Asheville. The social programme will include a drive through the famous Biltmore estate, and to such points of peculiar interest as the Weaver Powder Company's plant on the French Broad River. It is also planned to give a banquet, a ball and such other diversions as will add to the pleasure of the visitors.

Among the papers of especial interest is one by Charles P. Steinmetz of Schenectady, N. Y., upon the "Theoretical and Experimental Investigation of the Recent Destructive Blow-out on the Interborough System, Due to the Breakdown of a Cable." Dr. F. A. C. Perrine will read a paper entitled "The Appalachian Water Powers;" "A New-type Induction Generator" is the title of another attractive paper, by William Stanley of Great Barrington, Mass.

The transportation committee has its headquarters at No. 44 Broad Street, New York city, with F. C. Bates as chairman, the other members being Dr. Samuel Sheldon and Arthur Williams.

Special rates over all the railroads have been arranged for, and in all probability the Southern railway will run a special with diner out of Washington on the night of June 17th, arriving in Asheville about midday of the 18th. Equally satisfactory arrangements are being made for the convenience and comfort of the western membership by Mr. Finney in St. Louis, although the exact schedule has not yet been announced.

A feature of interest near Asheville is the work being carried on by the Biltmore forestry department, relating to problems in forestry engineering, which affect very materially the water supply of a locality.

## Methods of Obtaining Business.[1]

By L. D. Mathes.

No phase of the electric light and power business demands more careful consideration from the central station manager than that involving the expansion of the connected load. Depreciation, taxes and interest are forces which work 24 hours a day, with never a day off. Every central station loses a percentage of the business on its books; concerns fail or liquidate their affairs; individual customers drop out, and other business is discarded, due to nonpayment of accounts or other causes. This constant leakage must be overcome by securing additional connected load, not only to offset that which is lost from time to time but to increase the gross volume of the company's business, as it is a well-known fact that depreciation becomes greater with the age of the plant, and increased earnings are necessary to take care of this item as well as the interest on additional investment made through the extension of lines, etc.

To conduct successfully an advertising campaign for the sale of electricity or any other product, system and order are absolutely essential, and these are the first features which impress one in looking into the "business getting" departments of the larger central stations. The soliciting force, whether it be two, 10 or 100 men, has its work laid out and its daily task to perform. In Chicago, New York and Boston the territory is cut up in districts, each solicitor having so many squares, or blocks, as his territory. Reports are made daily on the number of calls made, business secured or lost, and the general prospects.

The mailing lists should be entered under separate headings—for instance, one list covering motors, another residential lighting, another window lighting, etc. The card-index system is readily adapted to this class of work and has been generally adopted by all lighting companies. The advertising matter sent each customer should be noted on the index cards or mailing lists in order that duplicate matter may not be mailed the same individual.

While system is essential we must guard ourselves against too much of it; if it requires all of the solicitor's time to keep up with the system, he does not make much headway in getting in direct touch with prospective customers.

It is a well-defined fact that all printed and intelligently circulated matter will receive more attention in the smaller cities, the general public having more time to read and digest such matter. A well-written circular will bring a far greater percentage of acknowledgments in a town of 25,000 to 50,000 than in a city of 100,000 or greater population.

Assuming that a customer has been secured and his name transferred to the ledger and meter-card index, it does not hold that he should be dropped from the mailing list, but rather, that having been induced to see the possibilities of electricity to the extent of taking on the service, the next matter forwarded him should be with the end in view of calling to his attention the various comforts and conveniences possible to the users of the electric service.

Say to your public: "We have absolute confidence in our product, and after a demonstration you will have the same. We will send up anything we have in stock. Use it for a week or two weeks or a month. If it does not in every respect give satisfaction, send it back and you are under no obligation of any character to the company." The writer knows of a case where over 100 electric irons have been sent out on approval and in every case a sale was consummated. It is oftentimes possible to sell an iron or a chafing dish where the service is not installed; it is then only a question of time until the householder will come over to electric lighting.

It is unnecessary to state before this convention that the load we are all looking for is the day load, or the load which does not run into the peak. The perfection of electrical-heating devices will do much to bring about this most desirable situation. Few central-station managers have given electric heating the consideration it deserves, many managers being inclined to satisfy themselves with a grunt of disapproval to the effect that the time is not yet propitious for pushing the electric ironing, heating and cooking proposition. When we consider that 75 or 85 per cent. of our investment is idle all day, it might occur to us that we can afford to make a special effort for this heating business, even though it involves a lower rate than that which must necessarily attain during the hours of peak load. When you stop to consider that with the cutting in of a standard domestic laundry iron you are turning on 10 16-candlepower lamps for several hours burning and at a time when you have an overwhelming surplus at the plant, this question assumes more than a little importance.

The writer has in mind at this moment a case within the state wherein a large hotel is serving all griddle cakes, toasts, chops and steaks from electric grids. In this instance the consumption is about 2,000 kilowatts per month; 85 per cent. of this consumption is during other than the peak-load interval. The rate is five cents. We doubt if there is, everything being considered, a better piece of business in the [illegible]

[illegible] company has secured in connection with [illegible] tion has influenced many [illegible] minutes many more.

Many lighting companies [illegible] afford to sell portables. Leasing [illegible] vices at actual cost and [illegible] vertising as well. A manager [illegible] it cost his company $5 apiece [illegible] portable last Christmas. These portables were, many of them, given as presents [illegible] into homes which had no electric wiring, and the company secured six desirable customers through the sale of the 50 lamps. In addition to this, a [illegible] ing trademark for the electric-lighting station is in evidence wherever one of these 50 lamps is encountered.

After all has been said, the method of securing additional light and power business narrows itself down to any method which appeals to us as being sound from a business standpoint and profitable from an income standpoint, whether there is an established precedent of the method or not. Free signs, controlled flat rates, free lamp renewals and many other forms of attractive service are more or less familiar to the members of this association and will not be touched on at length in this paper. The most attractive proposition of the above number is the flat-rate sign scheme, whereby the customer agrees by contract to pay the central station a stipulated sum a week, or month, for a term of one or two years, this covering the cost of the sign and the service; the monthly or weekly payments being based on the number of hours a night the sign is to be in circuit. The company's patrolman has the key to the switch and the company is thus in control of the situation. The Chicago Edison Company has been very successful in this line, having in operation many thousands of signs, and the management states that the sign business is a profitable feature.

Of all methods known none can be compared with the efforts of an intelligent solicitor. The solicitor must be backed up by his company with good advertising matter and clothed with that dignity which the company's representative must have to succeed. No company should be so aggressive in its advertising and soliciting as to become offensive. The soliciting art has been the object of much unkindly feeling on the part of the general public through the offensive tactics of book peddlers and life insurance agents. In the event that you should have competition in your town, be it gas or electricity, don't allow yourself or your subordinates to knock the "other fellow's" game. You have enough to do to tell the good points of your own proposition without digging out the bad features of your competitor's service. Campaign methods based along these lines will ultimately become reactionary in their effect.

There is a quantity not carried on the stock book nor reckoned as an asset which will nevertheless be found of inestimable value in the conduct of a light and power business, that is, the courtesy and consideration extended the general public. Every employe from the office boy to the manager should thoroughly understand that personalities do not enter into the business; that all are servants of the company and at the same time of the public whose patronage permits the company to exist. The average American citizen considers it his sovereign right to "roast" the service and the management whenever he sees fit; this right, as a rule, should not be denied him. If a customer protests against his meter reading, and you should be morally certain that the meter is correct, policy would prompt you to give the customer most considerate attention; agree to read his meter; see that the reading is actually taken, and after the heat of the moment has passed submit the matter to the customer. Many competitive plants have sprung into existence through the failure of managements to be more considerate in dealing with the public.

### Discussion.

A. W. Zahm of Mason City, Iowa, said that in St. Paul an active campaign for sign business was being made. They make a charge there of 25 cents for a four-candlepower lamp from 6:05 p. m. to midnight. They have installed over 400 electric signs. Clock switches are used. Stationary signs and monogram signs are both employed. About 43 foreign or out-of-town corporations use this method of advertising. St. Paul is far ahead of Minneapolis in the electric-sign business. Users pay a stipulated price for one or two years. After that the price is very much less. A sign with eight 10-candlepower lamps is put out, including current, at $10 a month. This five-foot sign has been very popular in St. Paul.

Austin Burt of Waterloo, Iowa, said that the reliability of service was the best advertisement. Give careful attention to the apparatus in the station and throughout the plant. The supply of current should be dependable. This is particularly true in relation to motor load. All the advertising in the world won't do any good unless you can convince your customer that the current will stay by him and not fail at any time, throwing a lot of factory machines, say, out of service.

J. Paul E. Bellamy of Knoxville, Iowa, brought out the point that electric apparatus advertised the cus-

[illegible]

[illegible] for lighting [illegible] last [illegible] gasoline and [illegible] tion the cost is actually more than for electric light and power.

## OBITUARY.

### Franklin L. W. Pope.

Franklin Leonard W[illegible] the late Franklin [illegible] Ralph W. Pope, secretary of the American Institute of Electrical Engineers, died at the home of his sister, Mrs. George W. Shirk, Cornwall, N. Y., on May 27, 1905. Mr. Pope was [illegible] N. J., in 1880 and graduated from Amherst College in 1903. Having a decided taste for railroad work, his vacations were devoted to active employment in the signal department of the Lackawanna railroad. He was subsequently employed at Grafton, W. Va., on the Baltimore and Ohio, but the night work was too arduous, and it is now believed that he there incurred tuberculosis before resigning, to enter the office of the signal engineer of the Pennsylvania railroad at Philadelphia. Under the imperative instructions of his physician he left Philadelphia in September, 1904, and went to Saranac Lake to recuperate. The change brought no relief, and a few months later he went to his sister's home to spend the remainder of his life. Mr. Pope was an exceedingly well-informed young man and gave promise of a brilliant and useful career.

### Dr. J. E. Lowes.

The death, by paralysis, of Dr. J. E. Lowes, at Pasadena, Cal., on the evening of May 24th, takes away the pioneer electric-railway man of Dayton, Ohio. Born and educated in Canada, he graduated at a homeopathic medical college in Cleveland and practiced his profession in Dayton for 15 years. Then he became interested in business and politics and practically abandoned medicine. Dr. Lowes built the White Line, the first trolley road in Dayton. It was afterward sold to an eastern syndicate and is now a part of the People's Railway system. Founder of the Dayton Electric Light Company, he recently reorganized it into a $3,000,000 corporation, and this with other heavy duties probably brought his illness. The Dayton and Western, the pioneer electric line out of Dayton, was built by Dr. Lowes, and after it was disposed of at a good profit, he began on the Dayton and Northern from Dayton to Greenville. Recently it has been completed to Muncie, Ind. He also was a stockholder in the Cincinnati, Dayton and Toledo, and the Home Telephone Company. Dr. Lowes was considered one of the leading electric-railway men in the country and was held in high respect by his associates. In addition to these interests, he was the owner of the Bradley Cordage Works and held the controlling stock in the T. N. Roberts Supply Company of Milwaukee. He was also interested in many other enterprises.

## Electrical Inspectors of the West to Organize.

The organization meeting of the Western Association of Electrical Inspectors is scheduled to be held in the National Life Building, Chicago, on June 1st and 2d. The programme, besides organization, includes trips of inspection, discussion of rules and various tests. The object of forming the association is to improve the methods of controlling the fire hazard of electricity, to obtain and circulate information on the subject, and to establish a more efficient and uniform practice in supervising the installation and maintenance of electrical wiring and apparatus. Membership in the association will consist of those engaged in the supervision of electric wiring and apparatus within the Central West. The call for the meeting is signed by the following-named city electricians and inspectors and representatives of the fire underwriters: E. B. Ellicott, F. V. Sackett and W. S. Boyd of Chicago; P. D. Watson of St. Paul, Minn., and Waldemar Mathiesen of Omaha, Neb.

1. Abstract of a paper read before the Iowa Electrical Association at Dubuque on April 19, 1905. The author is general manager of the Union Electric Company of that city.

## QUESTIONS AND ANSWERS.

### Telephone Wires and Electric-light Wires.

A telephone reader of the Western Electrician in Northern Illinois brings up some vexed questions in the following budget of queries:

First—What constitutes a contact on a telephone or electric-light pole. For instance, is one wire or a cable consisting of 50 wires, more or less, a contact? Or should the cable be considered as 50 contacts, more or less? Would you consider a cross-arm containing 10 wires, more or less, a contact for each wire or one contact only?

Second—Would you consider a telephone company carrying foreign electric-light wires ranging from 500 to 4,500 volts, alternating current, giving a greater concession to an electric-light company than if it were carrying a like number of contacts (as interpreted by question one) of 20-volt central-energy telephone wires?

Third—Where electric-light wires ranging from 2,000 to 4,500 volts are placed beneath telephone wires, what clearance should there be at the pole between the wires for the repairman to pass through?

Fourth—Is it not a safe rule, and one generally adopted, to keep all high-voltage wires, transformers and electric-light lightning arresters off all telephone poles except where same are placed above telephone wires at a sufficient height to obviate the danger of accidents and induction?

Fifth—What distance should there be on direct cross-overs between telephone and electric-light wires where the voltage on the electric-light wires ranges from 2,000 to 4,500 volts, and if, theoretically, there is no induction from one direct cross-over at a given distance, should there be from a number of such conditions?

ANSWERS.

In answer to the first question, it should be borne in mind that when one speaks of contacts on an electric-light or telephone pole, mechanical contacts are, as a rule, meant to be covered by the expression, and therefore the term "contact" should be applied in a different sense when considered either mechanically or electrically. Therefore, a cable containing 50 wires when suspended from a support on the pole constitutes one mechanical contact, even though it carries 50 electrical conductors. In the same manner, a pole carrying a cross-arm with 10 pins and one wire on each insulator may be said to have 10 contacts. In this instance it may be well to draw attention to the fact that, ordinarily, telephone service calls for a pair of wires for each metallic circuit. Therefore it must be understood that there are only five telephone circuits on the 10-pin cross-arms, whereas we have 10 mechanical contacts.

As a general conclusion, therefore, in answer to question No. 1, it is the mechanical contacts which are to be considered when speaking of the number of contacts on a pole.

Question No. 2 is subject to question No. 1, since for every telephone wire suspended from insulators upon the pole line there is one mechanical contact. This is also true of every electric-light wire. The difference in the currents carried by the systems has no bearing upon the mechanical equipment. That is to say, should there be 10 electric-light wires upon a pole and 10 telephone wires upon the same pole line, then, from a mechanical viewpoint, one system should not be considered as having obtained any greater concession than the other. It is here, however, that electrical considerations come into play. Telephone wires connecting to the 20-volt central-energy exchange are practically harmless as to danger from fire or liability for electrical shocks to man or beast, where, on the other hand, the electric-light wires do present, in some degree, potential menace to life and property, as the voltages are comparatively high, and in all cases the current-carrying requirements are much greater than those of the telephone wire. There is a possibility of fires, due to accidental crosses either between electric-light and telephone wires, or electric-light and other foreign bodies or circuits. As to the fire risk of telephone circuits carrying 20 volts, this is almost negligible, for such circuits are never intended to carry over 0.1 ampere, and as a rule are fused so that they will not carry 0.3 ampere for more than one minute's time, when the circuit would automatically open and thus offer a protection against accidental fires.

In answer to question No. 3: Electric-light wires, it is thought, should never be placed below the telephone wires, but if they are a clearance of at least six feet should be left between the cross-arms and three feet between center pins on the lower cross-arms, permitting the linemen to reach their circuits without any possibility of coming into contact with the wire. The safest rule would appear to call for only the three outer pins for electric-light wires when using a 10-pin cross-arm.

In answer to question No. 4: It is always dangerous to place high-potential electric wires and telephone wires upon the same pole. When this is done and there are any considerable number of telephone wires the best practice would be to place the electric-light wires above the telephone circuits and suspend a screen between the telephone circuits and the electric-light wires. This screen might be placed about three feet below the electric-light wires and about the same distance above the telephone wires. It is necessary that the screen be thoroughly grounded so that should an electric-light wire fall down upon the screen it will fuse the lighting wire, or at least reduce its potential to a point where it ceases to be dangerous, even though the broken contacts of the high-potential wire rests on the telephone wires.

With respect to the transformers and lightning arresters there seems to be no question that these should be placed above the telephone wires in order to prevent any possibility of telephone linemen accidentally coming in contact with these parts of the high-potential systems.

In answer to question No. 5: Regarding distance between the wires at direct cross-overs, there is first to be considered the possibility of breakage in the wires placed on top at all such cross-overs, say where the electric-light wires are above and telephone wires below, these wires should either be protected by a grounded metal screen suspended under the electric-light lead, or the distance between the supports of the electric-light wires should be less than from the support to the telephone wires crossing under the electric-light wires. Say there is a distance of 10 feet between the supports of the cross-over wire. Then the distance from either one of these supports to the nearest telephone wire should be over 10 feet, for then a breakage of the electric-light wire even at the support would not permit of the electric-light wire coming into contact with the telephone circuits, and thus rendering them equally as dangerous as the lighting wire.

The question of induction upon the telephone wires from an electric-light circuit crossing over the leads is one which requires a knowledge of local conditions in order to give a useful opinion. It would appear, however, as though the combination of cross-overs suggested by the correspondent would also call for considerable paralleling of the two circuits at no great distance from each other, and it is the paralleling of the two lines which gives rise to the greatest inductive disturbances.

### Finding the Area of a Circle.

Another answer to the question relating to the short-cut method of finding the area of a circle, referred to in the issues of the Western Electrician of April 15th and 22d, is contributed by R. Terver of London, England, who writes:

The short-cut method which I think the government inspector had in mind is as follows:

$0.7854\ d^2 = \text{area} - 7 \times 0.1122\ d^2$

Thefore, the figuring would be

$10^2 = 100$

$10^2 \times 7 = 700$

$10^2 \times 7 \times 0.1122 = 700$

700

1400

1400

78.5400

### Philadelphia Gas Lease Halted.

Thomas Dolan, president of the United Gas Improvement Company of Philadelphia, has withdrawn the offer, which was accepted by the councils of the city by a large majority, to extend the lease of the city gas works until 1980. As stated in the Western Electrician last week, popular indignation was aroused by the action of the councilmen. Since the council voted to accept the offer of the gas company Mayor Weaver announced that he would veto the ordinance. The affair has created a sensation in Philadelphia, and several heads of departments, said to be in a "ring" to favor corporations, have been removed by the mayor. As the result of popular agitation it is said that enough members of the Select and Common Councils have acceded to the wishes of their constituents to sustain the mayor's veto when the lease would have come up for final passage had the offer not been withdrawn.

The affair has created renewed agitation for municipal ownership of all public utilities in Philadelphia. It is said that a resolution is to be offered at this week's meeting of the councils to cancel the existing lease of the gas company and also to establish a municipal electric-light plant. Street-railway franchises are also being investigated by the reformers, with a view to the city taking over the lines.

### Mygatt Patent for Prismatic Reflectors Upheld.

In a decision handed down by Judge Ray, in the United States Circuit Court for the Southern District of New York, in the suit of Otis A. Mygatt vs. Edmund L. Zalinski and the The Illuminating Engineering Company, for alleged infringement of a design patent on prismatic reflectors manufactured by the Holophane Glass Company, the validity of the Mygatt patent was fully sustained, and the reflectors manufactured by the Illuminating Engineering Company, held to be an infringement. A permanent injunction and accounting was ordered.

The trial of this suit brought out some novel features in patent law, it being the first case on record where the peculiar appearance arising from the use of transparent glass has come into question.

The patent on which suit was bronght was design No. 32,685, and covered the well-known prismatic reflector which has been manufactured and sold by the Holophane Glass Company for the last five years. The infringing reflector was of the same general characteristics but with a slight modification which had also been made the subject of a design patent. It was contended by Zalinski that the Mygatt patent was invalid, and also that his reflector was sufficiently different not to infringe. Both contentions, however, were denied by the Court.

The Holophane Glass Company own numerous design patents covering all the forms and shapes of reflectors which are constructed on the prismatic principle. It is said to be their intention to bring other suits immediately against all manufacturers and dealers who are making or selling prismatic shades or reflectors that infringe their patents.

### Opening of the "White City."

Probably the most brilliantly illuminated summer amusement park in Chicago was opened to the public on May 27th. The park is known as "White City," and, as stated in the Western Electrician of January 28th, electric lighting is the most spectacular evening feature on the grounds. There are many attractions of an amusement nature to entertain pleasure seekers, and every facility for the comfort of visitors has been provided. Although several attractions, including the large electric tower, had not been completed at the time of the opening, the picture formed of the thousands of electric lights which outlined the various buildings was a striking one.

Especially fine is the fire show, given by several trained fire companies, including Hale's Fire Fighters from the Pike show at the St. Louis Fair. A full-size electric street car and an electric automobile are included in the realistic street scene. Beautiful Venice, the scenic railway and a score of other attractions are all of high order. A handsome ball room, accommodating 1,000 dancers, adjoining a dining hall of equal proportions, has been built for use both summer and winter. The $20,000 orchestrion built for the French section of the Liberal Arts Building at the St. Louis Fair, is located in the ball room and is run by an electric motor. Nearly all the moving attractions requiring mechanical power are operated by electric motors.

The park has been built at an expenditure of $1,000,000 by a company composed of Chicago men. Joseph Beifeld is president; E. C. Boyce, vice-president; A. J. Jones, secretary and treasurer, and Paul D. Howse, general manager.

### Electrical Exports for April.

Electrical exports from the United States for the month of April amounted to a total value of $1,008,361. The amount for the corresponding month in 1904 was $841,716, showing an increase for April, this year, of $166,645. Both classes of goods, electrical machinery and electrical appliances, the latter including telegraph and telephone instruments, show good gains. The figures in detail are as follows: Electrical appliances—April, 1904, $311,440; April, 1905, $443,478. Electrical machinery—April, 1904, $530,276; April, 1905, $564,883. It will be interesting to note that in the export of electrical machinery Japan is again the largest foreign buyer from the United States, having in April imported electrical machinery from this country to the value of $118,562.

The following-named countries were the principal importers of electrical machinery from the United States in April, the amount of each being given: Japan, $118,562; British North America, $102,634; Mexico, $94,518; United Kingdom, $70,127; British Africa, $22,316; Germany, $21,669; Brazil, $21,252; British Australasia, $16,361; British East Indies. $15,673; France, $14,649; Argentina, $7,938; Philippine Islands, $4,382; Cuba, $2,692.

The Arizona Power Company has been organized at Prescott, Ariz., for the purpose of supplying electric power to Prescott and other points in the vicinity. The company will put in a waterpower electric plant on Fossel Creek, near Mayer, Ariz.

## Lifting Magnets.

Lifting magnets may be operated very efficiently in many classes of work, particularly where iron or steel materials to be handled are of a shape and size making them inconvenient to grapple with the ordinary hooks and chains. Pig iron is one of the materials which lends itself especially well to handling by the electromagnet, no labor being required except that of the crane operator, and the iron may be handled direct from the car to the open-hearth charging boxes.

An extensive line of lifting magnets is manufactured by the Electric Controller and Supply Company of Cleveland, Ohio. Two types are illustrated herewith.

Fig. 1 shows an interesting application of the magnet to what is commonly known as "skull cracking." By a skull cracker is meant a heavy weight which is used for breaking up defective castings and the like for remelting. This weight is generally lifted by a crane to the desired height and then let go by a tripping device. This method is not altogether satisfactory, however, in that the weight has to be pried around until the hook can be attached to a ring or staple, and also in pulling the string of the tripping device the aim is liable to be destroyed and the weight fail to do the work properly. Fig. 1 shows the magnet lifting a ball weighing 11,000 pounds, and since, to drop the ball, it is only necessary to open the circuit, absolute accuracy of stroke is obtained.

The operation is conducted from a safe distance by the crane-man, thus eliminating the danger of accident to ground men who are usually required to operate a mechanical trip.

For placing the piece to be broken up in position the magnet is also often useful. If it cannot be so used it can be disconnected and laid aside a

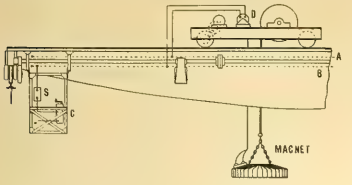



FIG. 4. WIRING OF LIFTING MAGNET

moment, or chains can be used without removing the magnet.

Iron or steel turnings or borings, bolts, rivets, punchings or similar small scrap are difficult to load or unload by hand, but with the aid of the lifting magnet, as shown in Fig. 2, as much as 600 to 1,200 pounds of this material may be taken at a single load by the same type of lift that is used for pig iron and for skull cracking.

Long plates of iron or steel are not easily grappled by chains, and to handle such plates magnets of the shape illustrated in Fig. 3 are conveniently used either singly or several together, as shown in the picture, the number of magnets depending on the weight and stiffness of the plate.

Fig. 4 shows one method of wiring the magnets. A small controller or switch is conveniently mounted in the crane cab. A drum (D) is mounted on the trolley and geared to a hoist shaft. A twin flexible conductor cable conveys the current to and from the magnet, the drum taking care of the slack. The cable is connected to a pair of contact rings on the drum and the current is conveyed from the controller through an extra trolley wire (B) and returned through the common-return trolley wire (A).

Many other applications may be made of the lifting magnet [illegible]

Fig. 1. Magnet Applied to "Skull Cracker."

Fig. 2. Magnet Lifting Scrap and Turnings.

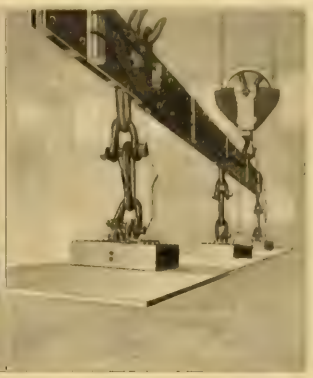


Fig. 3. Form of Magnet for Lifting Steel Plates.

LIFTING MAGNETS.

## Duplication of Electrical Apparatus to Secure Reliability of Service.

The question of the proper [illegible] electrical installation is a problem which must be settled largely upon a basis of cost, as is pointed out by Mr. H. W. Buck, in a paper read before the American Institute of Electrical Engineers, on May 16th. It is nearly always a question involving a balance between a power company's obligation to its customers and the obligation to its stockholders.

In discussing the subject, Mr. Buck divided the apparatus up into several classes, as follows: [illegible] erating units, generating-plant switchboard, generating-plant transformers, underground-distribution system, overhead lines, sub-station apparatus, apparatus on premises of individual customers. Reserve apparatus applicable to the above can again be divided into two classes: (a) Actual apparatus installed complete ready for service, (b) reserve parts held in storeroom.

The author of the paper discussed each one of the several classes of apparatus in detail, giving at the end some general observations which are of especial interest. He said:

"When the present steam railroads adopt electricity as a motive power for all traffic, both passenger and freight, more rigid requirements in reserve are likely to be found than have ever been considered necessary as yet in central-station practice. Under present steam-road conditions, if a locomotive breaks down, as frequently happens, probably only one train is stopped. The simultaneous breakdown of every locomotive on the road is, of course, improbable, consequently there is no likelihood of a complete tie-up of the system. Under a complete electrification, however, one whole division of the railroad might be operated from a single power house, and a breakdown in that plant would involve every train on the division. No important railroad system would venture to operate with such a risk hanging over it. This condition, in the writer's opinion, will lead beyond the mere duplication of apparatus in a power house to the installation of duplicate or possibly triplicate generating plants, having such capacities that any one of the plants can be shut down in cases of catastrophe and the whole load of the system carried by the others. Such an arrangement, with suitable reserves in transmission conductors, would practically insure continuous train service at all times.

"Where waterpower is used for the operation of important power systems, duplication of generating stations is especially important. In steam plants, as now constructed with multiple stacks, there is no single element of the plant which is common to and necessary for the operation of all the power units. Consequently any part of the equipment can be inspected and repaired without a total station shutdown. In an hydraulic plant, however, there are a number of elements in the development which are essential to the operation of the whole plant, among which may be mentioned the dam, flume, forebay, tailrace, tunnel, etc. In cases of emergency it may become necessary to shut off the main water supply in order to get access to these parts. Furthermore, hydraulic plants are subject to ice troubles and floods in winter and low water in summer. It therefore seems essential, if steam roads or other public utilities are to be operated electrically by hydraulic power, that the system should be operated by more than one generating station.

"Such are some of the considerations entering into this problem of duplication for reserve. The details are subject to the local conditions of each [illegible] in reserve to assure continu[illegible] virtually a separate power station in itself. The isolation of the generators, the cables connected with them, the individual cables connected to these main cables, the oil switches, bus bars, etc., permits all operating devices, where it is possible, in almost all modern stations, to operate in one unit. Economy does not dictate this separate operation. The question [illegible] is simply a question [illegible] each individual unit, and I do not think the impression should be conveyed that we have reached the final size of the large power plants, unless there is some special point, especially as indicated in the hydraulic plant, where there are any unreliable items, such as the dam, flume, forebay, tailrace, etc., which control the entire amount of power. In the steam plant there is no one item controlling the whole amount of power. The nearest approach to this condition is found in the water supply. That, in practically all stations, is in duplicate, and is also further protected by the use of large storage tanks."

Regarding the duplication of parts for the protection of the service, C. W. Ricker of New York thought that the problem should be attacked in the original design of the installation. In a great many modern plants, and including some of the most notable, a very great variety of apparatus has been installed and a great many voltages of electrical generation have been used in the station. The greater the variety of apparatus, of course, the greater the need of duplication, and it would seem that a plea for simplicity of design would be in order. Not long ago he visited a railway plant (alternating-current, high-tension), though not a very large one, of which it could be said that there was not a single piece of apparatus of the generating or controlling plant, not a single piece of apparatus or connection in the station, which was not entirely in view and readily accessible without having to remove the floors or take the apparatus to pieces to get at it. He thought there were comparatively few plants of which this can be said. The personal equation of the attendant is of very distinct importance in determining the reliability of a station operation, and the greater the complication which he must attend, the more diverse and adverse are its conditions. In some of the older stations in which the apparatus is far inferior to that of the present time, which, as we look at it now, we wonder how it could be kept in as reliable operation as it has been, may serve for comparison with some of the modern stations. In one notable station in the Middle West the amount of complication of apparatus in the way of electrically driven auxiliaries, steam-driven auxiliaries, and controlling apparatus, has been so great that the additional cost of duplication and maintenance has very seriously affected the economy of operation of the plant, although the coal economy has been very good.

C. O. Mailloux of New York said: "I presume everyone who has visited modern stations and studied the question of the requirements of their design realizes that they should be made that way, otherwise they could scarcely be managed or operated at all. The reference to the cost of replacement, as affected by the size of the unit, is indeed a very important question, but, as the last speaker pointed out, it is a question which the designer should really discuss and consider at the time the system is designed. There is more original sin in the design of central stations than people are apt to imagine. Of course, in attenuation of the sin, as we find it in many cases, it must be said that at the time the station was designed it was absolutely impossible to foresee and anticipate what was going to happen, either in the development of machinery, or in the development and [illegible] especially in electrical traction stations, the wonderful growth which they have had, where they have had suburban extensions, which have called for increased power and compelled the companies to resort to all manner of expedients in order to get current at all to operate their lines. I saw a case

of that kind in the Middle West last week, where a company operates two old stations, and has had to buy and borrow current. The difficulties are sometimes very great, but where it is at all possible to anticipate such growth, the question of the number of units and the size of the units should be carefully considered. That has a great bearing, not only upon the initial cost of the plant, but also upon the cost of the reserve apparatus."

## Telephone News from the Northwest.

The case in court to test the constitutionality of the ordinance requiring telephone companies in the city of Minneapolis to cut their wires at their own expense when houses are to be moved will be carried to the Supreme Court of the state by the Northwestern Telephone Exchange Company.

The Capital City Telephone Company of Pierre, S. D., has voluntarily abolished the toll charge to Fort Pierre, and connections hereafter are free to subscribers.

The Standard Telephone Company is planning the construction of a copper trunk line across the state from Dubuque, Iowa, to Sioux City. The State Telephone Company of the latter city will co-operate in the project.

A franchise was voted at Moorhead, Iowa, to the New Monona Telephone Company.

The United States Telephone Company's system, embracing about 1,500 miles of wire and extending from Waterloo, Iowa, into 14 counties, has been sold by Thomas Cascaden and F. F. McElhinney to S. Lichty of Vinton and A. T. Averill of Cedar Rapids. The consideration was given as $90,000.

The request of the Northwestern Telephone Exchange Company in Red Wing, Minn., to be allowed to construct conduits through the streets for its wires was not granted, the council feeling that telephone lines should be placed in conduits in alleys.

The new Sioux City Telephone Company was victorious in its suit against the Iowa Telephone Company at Sioux City to secure a mandatory injunction compelling the latter company to reinstall a telephone in the plaintiff company's office. The action developed over the action of the defendant company in voluntarily removing its telephone from the office of the Sioux City company on learning that the latter was using it to secure new business.

Twenty-five Independent telephone managers, representing the exchanges of Western Iowa, have agreed to take $40,000 worth of the $100,000 stock in the new telephone system at Council Bluffs, Iowa.

The Northwestern Telephone Exchange Company has made a tentative offer to the council of St. Paul, which is investigating telephone rates, to grant free service from the Midway district to either city. At present the subscriber located in the Midway district elects which city he will be connected with and receives free service with that city, but connections with the other city are charged at the regular toll of 10 cents. R.

## Indiana Telephone Items.

The Independent Telephone Company of Lancaster and Monroe townships, Jefferson County, has filed articles of incorporation, with a capital stock of $5,000. The company will establish exchanges in Dupont, Lancaster and Foltz, as well as throughout Jefferson County. David H. Bently, L. F. Healton, F. C. Curry, I. W. Word and others are the incorporators

The Brookville Telephone Company of Brookville has authorized the issue of $5,000 preferred stock. Extensive improvements are contemplated. John C. Shirk is president and M. H. Irwin secretary.

The Telephone Protective Association, composed of representatives from the Independent telephone companies of Clinton, Tipton, Boone and Madison counties, was entertained by the Union Telephone Company of Carmel on May 25th. The purpose of the association is to promote the interests of the exchanges of smaller towns and their subscribers, who are for the most part farmers. The principal topic discussed was farm telephone service. A paper was read by Mr. Charles Norton, secretary of the New Long-distance Telephone Company of Indianapolis on "Toll Systems," after which a general discussion was had. The benefits of the telephone in obtaining for the farmer better prices for his product and its convenience in emergency calls were discussed. It was also agreed that the isolation of farm life has been removed by reason of ready communication. Acting on the mutual plan of giving subscribers for stock a reduction in the price of service, it was the conclusion that no farming community need be without a good telephone exchange. The Union Telephone Company of Carmel, which entertained the association, is a mutual company with about 500 subscribers. Fifty or more exchanges of the four counties were represented in the meeting. The following were elected officers of the association: President, C. B. Jones, Baker's Corner; vice-president, E. H. Gilmore, Westfield; secretary, Leroy G. Patti of Carmel. At the close of the meeting a big basket supper was spread to more than 500 people. Similar associations are being organized among Independent telephone people of contiguous counties all over the state.

It is stated on good authority that a consolidation of all Independent toll-line interests of Indiana, under one company, along the lines of the organization of Ohio Independent toll-line companies, will be the result of the flurry caused by the sale of the United Telephone Company to the Bell people. A committee was appointed at a meeting held in Indianapolis on May 25th, when 15 Independent telephone companies operating near the territory covered by the United company were present to effect some kind of an arrangement after the method adopted by the Ohio companies. George W. Beers of Fort Wayne said that the United Telephone and Telegraph Company of Fort Wayne would at once bridge the gap between Huntington and Marion, at present filled by the United Telephone Company, connecting with the New Long-distant Telephone Company of Indianapolis. All the points reached by the United company's toll line will be covered by the Independents as soon as the necessary franchises can be secured and the lines built. The Independents are arranging to go into the Bell's new field and make a strong fight. A meeting will be held in Fort Wayne in a short time to receive the report of the committee appointed at the Indianapolis meeting and to draft plans for maintaining Independent service in the United company's field. The carrying out of contracts is involved in the controversy. The United Telephone Company has contracts with other Independent companies running six, 20 and as high as 99 years. It is the purpose of the companies that are parties to this contract to insist upon their enforcement. S.

## New York State Independent Telephone Association.

The annual convention of the New York State Independent Telephone Association will be held at the Common Council Chamber, City Hall, Albany, N. Y., on June 16th. A good programme has been prepared, and, from present indications, the attendance will be large. The officers of the association are as follows: President, H. H. Persons, Buffalo; vice-presidents, Howard Hendrickson, Albany, and Boyd McDowell, Elmira; treasurer, T. Harvey Ferris, Utica; secretary, T. S. Lane, Buffalo.

Some very effective work has been done throughout the state during the last year by the organization of district associations, which form a part of the state association. The following districts have been organized: Buffalo, Rochester, Hornellsville, Binghamton, Albany and Troy, Jamestown and Syracuse.

Further information relative to the convention can be secured by addressing the secretary, T. S. Lane, 332 Ellicott Street, Buffalo, N. Y.

## NEW COMPANIES.

The Odell Telephone Company of Odell, Ill., has been incorporated, having a capital of $2,500. George Desvoigne heads the list of incorporators.

Governor Edwin Morris, former Governor B. A. White and others of Montana have incorporated the Southern Montana Telephone Company, with the intention of constructing a telephone line from Bannack to Wisdom, Beaverhead County.

The Mena (Ark.) and Smithville Telephone Company has been incorporated with $5,000 capital stock to construct and operate a telephone system connecting Mena, Ark., and Smithfield, I. T. The incorporators are I. D. Jones, C. A. Smith and G. L. Lockbridge.

The Meadows-Warren-Roosevelt Telephone Company has been organized at Meadows, Ida., with a capital stock of $20,000. Thomas B. Snyder is president; Frank M. Hubbard, vice-president; William E. Webb, secretary, and A. R. Krigbaum, treasurer. The line will be about 120 miles long and will be built at once.

Among the telephone companies which have been incorporated recently are the following: Council Creek Telephone Company, Fullerton, Neb.; Pilot Point Telephone Company, Pilot Point, Texas; Garden City Telephone Exchange, Garden City, Kan.; Falls City Telephone Company, Falls City, Neb.; Union Telephone Company, Pleasant Dale, Neb.; Southern Montana Telephone Company, Dillon, Mont.; Ullin Telephone Company, Ullin, Ill.; Elgin Automatic Telephone Company, Elgin, Texas; West Virginia Independent Telephone Company, Parkersburg, W. Va.; Home Telephone Company, Oneonto, N. Y.

The International Telephone Manufacturing Company of Chicago has recently made arrangements with the Mexican General Supply Company of Chihuahua, Mexico, for handling its equipment for the Mexican trade, and carrying a supply of its apparatus. The stock carried at Chihuahua enables the company to supply its Mexican trade direct from that place.

## GENERAL TELEPHONE NEWS.

The Southern Bell Telephone Company of Virginia, Lynchburg, Va., has increased its capital from $2,000,000 to $2,500,000.

J. A. Werner of Lake City, Minn., has been made local manager of the Minnesota Central Telephone Company at New Ulm, Minn.

A 20-year franchise has been granted to F. B. McElroy of Dallas, Texas, for an Independent telephone system in Shawnee, Okla.

The Southwestern Telephone Company has secured a franchise to construct and operate a telephone system in Stephens, Ark.

The City Council of Girard, Kan., has been petitioned to establish a municipal telephone system. The city already has a municipal lighting plant.

George Woodworth has been elected president and F. A. Hazelbaker secretary of the Southern Montana Telephone Company, which is to build a line from Dillon to the Big Hole Basin.

William G. Hendricks, for a number of years manager for the Sunset Telephone Company at Sacramento, Cal., has been made manager for the northern district of California and part of Nevada. Mr. Hendricks' headquarters will be at Sacramento.

The Southern Bell Telephone and Telegraph Company, with main office at Atlanta, Ga., will, it is reported, make improvements and extensions to its system at Bessemer, Ala., to cost $20,000. Two additional trunk lines are also to be constructed between Bessemer and Birmingham.

The New York and New Jersey Telephone Company is meeting with competition from the local companies in the Riverhead (L. I.) district. The local companies are busy making extensions and the larger concern is offering a residence service as low as $12 a year. The North Shore Telephone Company at Port Jefferson is also taking a hand in the contest.

At a meeting of the directors of the Missouri and Kansas Telephone Company in Kansas City, Mo., it was decided to dispose of the property of the company in Oklahoma and Indian Territory to the Pioneer Telephone and Telegraph Company, a sister organization, in exchange for the property of the latter company in Kansas. This seems to be merely a rearrangement of the lines so they can be managed more economically.

The Co-operative Telephone Company of Detroit, Mich., in accordance with its franchise, has filed quit-claim deeds with the comptroller. The condition is that the company must turn over all of its property subjected to bonded indebtedness to the city before operating the system. The deeds are said by the corporation counsel to contain restrictions and he has instructed their return to be made out in the proper manner.

The annual meeting of the Independent Telephone Association of the state of Missouri will be held at Sedalia on June 8th. Theodore Gary of Macon, Mo., one of the most prominent Independent telephone men of the state, is actively engaged in arranging for the meeting. Mr. Gary is president of the Interstate end of the consolidated National-Interstate Telephone Association, which meets in Chicago on June 20th and 21st.

Sealed proposals will be received at the office of the engineer of the United States Reclamation Service, at Belle Fourche, S. D., until June 25th, for the construction and completion of a telephone system, about 16 miles in length and having four telephone stations. Specifications, forms of proposals and full particulars may be obtained from the chief engineer of the Reclamation Service, United States Geological Survey, Washington, D. C., or the engineer in charge of the Belle Fourche project.

Two elaborate telephone systems are being installed on the steamer Dakota, now under construction for the Great Northern Company. One is an exchange of the ordinary private-plant type, which places the occupant of each room in communication with 150 other stations in different parts of the boat, and the other is an intercommunicating system, which is made use of in the boat's administration. The officers, in making use of the latter, do their own switching. It will largely supplant the gong and jingle systems and the marine telegraph. It extends between the navigating and engine-room stations.

The Japanese, like the Chinese, have no alphabet in the ordinary sense, every word in their written language being represented by a separate character. In telegraphing in these languages, therefore, about 10,000 words are selected, and figures ranging from 1 up to 9,999 are allotted to each word. Each word of a message to be transmitted by telegraph in these languages is then first given its proper number by the telegraph clerk, by means of a dictionary which has been prepared under the authority of the government. These numbers are then transmitted by the Morse alphabet, and when received the message is translated back into the Chinese or Japanese characters by reference to a corresponding dictionary.

## Coming National-Interstate Telephone Convention.

Arrangements for the convention of the National Interstate Telephone Association to be held in the Auditorium Hotel, Chicago, on June 20th and 21st, are being made on a basis for a big meeting. James B. Hoge of Cleveland, Ohio, and Theodore Gary of Macon, Mo., constitute the committee in charge. From these gentlemen it is learned that already there are assurances of at least 15 states being represented at the convention.

The members of the advisory board and executive council will meet in Chicago on June 19th for the purpose of arranging all details of the convention on the following day. It is planned to bring together in Chicago on the 19th 48 representative Independent telephone men, divided into four committees of 12 each, to report on "Standard Operating Rules and Regulations," "Standard Forms of Accounting," "Standardization of Equipment" and "Best Methods of Advertising." The results of the deliberations of these committees will be presented to the convention.

Several papers by men familiar with their subjects have been announced as follows: "Combined Telephony and Telegraphy," by Samuel G. McMeen of Chicago; "Shall the Independent Telephone Companies Have an Insurance Company of Their Own?" by James S. Brailey, Jr., of Toledo, Ohio; "Standard Toll Signs," by L. L. C. Brooks of St. Paul, Minn. Thomas Bromley of Muncie, Ind., will read a paper entitled, "What Arrangement is Necessary Between the Operators and the Manufacturers to Protect Independent Companies." This paper will be responded to by a member of the manufacturers' committee.

A feature of the programme which is intended to give all present an idea of the telephone situation of the country is the arrangement by which each state has been requested to have one representative prepared to give a short talk on the situation in his state.

Arrangements have been made for an address of welcome by Mayor Dunne of Chicago, and a response by Breckenridge Jones of the Kinloch Company, St. Louis. Following these Mr. Hoge and Mr. Gary will address the convention.

June 22d, the day following the convention proper, it has been planned, is to be devoted to inspecting and visiting exhibits, and to such entertainment as the manufacturers, supply dealers and others will tender. The whole meeting is to be wound up with a banquet on the evening of June 22d. This arrangement really makes the convention cover three days—June 20th, 21st and 22d.

## Recent New York Incorporations.

The desire to incorporate new electrical undertakings in the state of New York to come within the advantages of the existing law has resulted in the formation of many more concerns in addition to those previously reported. Among those reported up to May 27th are the following; amount of capital stock and name of one director being given:

Albany, Susquehanna Valley and Binghamton Power Company, Schenevus, $75,000, M. E. Baldwin of Schenevus; Anti-Monopoly Light and Power Company, New York, $100,000, A. G. Stephenson of New York; Aurora Heat, Light and Power Company, Richmond Borough, New York, $5,000, J. E. McDonald of New York; Buffalo and Montauk Company, Buffalo, $2,000,000, Hugh Taylor of Buffalo; Castleton Light, Heat and Power Company, Castleton, $25,000, J. D. Smith of Castleton; Consumers' Power Company of Buffalo, $200,000, J. S. Lambert of Buffalo; Dexter Electric Light and Power Company, Dexter, $100,000, Edward Hunter of Dexter; Dutchess Gas and Electricity Company, Poughkeepsie, $25,000, A. E. Seibert of Brooklyn; General Transmission Company, Buffalo, $15,000,000, J. D. Ferris of Buffalo; Genesee County Electric Light, Power and Gas Company, Batavia, $100,000, S. B. Storer of Syracuse; Holland Electric Power Company, New York, $20,000, G. G. Cooper of New York; Jefferson County Gas and Electric Company, Watertown, $100,000, J. B. Taylor of Watertown; Marcellus and Otis Lake Railway Company, Marcellus, $200,000, G. M. Brill of Merion, Pa.; Minetto Light, Heat and Power Company, Minetto, $20,000, C. B. Benson of Minetto; Niagara and Eastern Power and Transmission Company, Niagara Falls, $2,000,000, H. B. Bodi of Niagara Falls; Niagara Gorge Power Company, Buffalo, $2,000,000, J. T. Jones of Buffalo; Oswego County Light and Power Company, Syracuse, $100,000, H. D. Brewsters of Syracuse; Otsego Transmission Company, Oneonta, $40,000, John D. Capron of Oneonta; Pioneer Gas and Electric Company of Buffalo, $300,000, William S. Carroll of Buffalo; Ritzer Manufacturing Company, Oneonta, $10,000; W. H. Smith of Oneonta; Southern Dutchess Gas and Electric Company, Fishkill, $25,000, J. T. Smith of Matteawan; United Public Service Corporation, New York, $500,000, Charles H. Gardner of New York.

## Power Development on the Tennessee River Near Chattanooga.

The Chattanooga and Tennessee River Power Company has been incorporated, with a capital stock of $3,000,000, by C. E. James, J. C. Guild, R. H. Williams, J. C. Sims and George D. Lancaster, for developing waterpowers and transmitting power by electricity. This company's specific purpose is the development of the power of "The Suck" in the Tennessee River, 13 miles below Chattanooga. It receives a franchise from the city in accordance with recent agreements and has privileges granted by Congress. Its franchise requires the beginning of work within two years and completing it within four years, together with the necessary rights for stringing wires, constructing conduits, etc., for plant and transmission lines.

# CORRESPONDENCE.

## Great Britain.

London, May 16.—The judgment in the case between the Swansea corporation and the National Telephone Company, mentioned last week, went against the company. It will be remembered that the contention of the corporation was that under the Telegraph Act of 1899 any municipality holding a telephone license could apply to the National Telephone Company in the same area for intercommunication between the two systems, and that inasmuch as "facilities" were not defined in the act a common sense view of the matter should be taken, and only the necessary connection between the two rival main exchanges should be made. The company, on the other hand, argued that as the act contemplated intercommunication between the two systems and not between the two exchanges, complete intercommunication was intended and not half measures. The difference of opinion arose owing to the bad drafting of the Telegraph Act of 1899, and, realizing this, the judge intimated that he had a jurisdiction in the matter so far as trying to make the act work was concerned. Accordingly, he declared that to connect the main exchanges of the corporation and the company and two smaller exchanges was all that was sufficient to meet the needs of the case at present, but the company could apply for further direct connection between the other exchanges when the traffic warranted it. The time given to the company in which it may appeal to a higher court has not yet expired, but so far nothing has been made known of its intention.

Mention was made some time ago of the suggestion that the County Council of Durham should embark upon a scheme of "bulk" supply of electricity somewhat on the lines of the great power companies of the United Kingdom. After much discussion the matter was temporarily dropped, owing to it having been ascertained from counsel that without special parliamentary powers such an action would be ultra vires. The proposal has now been revived and it has been unanimously resolved by the special committee to promote a bill in Parliament. This resolution has, however, not been finally considered by the County Council itself, and it would appear that the approval of the Local Government Board, the loan-sanctioning authority, would be necessary to ensure success. Already two power companies have authority over portions of the County of Durham.

The carrying of goods traffic upon electric tramways has much increased in Great Britain during the last twelve months. A test case, however, is threatened in the law courts with regard to the rights of the Manchester corporation in this matter. Last year the Manchester corporation received parliamentary powers to carry goods and parcels upon its tramways and naturally was opposed by the local carriers, but unsuccessfully. The corporation had inaugurated the system and in addition has added a system of collection and delivery of goods by means of vans and carts. This latter proceeding, the local carriers contend, is illegal, and an injunction is asked to restrain the corporation from so doing.

Much criticism is at present being heaped upon the Royal Commission on London Traffic for its laxity in presenting a report to the government, and many unkind suggestions are being made as to the reasons why. One daily paper has boldly stated that the chairman of the commission was absolutely ignorant of the subject, and that the commissioners are absolutely at loggerheads as to the final form of the report. Too much notice cannot be taken of such comments, yet serious delays have occurred by the protracted proceedings, and I hear that last week further evidence was being heard privately. It is now officially stated that the report will be available within a month. It is also stated, not officially, that many orders for copies of the report have been sent over from America.

The difficulty in which the Torquay corporation has been placed with regard to the Dolter Electric Traction Company, owing to the refusal of the Local Government Board to sanction a loan for extension of works, has not yet been avoided. As I have pointed out, the corporation is under an agreement to supply the company with power for tramways, which will be ready in August. This supply cannot be given without erecting new works, but to this the Local Government Board has demurred on the ground that the existing works are unremunerative. Thus placed between two stools, the corporation is threatened with an action for damages by the tramway company, and in consequence it has been decided to place the desperate circumstances in which the corporation is placed before the Local Government Board with a request that the original scheme be sanctioned.

The result of the "inquest" upon the recent fires at the exchanges of the National Telephone Company in London has been a recommendation by the coroner that a government inquiry into the whole question of telephone risks generally and their prevention should be held, and that such inquiry should be followed by the acquiring by the Legislature of special powers regulating structural and other matters connected with the telephone serv- [illegible] are on the [illegible]

[illegible]

## New York.

[illegible] which included the chief cities of Canada. Yesterday the delegates visited the workshops of the General Electric Company at Schenectady.

The plans [illegible] been furthered [illegible] half of the city, of a block at Ninetieth and Ninety-first streets, Avenue A and East River, for $350,000. Three small parcels of land at Ravenswood, L. I., have also been acquired in connection with the civic scheme.

Governor Higgins yesterday signed the bills which will transfer franchise-granting privileges from the Board of Aldermen to the Board of Estimate and Apportionment.

State Attorney-general Mayer delivered on Wednesday a decision in favor of the legal status of the New York, Westchester and Boston railroad, mainly on the ground that the company had already received a franchise from the city of New York and paid a portion of the compensation provided under penalty to complete its system. Following the decision the Westchester company announced that it will commence the construction of its lines in the Bronx on June 5th. This scheme is for a four-track third-rail electric line crossing all streets either above or under grade.

The National Consumers' League is the latest to protest against proposals to add to the existing tracks on the Second and Third Avenue elevated lines. A hearing on this proposition will be held on June 8th if the Interborough files its application in time. Civic bodies on the East Side are allied with the Metropolitan interests in opposing this plan, but many Bronx committees are in favor of it, because the Interborough company has offered a through five-cent fare, with transfers between points in the Bronx and Manhattan served by their elevated or subway lines.

President H. H. Vreeland of the Metropolitan Street Railway Company announces the placing of contracts for the improvement of the car service at the Williamsburg Bridge and the possible completion of the work by November next.

The competition for passenger traffic on the Fourth Avenue route has caused the Metropolitan Street Railway Company to put up a large sign at Thirty-fourth Street and Fourth Avenue, pointing out sundry advantages of transferring to the surface cars at that point.

The Brooklyn Transportation Reform League has laid before the Rapid Transit Commission a plan providing for through elevated traffic between the Bronx and Coney Island, via the Third Avenue elevated line.

An antiquated horse car designated as "No. 1" is still in daily use on the Eighteenth Street crosstown line and has apparently not been repainted within the last 25 years. D. W. W.

## New England.

Boston, May 27.—A number of the delegates to the International Railway Congress were the guests of the local railroad men and the city of Boston on Monday, being shown the points of interest to them as railroad men and given a harbor excursion, with a luncheon on board, on a steamer placed at their disposal by Mayor P. A. Collins, who accompanied the party. There were about 30 participants.

The Cambridge subway bill was given free course through the Legislature this week under suspension of rules, and the city will have an underground structure on terms agreeable to the Elevated Railway Company and the city government instead of the noisy and unsightly overhead system which was authorized a few years ago.

Plans have been completed and forwarded to Washington for a central-power, light and heat plant at the Charleston navy yard. At the yard there are now nine distinct plants for steam, electric and other power and light-producing purposes. The various scattered plants will be concentrated in the new power and lighting station which is nearing completion in the yard. There are already installed two 100-kilowatt rotary converters and two more of 500 kilowatts have been advertised for.

There are two turbines of 1,100 horsepower and a 750-kilowatt generator also in place.

The Hampshire and Worcester street railway, which has been in the hands of a receiver since last January, has been permitted to resume operations by order of the court, and commenced running cars again last week.

The Pittsfield Street Railway Company will install turbines in the new power plant which is to be built for the railway.

Formal transfer of the Hartford, Manchester and Rockville Tramway Company to the Boston and Worcester Street Railway Company is expected to take place June 1st. Boston interests will take 2,000 of the 3,000 shares at $205 per share. The preliminary work for the Hartford and Worcester road is under way. This road is the one to be built by the Shaw syndicate, which is in control of the necessary links to connect the Boston and Worcester road with a through line to Hartford.

B.

## Dominion of Canada.

Winnipeg, Man., May 27.—Bids are being asked for the delivery of 1,500 electrical horsepower to the city of Winnipeg at a point in the city to be agreed upon, power to be paid for monthly by the city, the quantity used to be determined by meters placed on the company's incoming switchboard. A marked check for 5,000 is to accompany the tender, and in case of acceptance the contractor must deposit $20,000 within 30 days, both sums to be retained by the city as security for the completion of the work and transmission of the power to the city. The city will also receive proposals for the sale to the city of waterpowers in the neighborhood, tenders to be sent to City Clerk C. J. Brown not later than June 12, 1905.

The Town Council of Yorkton, N. W. T., is making arrangements to install an electric-light plant. Mayor Robert Locke may be communicated with.

Equipment for Leitch Bros.' new electric-light plant at Sak Lake, Man., has arrived and is being installed. In addition to lighting their mills it is contemplated to light the town if the plant is found to be large enough to do so.

The rate-payers of Dauphin, Minn., have voted $25,000 for the purchase of an electric-light plant.

The Town Council of Carberry, Man., has made all the necessary arrangements and reached an agreement with J. H. Boyes for the installation of an electric plant.

The docks of the Rainy River (Ont.) Navigation Company on the Canadian side, immediately at the head of the canal at the International Falls, are so located as to interfere with the building of the cofferdam that is to be used to turn the water of the river into the canal while the American side of the dam is being built, and it will be necessary to blow them out. New docks will be built for the company about three blocks further east.

The Canadian Westinghouse Company of Hamilton, Ont., has sold a 500-kilowatt enclosed-type turbo-generator unit to the Canadian Pacific railway. This unit is to be installed at Port William, Ont., on the Canadian Pacific railway and to be used for supplying power to the various grain elevators at that point. The unit is to operate three-phase, 600-volt, 7,000 alternations, 3,600 revolutions per minute.

H.

## Ohio.

Cleveland, May 27.—Officers of the Ohio Traction Company of Cincinnati, incorporated a few days ago with a capital stock of $20,000,000, have been chosen as follows: President, W. Kelsey Schoepf; vice-president, Charles P. Taft; secretary, S. C. Cooper, who is also secretary of the Cincinnati Traction Company; treasurer, A. L. Meyers. This company takes the place of the Union Traction Company, which was incorporated under the laws of New Jersey. It is stated that negotiations have been started to secure the Toledo, Bowling Green and Southern for the purpose of getting into Toledo with a line that is proposed to connect with the Northern Traction Company's line. The capital stock has been divided, one-half preferred and the remainder common. Of this, $8,500,000 of the preferred will be issued and $1,938,000 will be offered to the public at 105.

An attempt will be made to regulate the price of electric light in Cleveland, it is said, and if this cannot be done with the old company, an ordinance granting a new company a franchise will be submitted to a vote of the people, as required by law.

Of the $800,000 which the Mansfield, Ashland and Cleveland road will require for construction, it is said that $700,000 has been pledged.

Construction work on the Avon Beach and South Lorain line will be commenced in a few days. Private right-of-way has been secured for the whole distance, including entrance to South Lorain.

The Provident Savings Bank and Trust Company, receiver for the Barriett Electric Company, Cincinnati, reports estimated value of the plant as from $8,000 to $10,000. Open accounts due are $3,032.50, but only $190.61 has been collected after diligent effort.

The Edwards Electric Headlight Company, organized by the bondholders of the Edwards Railroad Electric Light Company of Cincinnati, has been organized to acquire the plant at Laporte, Ind., which was bid in at receiver's sale by M. K. Northam a few days ago.

The capital stock of the Toledo and Western will be increased from $1,800,000 to $2,500,000 at an early date, according to plans announced some time ago. This has become necessary because of the varied industries which have located along the line, necessitating more freight cars and other equipment and extension for the purpose of making connections with some of the western lines.

O. M. C.

## Indiana.

Indianapolis, May 27.—The City Council of Decatur has amended the franchise granted the Springfield, Decatur and Fort Wayne traction line so as to make the life of the franchise 50 years instead of 30. The franchise binds the company to maintain its power house in Decatur.

Wallace Campbell of Anderson, who is promoting an electric railway to run from Anderson through Noblesville and Lebanon to Crawfordsville, announces that he has arranged with St. Louis men to finance the enterprise. It is now proposed to furnish power for the line by a dam across White River above Noblesville.

Edward Daniels, master in chancery at Indianapolis, under a decree of the Federal Court, has sold to U. D. Mallory of Batavia, Ill., and T. W. Spence of Milwaukee, Wis., the electric railway between Laporte and Michigan City. The purchasers represent the bondholders who have organized the Laporte and Michigan City Traction Company, with a capital stock of $400,000. Stock will be assigned to the Indiana Railway Company, which will turn over to the bondholders bonds to the amount of $350,000. The purchase price of the road was $450,000.

The Columbus Street Railway and Light Company is arranging to build a new power house at Second and Sycamore streets. With the new power house will be combined a central steam-heating plant.

The Fort Wayne and Wabash Traction Company will extend its line to Battle Ground this summer. The extension will start at the Soldiers' Home. The distance is four miles. The next link will be an extension between Battle Ground and Logansport.

The Lake Erie and Western railroad has placed through tickets on sale between local points where interurbans compete at a rate of one fare for the round trip. Two people can use these tickets one way, or one person for the round trip, and they are good for 10 days.

The Indiana Union Traction Company has decided to discontinue its present system of collecting fares on interurban cars and will sell tickets at stations in the cities and towns along the 210 miles of interurban lines. The passenger who fails to buy a ticket before boarding a car will be compelled to pay a full one-way fare to his destination.

The Supreme Court of Indiana holds that the act of 1903, authorizing interurban railroads to cross steam railroads at grade, makes it the imperative duty of the interurban road to put in interlocking devices within six months under penalty of forfeiting all rights to continue the use of the crossings. A temporary injunction forbidding the Monon railroad to tear out the tracks of the Indianapolis and Northwestern Traction Company where it crosses the steam road, near Frankfort, was dissolved, and unless the interlocking device is constructed the steam company will have a right to tear out the crossings.

Articles have been filed with the secretary of state for the incorporation of the Edwards Electric Head Light Company of Laporte. The capital stock of the company is $250,000. Charles A. Goodyear heads the board of directors.

Farmers within eight miles of the city of Anderson are applying for connection with the municipal electric-light plant for light and power. The farmers agree to set the poles, and the expense to the company will not be great on that account. Besides electric light for their homes and barns, the farmers want current for small motors to drive feed mills, churns and other machinery.

S. S.

## Michigan.

Detroit, May 27.—The exponents of municipal ownership in Detroit have been advocating the building of a test street railway on some street not now occupied by the Detroit United railway and of leasing it to that line. The Detroit United, however, refuses to enter into any such arrangement, and now the attention of the city officials is turned to the suburban lines entering the city over leased lines owned or controlled by the Detroit United. It is stated that a proposition has been made the Detroit, Monroe and Toledo electric railway to use a track which would be built by the city extending from the City Hall to the western limits. The track would be built double and the arrangement would carry with it a local service by the interurban line within the city limits at a three-cent fare. It is also stated that the Detroit, Ypsilanti, Ann Arbor and Jackson line was approached with a similar proposition. The fact of any such negotiation being in progress has been denied by officials of both of these lines.

The Traverse City Traction Company has been organized by W. H. Blake of Cheboygan, who will put on a line of automobile busses to run through the city streets the same as street cars, and also run round the bay shore to the near-by summer resorts. Each car will have a capacity of 12 passengers. The cars will be operated by gasoline engines.

The Detroit, Ypsilanti, Ann Arbor and Jackson electric road has found its present cars inadequate to the increased business this spring and is now experimenting with larger ones.

It is understood that the contract for the electric railway between Toledo and Ann Arbor has been let to the Fidelity Construction Company of Detroit. Overhead construction will be used for the entire distance. The line is about 46 miles in length and runs through Milan and Dundee. No very difficult grades will be encountered and it will be nearly an air line. The road will be operated by the Toledo and Ann Arbor Traction Company.

The interurban railways in this state are taking advantage of the new law giving them the right to condemn property. The Jackson and Lansing railway will file a map with the railway commissioner preliminary to commencing proceedings to obtain right-of-way near Mason. This company will also ask for grade crossings with two steam roads at Lansing. The South Bend and Southern Michigan has also filed a map showing separated crossings with three steam roads which it will cross between Niles and St. Joseph.

The Michigan Central railroad, it is said, has now decided to cross the Detroit River by tunnel. A double tube will be used and cars will be operated but one way in each. The equipment will be entirely electric and a large power house will be constructed on the Detroit side. The work will be started within 90 days from the Canadian side, so that the operation on the American side will not be affected until the tunnel is about completed. The estimated cost is $7,500,000 and the time to complete it over two years. The work will be under the supervision of W. S. Kinnear, chief engineer of the Michigan Central railroad. The Michigan Central is said to have made extensive surveys in the vicinity of Ypsilanti, and it is stated that a large dam will be constructed in the Huron River at Hudson. Options have been secured for a large amount of property in this region. It is not known to what use this large power will be placed.

C. G. W.

## Northwestern States.

Minneapolis, May 27.—The franchise granted last fall at Sioux City, Iowa, to Des Moines capitalists for a street-railway system has been annulled on the failure of the grantees to file a suitable bond within the six months.

The Western Union Telegraph Company is planning about $15,000 worth of improvements at Green Bay, Wis.

The council of Stoughton, Wis., has voted to purchase the electric-light and power company's plant at that place, $12,000 being the price to be paid.

Fred T. Yates of Washburn has received a franchise at Glenwood, Wis., for an electric-light plant and will start work at once. The system will be in operation within 60 days.

The contract for constructing the new electric-light plant at Moorhead, Minn., has been awarded to the Westinghouse Company of Pittsburg at $18,750.

R.

## Pacific Slope.

San Francisco, May 25.—Chief Engineer Rogers of the Ocean Shore Railway Company, which purposes running an electric railroad from San Francisco south along the ocean shore as far as Santa Cruz, states that the 83 miles of road between San Francisco and Santa Cruz can be completed within two years. The company has made inquiries for ties and other material. Electric locomotives will be used on the road and two power stations will be established. The company has opened offices at 132 Spring Valley Building.

The Ione Electric Light and Power Company, owned by Jackson Dennis, George Henry and others, has been incorporated with a capital stock of $30,000. The company has built a sub-station at Ione, Cal., and has constructed a three-phase transmission line from Ione to Mantel, where power will be secured either from the American River Electric Company or from the California Gas and Electric Corporation. The new company will distribute light and power in the town of Ione.

Proposals will be received by Sam J. Zerbe, city clerk of Fort Braggs, Cal., till June 26th, for a franchise to erect, construct and operate an electric plant for the purpose of generating electricity to furnish heat, light and power to the town of Fort Braggs, Cal., as applied for by the Fort Braggs Electric Light Company.

The Truckee River General Electric Company has a $250,000 contract to supply power to drain the Comstock mines, and has concluded to erect an

entirely new station at Virginia City, instead of building an annex to the present station.

A cable of the California Gas and Electric Corporation carrying 4,000 volts from the Nimbus and Centerville power stations to the gold dredgers working at Oroville, broke recently and fell on a wire of the Oroville telephone system, burning out a portion of that system.

The electric light and power plant of the Truckee Electric Light and Power Company, Truckee, Cal., was destroyed by fire a few days ago. The loss is placed at $40,000.

E. V. Walbridge has been granted a franchise to construct and operate an electric railroad along the public road leading from Red Bluff to Tuscan Springs, Tahama County, Cal.

The town trustees of San Leandro, Cal., are now securing figures on the cost of construction of an electric fire-alarm system.

I. W. Anderson, president of the Northwest Gas and Electric Company of Walla Walla, Wash., who has secured the franchise recently granted to E. S. Isaac, states that the company will build a system of street railways at Walla Walla during the present year.

The San Joaquin Light and Power Company has filed articles of incorporation at Fresno, Cal., the incorporators being A. C. Balch, Kaspero Cohn, Abe Haas and others. The capital stock is $3,000,000. The headquarters of the company are at Los Angeles.

Manager Thompson of the Red Boy Mining Company, Baker City, Ore., states that the company will expend $150,000 in the development of its Olive Lake electric power scheme. Work will begin at once.

The United Railroads of San Francisco has placed an order with an eastern car manufacturing concern for 50 new electric cars of a design similar to those now in use on the Ellis and O'Farrell streets line. The new Cliff line, formerly operated as a steam-dummy line, was placed in operation on May 27th.
A.

## PERSONAL.

Baron Alphonse de Rothschild of Paris, whose death occurred recently, was one of the honorary members of the National Electric Light Association.

It is reported that Paul Morton, secretary of the navy, will probably accept the presidency of the Interborough Rapid Transit Company of New York city.

Abraham White, who is president of the De Forest Wireless Telegraph Company of America, sailed for Europe on May 25th on board the steamship Deutschland. He will land at Plymouth and go to London for the purpose of organizing an English De Forest company.

Edward J. Wheeler, for 10 years editor of the Literary Digest of New York, has assumed the editorial control of Current Literature. Alexander Harvey and Leonard D. Abbott will also go with Mr. Wheeler from the Literary Digest to Current Literature. Mr. Wheeler is an able editor and has made the Literary Digest one of the best journals of its class in the country.

Thomas G. Grier, one of Chicago's well-known electrical men, has returned from a journey to the Mediterranean and to Egypt, undertaken for rest and recreation. Mr. Grier sailed from New York on January 30th, making his first stop at the Madeira Islands. He was absent from the country about three months and a half, and during that time gave himself up to the delights of foreign travel. He returns to his electrical business in Chicago with renewed zest and vigor.

At a meeting of the board of directors of the Westinghouse Electric and Manufacturing Company held in New York a few days ago E. M. Herr was elected first vice-president and chief executive under the president. The advent of heavy electric traction and the adoption of electricity by main-line railways render the services of a man skilled not only in manufacture, but also conversant with railroad operations, especially desirable at this time. There are few men who are more widely known among railroad managers and in whom more confidence is reposed than in Mr. Herr. He was locomotive superintendent of the Northern Pacific railway for a number of years, and previous to that had many years' experience in various positions on important railways in the West. For the last seven years he has been vice-president and general manager of the Westinghouse Air Brake Company. The Westinghouse Electric and Manufacturing Company has now four vice-presidents—E. M. Herr, Frank H. Taylor, L. A. Osborne and Newcomb Carlton, which makes an especially able and efficient force of officials. It is said that the works at East Pittsburg have never in the history of the company been so busy with the construction of electric-railway apparatus as at present. The exhibition tests recently made before the delegates of the International Railway Congress with the large 1,350-horsepower electric locomotive gave the visitors an idea of the possibilities of electric motive power in railway service.

## ELECTRIC LIGHTING.

The [illegible] Light Company [illegible] has been incorporated [illegible] capital [illegible] $5,000.

It is reported that the city of [illegible], Mo., [illegible] $10,000 of bonds for the [illegible] electric-light plant.

Plans have been completed for the [illegible] new electric-light plant at the [illegible] in Higginsville, Mo. The plant [illegible]

At the special election in Breckenridge, Mo., the question to bond the city for $10,000 for the purpose of putting in an electric-light plant was carried.

Nixon & Kimmel have been granted a franchise and will install a lighting system at Rathdrum, Ida., under the name of the Rathdrum Electric Lighting Company.

Hiram Phillips of St. Louis, Mo., has been engaged by the city of Jackson, Mo., as engineer in charge of the construction of waterworks and an electric-light plant to be built at a cost of $40,000.

The Warren Light and Water Company of Warren, Ark., has been incorporated with $20,000 capital stock by Fred Purcell, J. A. Wells, W. J. Savage and others to operate a system of waterworks and an electric-light plant in Warren.

The Cramer Electric Company of Hailey, Idaho, will take over the property and franchise of the Idaho Electric Supply Company, and will furnish light and power for Hailey and Bellevue. An entirely new plant will be installed.

The city of Breckenridge, Mo., has voted $10,000 of bonds for the installation of an electric-light plant of about 100 horsepower to accommodate about 25 arc and 1,200 to 1,500 incandescent lights. A stone building 50 by 45 feet will be erected.

## ELECTRIC RAILWAYS.

A charter has been issued to the Oklahoma Traction Company of Oklahoma City. The company has a capital of $300.000.

A franchise for an electric railway in Chickasha, I. T., has been granted to Julius E. Wright, S. Howard Leach and J. A. Bohart.

Three companies are seeking a franchise for an electric railway in Tulsa, I. T.: two local companies and the Arkansas Valley Interurban Company, now building from Wichita, Kan.

The Oklahoma Traction Company of Oklahoma City, with $300,000 capital stock, has received a territorial charter for the purpose of connecting Oklahoma City, Capital Hill and Lexington by an electric railway 40 miles in length. C. V. Egleston of Oklahoma City, is an incorporator.

The City Council of Monroe, La., has awarded the contract for the construction and equipment of the electric-street railway to the Western Electrical Construction Company of St. Louis for $100,000. Work must be commenced at once and completed in six months. There will be about 6½ miles of track.

In the United States Circuit Court, Western District of New York, Judge Hazel has granted a temporary injunction in the suit in the under-running trolley case involving the Van Depoele reissue patent, No. 11,872. The Thomson-Houston Electric Company, complainant, applied for a preliminary injunction restraining infringement of the patent. The International Trolley Controller Company is the defendant.

The recently organized American Engineering Company of Indianapolis, Ind., has closed a contract with the Huntington, Columbia City and Northwestern Traction Company for the construction and complete equipment of the proposed lines of the latter company from Huntington to Goshen, and eventually to South Bend. The contract represents work to the value of about $1,500,000. C. N. Wilson is president of the engineering company.

The street-railway system in Galesburg, Ill., owned by the Galesburg Electric Motor and Power Company, was given over on May 26th to the ladies of the Galesburg Hospital board, and the proceeds of that day were donated to the charitable institution. Mrs. J. K. Mitchell acted as general manager, and assisting her were Mrs. Andrew Harrington, Mrs. W. E. Phillips, Mrs. H. F. Wetherbee and Mrs. J. Grant Beadle. A large number of the prettiest girls of the city served as conductors.

Eastern men have purchased the holdings of Cleveland men in the Kansas City and Leavenworth Traction Company and now own a controlling interest in it. Judge C. F. Hutchins of Kansas City, Kan., was in Cleveland some time ago and secured an option on the stocks and bonds held by W. H. Gabriel, D. H. Kimberly, C. O. Evarts and others. Fisk & Robinson, New York bankers, and other capitalists of that city are the new owners of the property, and it will be reorganized under the name of the Kansas City and Western Railway Company.

## PUBLICATIONS.

[illegible]

[illegible] publ[illegible] dull care away."

[illegible] been issued by the manufacturer and gives all the salient points in their construction and operation, besides price lists for the convenience of the buyer.

The [illegible] of Barrington, Mass., describes its rotated jewel-bearing wattmeters in a new bulletin. These wattmeters, which are for alternating-current circuits, may be easily installed [illegible] given in the bulletin, the various connections being shown by diagram. The bulletin will be found a useful one as it contains directions for assemblying, calibrations, etc.

$H_2Mg_3Si_4O_{12}$ is the formula for the material which in manufactured form is known as Lava, made by the American Lava Company of Chattanooga, Tenn., and described by the company in an attractive mailing card which it is sending out to the trade. This material is used in instruments requiring a fixed relation of their parts under all conditions, as it neither swells nor shrinks in atmospheric moisture, and its temperature coefficient of expansion being negligibly small.

Lighting of banks and office buildings, where good light is an important consideration, is made the subject of a well-written and pleasingly illustrated booklet issued by the Nernst Lamp Company of Pittsburg, Pa. A number of fine interior views of banks are shown in the booklet, illustrating effects which may be obtained with Nernst lamps, in rooms of large size and ornate architecture. A picture is also shown of the Farmers' Bank Building in Pittsburg, where 2,300 Nernst lamps are in use.

"Tomorrow's a myth; get busy forthwith! Today is a fact; act, man, act." This is the advice which the Yost Electric Manufacturing Company of Toledo, Ohio, gives to its customers on a neat mailing card which it is sending out (with the permission of Theodore F. MacManus). The company says that the General Electric Company instituted suit against it for infringement of the Palmer patent covering fiber linings for sockets. The patent was declared void in the lower court, and the decision is now affirmed, the Yost company says, by the Circuit Court of Appeals.

Two new bulletins of the Westinghouse Electric and Manufacturing Company describe, respectively, portable instruments and direct-current multiple arc lamps. The instruments described in one of the bulletins are particularly designed for field service, in testing instruments at points of installation and in making comparisons with other standards. The multiple arc lamp is for 110 and 220 volts. The lamp is of an improved design and is thoroughly described in all its details in the bulletin devoted to it. It is of the direct-lift type, the pull of the magnets being directly upward, and the parts arranged to secure uniformity of action.

"In these days, when catalogues are 'thick as leaves in Vallombrosa,' it may seem to some unnecessary that another one—and that one on so well-known an article as a file—should see the light," says the G. & H. Barnett Company of Philadelphia, proprietor of the famous Black Diamond File Works. Nevertheless this company has issued a well-executed article of the catalogue order which proves that even so rough an article as a file may be described in an interesting manner. The catalogue contains 42 pages in which are illustrated every shape of file in common use, even including horse rasps for the farrier. In all there are 205 different shapes and sizes shown. Numerous medals have been awarded the company by the leading expositions. The illustrations will prove of value to the mechanic who is often in search of some special shape or cut of file for his particular use.

## SOCIETIES AND SCHOOLS.

The engineering department of the South Dakota Agricultural College at Brookings is said to be having quite a demand for young men to fill positions in electrical engineering. Roy Elliott of this school recently took a position in the testing department of the General Electric Company.

At the sixth annual commencement of the Thomas S. Clarkson Memorial School of Technology, Potsdam, N. Y., on June 9th, C. J. H.

Woodbury, assistant engineer of the American Telephone and Telegraph Company, Boston, Mass., will deliver the address to the graduating class on "The Engineer as an Economist."

Worcester Polytechnic Institute will hold its commencement-week exercises on June 4th to 8th, on which latter date the graduating exercises will be held in the Assembly Room of Boynton Hall. The annual commencement lecture will be given by Mr. W. W. Bird, professor of mechanical engineering and director of the Washburn shops of the institute. His subject will be "The Labor Problem from an Engineer's Point of View."

Plans have been filed for the United Engineering Building in New York. The building will occupy five lots at 2533 West Thirty-ninth Street, going back to two lots on Fortieth Street. The structure will consist of 13 stories in the French renaissance style. The American Institute of Electrical Engineers will occupy the whole of the tenth floor and will of course share those parts of the building not specifically devoted to the mechanical and mining fraternities.

At a special meeting of the Chicago Trade Press Association on Monday evening, May 29th, at the Hamilton Club, the members were addressed by the Hon. Edwin C. Madden, third assistant postmaster-general. Mr. Madden's subject was "The Postal Service and the Publisher." The attendance was large, and Mr. Madden's lucid address was listened to with profit and pleasure. J. Newton Nind, president of the association, followed with an address in which he set forth the aims and purposes of the association.

## MISCELLANEOUS.

Henry K. Goodwin of Lawrence, Mass., who has served nearly 20 years in Charlestown prison for the killing of Albert D. Swan, has been granted a pardon. The Boston Post says: "Goodwin shot Swan August 27, 1885, under the delusion that Swan had robbed him of valuable [electrical] patents. He has been a model prisoner and a useful one, having installed the entire electrical plant in the institution. A self-imposed condition of the pardon is that Goodwin is to leave Massachusetts."

An electrical interlocking device to be used in connection with block signals as a safety device is being installed on 600 miles of the main line of the Illinois Central railroad. An electrical appliance in each tower will prevent the operator from changing his own signals until the man in the next station releases the lock. Under the ordinary block signal, which has been regarded for 25 years as entirely protective, the movement of trains has been controlled by one signalman at a time. While he was able to hold a train between two blocks, he also had power to release it at will. General Manager Rawn had come to the conclusion that the only way absolutely to block trains is to place their control in the hands of two operators instead of one.

## TRADE NEWS.

Dodge & Day of Philadelphia, Pa., made a preliminary examination a short time since of the plant of the Link-Belt Machinery Company, Chicago, Ill. As a result, considerable additional electrical equipment will probably be installed.

Sealed proposals are being invited until June 13th by the bureau of supplies and accounts, Navy Department, for furnishing eastern navy yards with the following: Schedule 275, electrical supplies, wire, cable, incandescent lamps; schedule 277, telephones, electric elevator. Blank proposals can be obtained on application to the bureau or to the navy pay office in New York.

Sealed proposals will be received at the office of the supervising architect of the Treasury Department, Washington, D. C., until 3 p. m. on June 14th for the installation of an electric passenger elevator and an electric dumbwaiter in the United States Marine Hospital Building at Savannah, Ga. Copies of drawings and specification may be obtained at the above address.

A quartette of men prominent in manufacturing circles represented the H. W. Johns-Manville Company of New York at the International Railway Congress recently held in Washington. They were T. F. Manville, president of the company; J. E. Meek, who had charge of the company's exhibit; L. B. Melville, and James Younglove, manager of the Chicago office. The company had an interesting display of its Asbestos and Magnesia products and other electrical displays.

A new consulting engineering concern, known as the Milwaukee Enginering Company of 50 Hathway Building, Milwaukee, has been formed to a general electrical, mechanical, hydraulic and civil-engineering business, such as the erection of electric-light and power plants, street railways and sewage systems, including steam heating by exhaust. The engineering departments are under the direct charge of W. Ross, an able and experienced engineer, whose assistants are engineers of repute. The company makes valuations for bonding companies, for cities which contemplate the purchase of existing plants and of fire losses on electric machinery.

The American Electric Fuse Company of Chicago has made itself known the world over by its protector devices, but it is a surprise to some to know that this same company is reputed to be the largest manufacturer in the country of copper and iron joints. At this season of the year it is turning out over 1,000,000 a month. Its tinned copper joints for iron wire are a great success and are being adopted for standard construction.

The Osburn Flexible Conduit Company's Chicago office, in charge of I. A. Bennett, manager for the western territory, is now located at 141 South Clinton Street, where it occupies a large store and warehouse and carries a complete stock of Flexduct flexible conduit. The company states that it is prepared to fill all orders immediately from Chicago stock, and requests for samples and advertising upon this already well-known conduit will be promptly handled by Mr. Bennett.

Suit was begun on May 13th by the St. Louis Union Trust Company as trustee and the Wagner Electric Manufacturing Company as licensee against the Century Electric Company of St. Louis for alleged infringement of United States patents No. 458,162, No. 530,176 and No. 530,177. These are patents relating to the Wagner company's type of single-phase motor, and under them the Wagner company enjoys an exclusive license from the St. Louis Union Trust Company as trustee for the owner of the patents.

Foree Bain, Chicago, the well-known patent lawyer and expert in patent causes, announces that the business which he has conducted for many years in the Monadnock Building will hereafter be conducted under the firm name of Foree Bain & May, with new offices at 947-949 Monadnock. George T. May, Jr., formerly of Washington, who has been associated with Mr. Bain for the last three years, becomes a partner in the business. Mr. May is well known in the profession and enjoys the confidence of Mr. Bain's clients.

Exporters and importers are requested by Urbain J. Ledoux, American consul at Prague, Bohemia, to send him their latest catalogues, together with city and cable address, codes, reference or commercial rating, discounts and terms, languages of correspondence, nature of exports and imports, list of foreign branches and agents, and other commercial information. This will be filed in the consulate at Prague to facilitate sales. The kingdom of Bohemia has a population of over 6,000,000, in the heart of Europe, and is practically virgin territory for American exporters.

The Universal Electric Equipment Company of Birmingham, Ala., having completed experiments, has located a plant in Birmingham, where it will manufacture an electric train-lighting system. The stockholders of the company are largely Birmingham men. John L. Parker is president; A. W. Nelson, vice-president; G. G. Sharpe, treasurer; J. H. Thompson, chief engineer, and Daniel Rogan, secretary. Besides the lighting system the company will manufacture a wind-driven lighting plant for isolated places and other devices. The manufacturing will be done under the supervision and patents of Mr. Thompson.

## BUSINESS.

Mathias Klein & Sons of 81 West Van Buren Street, Chicago, the well-known makers of linemen's and other construction tools, report a flourishing business.

The Baltimore Engine Company, to do mechanical and electrical engineering, has been incorporated with an authorized capital of $100,000 by H. S. Roop of Baltimore, Md., and John and William Harris of Camden, N. J.

W. C. O'Brien, John Watson, Jr., G. H. Whittingham, Randolph Barton, Jr., and R. C. Stewart, all of Baltimore, Md, have incorporated as the Whittingham Manufacturing Company, to engage in the electrical business in Baltimore.

An improved receptacle now manufactured by Pass & Seymour of Solvay, N. Y., has a porcelain extension on the side to carry the two supporting screws. There is also a substantial porcelain backing under the brass lugs. The receptacle is made in accordance with the latest code rules.

The National Battery Company of Buffalo, N. Y., will have an extensive exhibit in the rotunda of the Brown Palace Hotel at Denver, Colo., during the coming convention of the National Electric Light Association, which will be held June 6th to 11th. The exhibit will be in charge of J. Walter Gillette, general sales manager.

The Challenge primary battery, manufactured by the Challenge Manufacturing Company of Newark, N. J., in the matter of efficiency and mechanical construction will hold its own with the best. The company says that the battery has an extremely low internal resistance, with absence of local action. It will maintain a high electromotive force under heavy discharge without polarization, and the elements are made of the best materials obtainable—requisites of a good battery.

The S.-E. Missouri Cypress Company, Campbell, Mo., producer of cypress telephone and electric-light poles and ties, announces that it has been compelled to double its capacity to fill the orders received from the electrical and allied companies. The company will be pleased to hear from those in the market for poles and ties.

W. R. Ostrander & Co. of New York, manufacturers of speaking tubes and electrical supplies in general, take pleasure in the increasing satisfaction which their customers display regarding the company's sockets and receptacles. They take particular pride in a recommendation of their long type of socket from one of their customers, who uses over 200,000 in a year.

One of the products of Pass & Seymour of Solvay, N. Y., which they wish to recommend to the trade, are their standard sockets for 250 volts, using a copper contact shell. They also call attention to the manner in which their tubes and cleats are packed for shipment, which is done in strong pasteboard boxes. The tubes and cleats are thus found to arrive at their destination unbroken, which is not the case when they are shipped loose in a barrel or box, as is frequently the case.

The Brunswick refrigerator for household purposes manufactured by the Brunswick Refrigerator Company of New Brunswick, N. J., and which was described in the Western Electrician of November 19, 1904, was made the subject of a test recently in Boston. The machine was operated by a one-half-horsepower motor. The test lasted 34.67 minutes. The refrigerator used water at a rate equivalent to a consumption of 60 cubic feet per day of 24 hours. The electrical consumption was 14 horsepower-hours per day of 24 hours.

The winding department of the Doubleday-Hill Electric Company of Pittsburg, Pa., is now in charge of H. A. Kellogg, formerly connected with the winding department of the Siemens & Halske Electric Company and also with the Westinghouse Electric and Manufacturing Company. Mr. Kellogg has handled all classes of work in this line from fan-motor armatures to 1,800-kilowatt armatures. The Doubleday-Hill company also manufactures special tablet boards, switchboards, wire connecters, armature and field coils, trolley wheels, experimental magnets, rheostats, etc.

The Economical Electric Lamp Company of 227-229 Fulton Street, New York, manufactures what it deems to be an economical turn-down lamp, which is furnished for all voltages from 40 to 240, and adapted for Edison, Westinghouse and T.-H. bases. This lamp, the company says, received the highest and only award for lamps of its class at the Louisiana Purchase Exposition. A booklet is issued by the company, and furnished in quantities to central stations, illustrating, by pictures bearing the Economical company's imprint, a few of the places where these lamps may be used to advantage.

Owing to the great rush of business at the present time, C. F. Ziegler, president of the Reynolds Electric Flasher Manufacturing Company of Chicago will not be able to attend the National Electric Light convention at Denver, but he will be represented there by I. A. Bennett, who will have headquarters in the Brown Palace Hotel. Mr. Bennett is very well and favorably known among the electric fraternity, and will make a valuable substitute for Mr. Ziegler. He will have a number of the celebrated Reco and Improved Reynolds flashers on exhibition and will take pleasure in explaining their superior qualities to all who are interested.

The Marion Insulated Wire and Rubber Company of Marion, Ind., reports that it has opened up a Chicago warehouse, located at 141 South Clinton Street, and is carrying a full and complete stock of rubber-insulated wires and cables. This company manufactures all classes of rubber-covered wire, and while it is located at Marion, Ind., which is only a day's freight from Chicago, it has deemed it advisable to open up a Chicago warehouse under the management of I. A. Bennett in order to further facilitate the deliveries of its brand of wire known as Eagle brand, also Lucas brand, the latter with a 30 per cent. rummer insulation.

The National Cable and Wire Company, Shoustown, Pa., which recently removed its offices and factory from Pittsburg, now occupies one of the best equipped plants in the country. The company manufactures all grades of rubber-covered wires, dry-core lead-encased telephone and telegraph cables, all grades of braided and weatherproof wires, duplex twist-line wire, duplex electric-light wire, all grades of pothead wire, etc. The factory covers five acres of ground and the main building is 200 by 300 feet, with an auxiliary building 100 by 200 feet. A siding gives easy shipping facilities. The company is also able to ship south by water. J. H. Hunter, the general manager of the company, takes pride in the fact that his plant contains all modern appliances and says that it includes the newest and latest rubber mills in the United States.

W. N. Matthews & Bro., manufacturers of the Stombaugh guy anchor, have moved their offices

and warerooms to 203 North Second Street, St. Louis. They state that this move was made necessary by the large increase in their business, which necessitated their carrying a much larger stock of anchors in St. Louis than ever before in order to keep up their reputation for prompt shipment to [illegible]

[illegible] west of the Mississippi. [illegible] of the [illegible] are made from [illegible] Ohio and Chicago. [illegible] stock in San Francisco. [illegible] quantity of anchors over 12, [illegible] days' trial, with the understanding that if the goods [illegible]

[illegible]

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued (United States Patent Office) May 23, 1905.*

790,303. Burglar Alarm. John E. Liess, Chicago, Ill. Application filed November 13, 1903.

In an electric burglar-alarm system there are associated with a primary protective circuit an alarm sounder adapted to respond to successive temporary abnormal conditions of the circuit and means associated with the circuit for automatically stopping the sounding of the alarm sounder after each of the successive temporary abnormal conditions. A secondary protective circuit and means for automatically substituting the secondary circuit for the primary circuit are the other features.

790,309. Electrical Veterinary Appliance. Albert Paxton, Montpelier, Ind. Application filed September 15, 1904.

An electric veterinary appliance comprises a saddle having a pocket, a platform carried by the saddle, a battery in the pocket, an induction coil carried by the platform and electrodes in circuit with the induction coil for application to various parts of the horse.

790,320. Railway Signaling System. Benjamin F. Saurman, Philadelphia, Pa. Application filed October 8, 1904.

Visual and audible signals are carried by the train, the visual signal adapted to be successively operated by blocks in the system, and the audible signal adapted to be controlled by the visual signal when it occupies a certain position.

790,342. Concentrator. Harry H. Campbell, Steelton, Pa. Application filed April 14, 1904.

In an ore separator are combined an inclined table, a series of magnets arranged adjacent thereto in a row extending from near an upper corner of the table to near the diagonally opposite lower corner and means for reciprocating the magnets in a direction transverse to that of the incline of the table.

790,389. Process of Reducing Metallic Compounds. Edgar F. Price, Niagara Falls, N. Y. Application filed August 31, 1904.

790,390. Process of Reducing Metallic Compounds. Edgar F. Price, Niagara Falls, N. Y. Application filed August 31, 1904.

790,391. Process of Smelting Metallic Compounds. Edgar F. Price, Niagara Falls, N. Y. Application filed August 31, 1904.

790,392. Process of Producing Ferrochromium. Edgar F. Price, Niagara Falls, N. Y. Application filed August 31, 1904.

790,393. Process of Smelting Iron Ores and Producing Ferrochromium. Edgar F. Price, Niagara Falls, N. Y. Application filed October 19, 1904.

790,394. Process of Smelting Refractory Ores. Edgar F. Price, Niagara Falls, N. Y. Application filed November 7, 1904.

790,395. Process of Producing Low-carbon Metals or Alloys. Edgar F. Price, Niagara Falls, N. Y. Application filed November 22, 1904.

790,396. Process of Producing Low-carbon Metals or Alloys. Edgar F. Price, Niagara Falls, N. Y. Application filed November 22, 1904.

790,397. Process of Producing Low-carbon Metals or Alloys. Edgar F. Price, Niagara Falls, N. Y. Application filed December 10, 1904.

Further mention of the series of patents by Mr. Price will be made in a future issue.

790,414. Alternating-current Commutator Machine. Gabriel Winter, Vienna, Austria-Hungary, and Friedrich Eichberg, Berlin, Germany, assignors to the General Electric Company, Schenectady, N. Y. Application filed August 24, 1903.

In a multipolar alternating-current machine are a rotor-winding provided with a commutator, two sets of equipotential brushes distributed around the commutator and conductors connecting each brush of one set with a brush of the other set so as to form a number of independently connected pairs.

790,428. Telephone Transmitter. Harry M. Gail, Buffalo, N. Y. Application filed July 7, 1904.

A transmitter comprises a tubular body the axis of which is arranged horizontally, caps being arranged at opposite ends of the body and diaphragms arranged vertically in the body. A mouthpiece is mounted on the body and has branches leading to the diaphragms. A retaining-sleeve surrounds each pair of electrodes and forms a cell between them. A body of granular material is arranged in each cell.

790,434. Trolley. John B. Humphrey, Louisville, Ky., assignor of one-half to Sam B. Crowder, Louisville, Ky. Application filed September 21, 1904.

Combined with a trolley pole are a casting secured to the top and provided with a recess in it upper face, and a vertical central bore and a trolley harp having also a vertical central bore. A depending annular flange is constructed to surround the casting and cover the joint between the casting and the trolley harp, a bolt extending through the vertical bores of the casting and the harp.

790,450. Switch-operating Mechanism. Elisha Moore, Boston, Mass. Application filed July 19, 1904.

In a switch-operating mechanism are a switch of the railway, a circuit controlled by cars traveling past the switch, an electric motor in the circuit and means through which alternate operations of the circuit and motor shift the switch in one direction, and the other operations of the circuit and motor shift the switch in the opposite direction.

790,471. Dynamo-electric Machine. Edwin C. Wright, Newport, Ky., assignor to the Bullock Electric Manufacturing Company, Cincinnati, Ohio. Application filed September 30, 1904.

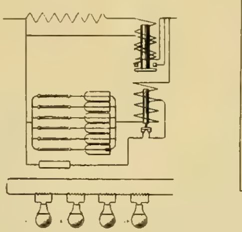
In the rotatable member of a dynamo-electric machine are a core, a winding thereon, and means for supporting the end turns of the winding. These means comprise an end cover, an outside cylindrical cover, a supporting member mounted on the shaft of the core and having an inclined surface and wedges mounted on the inclined surface.

790,472. System of Distribution for Multiple-glower Lamps. Alexander J. Wurts, Pittsburg, Pa. Application filed November 9, 1900.

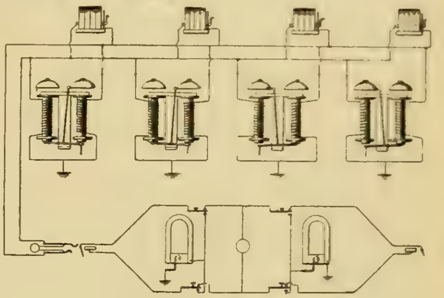
The lamp is privided with a multiple glower and a resistance in shunt with the glower. An interrupter is provided for the glower circuit. (See cut.)

790,475. Dynamo-electric Machine. Bernard A. Behrend, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company. Application filed September 19, 1904.

In the rotatable member of a dynamo-electric machine are a core, windings on the core having end turns and an end cover for forcing the end turns against the core in a direction parallel to the longitudinal axis of the rotatable member.



NO 790,472.—DISTRIBUTION SYSTEM FOR MULTIPLE-GLOWER LAMPS.



NO. 790,550.—PARTY-LINE TELEPHONE.

790,485. Rotor Construction. Louis H. Dunker, Norwood, Ohio, assignor to the Bullock Electric Company, Cincinnati, Ohio. Application filed September 19, 1904.

In a dynamo-electric machine are a rotatable element comprising a core having two or more poles, windings thereon having end turns and means for supporting the end turns, the supporting means for the end turns on one pole being adjustable independently of the supporting means on any other pole.

790,502. Battery Solution. Frank M. Holmes, Marionville, Mo., assignor to Richard H. Stevens, trustee, Clayton, Mo. Application filed January 25, 1904.

Combined with the exciting field are a sealing cover comprising a gum solution derived from the sap of pitted fruit trees.

790,525. Electric Glower Lamp. Henry N. Potter, Göttingen, Germany, assignor to George Westinghouse, Pittsburg, Pa. Application filed August 14, 1899.

Combined with a glower and an electric heater are an insulating support for the members having contact terminals, a ballast, a heater cut-out and a base having contact terminals with which the contact terminals on the glower and heater support make detachable contact.

790,538. Protected Third-rail Electric-railway System. Henry A. Thomsen, New York, N. Y. Application filed February 12, 1904.

The conductor-rail housing is supplied with a hood-shaped metallic member made in lengths or sections, the lengths having lapping relation at their contiguous end portions. The joints of the sections are insulated electrically.

790,541. Controller for Electric Motors. Walter J. Warder, Jr., Chicago, Ill., assignor to the Western Electric Company, Chicago, Ill. Application filed September 26, 1904.

The controller embodies a drum which forms a part of the magnetic circuit. A polar extension with a composite finger is mounted on the drum, the finger consisting of a non-magnetic portion for carrying current. A magnetic portion carries a flux, the magnetic portion being adapted to maintain a fixed position with respect to the drum. (Cee cut on next page.)

790,548. Annunciator. George F. Atwood, New York, N. Y., assignor to the Western Electric Company, Chicago, Ill. Application filed June 18, 1904.

A push button having an opening in its face is provided with a signal device mounted within the button and arranged to display its signal at the opening. Switch con[illegible]

[illegible]

790,550. [illegible] Brooklyn, N. Y., [illegible] way, New York, N. Y. Application filed September 12, 1904.

[illegible] magnet. (See cut.)

790,551. [illegible] burg, Pa., assignor to George Westinghouse, Pittsburg, Pa. Application filed September [illegible] 1903.

A two-part [illegible] removably clamped [illegible] arms and [illegible] a glower and heater [illegible] the free ends of the [illegible]

790,569. Electric Machine. Albert F. Hemingway, Chicago, Ill., assignor of one-half to John R. Markle, Chicago, Ill. Application filed August 15, 1904.

In combination with the armature are main fields influencing it and having poles of given polar embrace presented thereto. Auxiliary fields influencing the armature and having poles of smaller polar embrace are in alignment with the first-named poles. A controller serving to vary the current of the auxiliary field is also supplied.

790,571. Spark Plug. Gustave L. Herz, New York, N. Y. Application filed July 14, 1904.

The spark plug comprises a shell consisting of inner, intermediate and outer members. A conducting wire and a conducting-wire insulator are located within the shell and have a tapered-joint connection therewith.

790,581. Inductance and Induction Coil for Electrical Apparatus. Dimmitt R. Lovejoy, Niagara Falls, N. Y., assignor to the Atmospheric Products Company, Niagara Falls, N. Y. Application filed August 19, 1903.

The coil is made up of a number of pancake windings connected together to form a continuous coil. Flanges or barriers of insulating material are situated between adjacent windings, and all of the windings are so connected as to form a continuous coil. The laminated core comprises two separate members having gaps between, and means to adjust the gaps.

790,655. Medical Ozonizer. Marius Otto, Paris, France, assignor to the American Ozone Company, Niagara Falls, N. Y. Application filed June 6, 1903.

A circuit connects the source of electricity with the primary coil of an induction-coil, a [illegible] make-and-break device being placed in the circuit. Another circuit connects a resonator with the secondary coil of the induction-coil and is provided with condensers and a spark gap. An ozonizer has a circuit connecting the poles of the ozonizer with the resonator.

790,684. Telephone-call Attachment. Joseph Harveston and John O. Mudgett, Santa Cruz, Cal. Application filed December 16, 1904.

A telephone call attachment consisting of a revolubly mounted toothed disk has connections by which an electrical circuit is intermittently [illegible] of the teeth. A second disk is revoluble [illegible] with the toothed disk, the disk having a depression in its periphery. A revoluble shaft with which the depression is normally [illegible], means including a [illegible] member for actuating a bell-crank lever and a pin on the second disk engaged by the lever for turning the second disk so that its periphery will contact with the revoluble shaft and complete [illegible] revolution of itself in the toothed disk, are the other parts.

790,740. Desk Attachment for Portable Telephones. Edmund Cavanaugh, Rochester, N. Y., assignor to the Defiance Machine Company, Rochester, N. Y. Application filed December 26, 1903.

A swinging bracket by means of which the telephone is mounted upon the desk is the basis of the patent.

790,747. Electroplating Apparatus. Charles T. Pratt, Frankfort, N. Y., assignor to the Pratt Chuck Company, Frankfort, N. Y. Application filed October 3, 1903.

Electroplating apparatus adapted for use on slip nipples embodies a bath tank, a series of removable frames, inclined cathode work-supporting bars and supports for a removable anode bar in each frame, and anode bars arranged with reference to the cathode bars so as to pass axially through a row of nipples supported on the cathode bars.

790,753. Electric Clock System. William A. Roberts and Edward T. Robinson, St. Louis, Mo. assignors of one-third to Edward I. Robinson, St. Louis, Mo. Application filed March 19, 19, 1904.

A master clock is associated with a series of secondary clocks having electrically actuated driving escapements. Conductors lead from the master clock armature and armature receiving contact member to the secondary driving escapements.

790,768. Electric Stop-motion for Textile Machinery. Joseph B. Whitney, Brooklyn, N. Y. Application filed August 9, 1902.

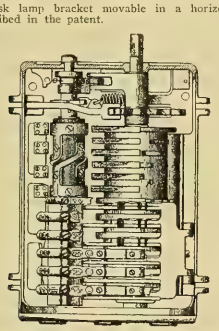
Mechanism for detecting the breaking of a longitudinally moving thread or other filament embodies a detector or faller on a pivotal support. An electric circuit comprising a magnet co-operative with an armature contains the fallers, which constitute circuit closers, the fallers being normally held by threads being operated upon to maintain the circuit open.

790,789. Electric Cut-out Switch. Joseph Frechette, Pawtucket, R. I., assignor of one-third to Thomas F. Hughes, Pawtucket, R. I. Application filed April 11, 1904.

In an electric cut-out switch is a spring forming part of and normally closed in the circuit and means for elevating the spring to break the circuit. The means act to slowly elevate the spring and gradually increase the tension in breaking the circuit and to pass from beneath the spring and permit the latter to instantaneously resume its normal position by its own resiliency.

790,809. Desk Light. Theodore Smith, Chicago, Ill. Application filed January 29, 1904.

A desk lamp bracket movable in a horizontal plane is described in the patent.



NO. 790,541.—CONTROLLER FOR ELECTRIC MOTORS.

790,812. Electric Telephone Switch. George F. Archer, New York, N. Y. Application filed October 15, 1903

A signal-wire terminal and a catch forming a talking-wire terminal are associated with a movable base or support for the catch. An incline on the base and a contact or circuit closer made to contact with the catch and incline to move the catch to releasing and to engaging position are the other features.

790,814. Multiple Switch for Telephones. Charles V. Beaver, Anita, Iowa. Application filed December 7, 1901.

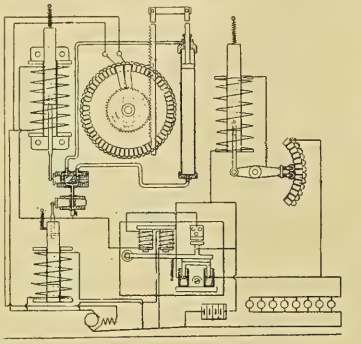
Line-wire binding posts and auxiliary-signal binding posts are located at one end of a board, a switch lever being pivoted at the same end of the board and two series of four fixed line-wire contacts located at the opposite end of the board to the right and left respectively of the switch lever. Four contacts are carried by the switch lever and co-operate with the line-wire contacts.

790,819. Means for Controlling Electric Currents. Gerald J. Dorman, Brooklyn, N. Y., assignor to the Consolidated Railway, Electric Lighting and Equipment Company. Application filed October 16, 1902.

Combined with a dynamo are an accumulator, the lamps, the supplying circuits, a switch normally open between the dynamo and the accumulator and a resistance in the lamp circuit normally short circuited by the switch. The other parts of the apparatus are a shunt magnet in shunt with the dynamo, and a series magnet in series between the dynamo and accumulator, whereby when the voltage of the dynamo falls below normal the circuit will be broken between the dynamo and accumulator and the lamp resistance short circuited. (See cut.)

790,822. Fire-alarm Apparatus. Harry T. Gale and Ransom W. Davenport, Buffalo, N. Y. Application filed May 7, 1904.

In a booth containing a fire-alarm apparatus are a door hinged to the booth, an arm movable with the door and concentric with the hinge, contacts included in a circuit with the fire-alarm apparatus and means upon the arm and inclosed within the booth for electrically connecting the contacts when the door is closed.



NO. 790,819—ELECTRIC CIRCUIT CONTROLLER.

790,833. Igniter-operating Device for Gas or Vapor Engines. Coleman B. Harris, Wilmington, Del. Application filed January 7, 1903.

The contact piece of the sparking arrangement is carried on a rocking shaft which brings the contact piece into and out of engagement with the sparking terminal.

790,838. Electrical Device or Circuit. Robert J. Hewett, Westfield, N. J., assignor to the Hall Signal Company. Application filed August 11, 1904.

Combined with a magnet adapted and designed to be shunted are a resistance and a circuit controller operated by the magnet and in multiple with the resistance. When the magnet is energized the circuit controller closes to cut out the resistance, and when the magnet is shunted the circuit controller opens to cut in the resistance. Another resistance is placed in multiple with the magnet and adapted to be shunted when the magnet is shunted.

790,854. Telephone System. John G. Roberts, Evanston, Ill., assignor to the Kellogg Switchboard and Supply Company, Chicago, Ill. Continuation of renewed application, filed February 23, 1901. This application filed May 8, 1902.

With a pair of telephone lines and means at the central office for uniting them are combined a source of ringing current and a ringing device for applying it to the called line. An automatic time-limit apparatus interrupts the circuit of the source of ringing current after a predetermined time, and means controlled through the agency of a switch at one of the substations of the united lines disconnect the source of ringing current.

790,856. Reversing Mechanism for Explosion Engines. Thomas L. Sturtevant, Quincy, and Thomas J. Sturtevant, Wellesley, Mass. Application filed June 11, 1903.

In an explosion engine the sparking apparatus contains a manually operated switch by which an electric circuit may be opened to shut off the current. Automatic means are connected with the engine shaft whereby the circuit will be closed when a rebound occurs at a compression-stroke.

790,866. Battery. William C. Banks, New York, N. Y. Original application filed April 11, 1901. Divided and this application filed January 5, 1905.

A battery element of annular form is described, the annular part being hollow and having one vertical face and one face inclined. The element presents a downwardly decreasing horizontal area within its walls, and at the same time will maintain a uniform distance from an opposite vertical face of a secondary battery element.

## EXPIRING PATENTS.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on May 29, 1905:

383,436. Electric Retouching Device. G. F. Card, Covington, Ky.
383,439. Electric Alarm Clock. E. J. Colby, Chicago, Ill.
383,450. Printing Telegraph. S. V. Essick, Brooklyn, N. Y.
383,464. Thermoelectric Generator. R. J. Gulcher, Berlin, Germany.
383,484. Manufacture of Filaments for Electric Incandescent Lamps. J. W. Packard, New York, N. Y.
383,485. Eraser. J. W. Osborne, Washington, D. C.
383,495. Test Circuit for Multiple Switchboards. C. E. Scribner, Chicago, Ill.
383,502. Apparatus for Lighting Railway Cars by Electricity. I. A. Timmis and Stanley C. C. Currie, London, England.
383,520. Production, Transmission and Distribution of Electric Currents. C. E. Fritts, New York, N. Y.
383,536. Thermoelectric Apparatus for Controlling the Temperature of Water in Tubes. E. A. Newman, Washington, D. C.
383,548. Electric Battery. E. A. Wildt, Long Island City, N. Y.
383,560. Secondary Battery. C. A. Faure, Paris, France.
383,561. Propelling Vehicles by Electricity. C. A. Faure, New York, N. Y.
383,562. Secondary Battery. C. A. Faure, New York, N. Y.
383,563. Telephone Call-bell System. F. E. Fisher, Detroit, Mich.
383,564. Armature for Electric Motors. F. E. Fisher, Detroit, Mich.
383,565. Dynamo Armature. F. E. Fisher, Detroit, Mich.
383,566. Annunciator. F. E. Fisher, Detroit, Mich.
383,567. Armature for Dynamos. F. E. Fisher, Detroit, Mich.
383,575. Manufacture of Secondary Batteries. R. M. Hunter, Philadelphia, Pa.
383,583. Electromagnetic Register. J. F. McLaughlin, Philadelphia, Pa.
383,602. Carbon Conductor for Electric Lamps. H. Joachin von Metzradt, New York, N. Y.
383,605. Apparatus for Testing Electric Circuits. A. D. Wheeler, Hyde Park, Mass.
383,611. Electric Cigar Lighter. R. Belfield, Pittsburg, Pa.
383,616. Incandescent Lamp. H. M. Byllesby and P. Lange, Pittsburg, Pa.
383,617. Armature for Dynamos and Motors. H. M. Byllesby, Pittsburg, Pa.
383,618. Synchronizing Device for Alternate-current Dynamos. H. M. Byllesby, Pittsburg, Pa.
383,619. Armature for Dynamos and Motors. H. M. Byllesby, Pittsburg, Pa.
383,620. Combined Alternate-current and Storage System of Electrical Distribution. H. M. Byllesby, Pittsburg, Pa.
383,621. Alternate-current and Storage System of Electrical Distribution. H. M. Byllesby, Pittsburg, Pa.
383,622. Alternate-current and Storage Systems of Electrical Distribution. H. M. Byllesby, Pittsburg, Pa.
383,623. Combined Alternate-current and Storage System of Electrical Distribution. H. M. Byllesby, Pittsburg, Pa.
383,640. Storage-battery Plate. C. D. P. Gibson, New York, N. Y.
383,647. Switch for Adjustable Resistances. P. Lange, Pittsburg, Pa.
383,648. Apparatus for Connecting Alternate-current Dynamos. P. Lange, Pittsburg, Pa.
383,649. Voltmeter. P. Lange, Pittsburg, Pa.
383,651. Governor for Electric Motors. R. H. Mather, Windsor, Conn.
383,655. Circuit-closing Device for Electric Clocks. C. H. Pond, Brooklyn, N. Y.
383,657. Bobbin for the Field Magnets of Dynamos. A. Schmid, Allegheny, Pa.
383,658. Brush Holder for Electric Generators. A. Schmid, Allegheny, Pa.
383,659. Armature for Dynamos. A. Schmid, Allegheny, and H. M. Byllesby, Pittsburg, Pa.
383,661. Circuit-controlling Apparatus for Electric Lighting Circuits. O. B. Shallenberger, Rochester, Pa.
383,666. Apparatus for Detecting Ground Connections in Electric Circuits. O. B. Shallenberger, Rochester, Pa.
383,667. Method of Indicating Electric Currents. O. B. Shallenberger, Rochester, Pa.
383,668. Electrical Indicator for Alternating Electric Currents. O. B. Shallenberger, Rochester, Pa.
383,669. Electrical Indicator. O. B. Shallenberger, Rochester, assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa.
383,670. Electrical Indicator. O. B. Shallenberger, Rochester, Pa.
383,671. Electrical Indicator. O. B. Shallenberger, Rochester, Pa.
383,672. Method of Indicating Electric Currents. O. B. Schallenberger, Rochester, Pa.
383,675. Manufacture of Incandescent Electric Lamps. E. P. Thompson, Elizabeth, N. J.
383,676. Evacuating Electric Lamps. E. P. Thompson, Elizabeth, N. J.
383,706. Galvanic Battery. H. B. Cox, Cincinnati, O.
383,725. Electrical Needle Annunciator. W. E. Gill and R. Segerdahl, Chicago, Ill.
383,734. Insulator for Electric Wires. F. E. Keyes, Peterborough, N. H.
383,756. Crawler for Electric or Other Circuits. H. G. Morris, Philadelphia, Pa.
383,770. Underground Conduit and Grip for Electric Railways. E. E. Ries and A. H. Henderson, Baltimore, Md.
383,794. Electric Smelling Bottle. C. T. Brown, Chicago, Ill.
383,822. Current Collector for Electric Machines. W. Stanley, Jr., Great Barrington, Mass.
383,844. Overhead Conducting System for Electric Railways. G. T. Woods, Cincinnati, Ohio.

## SPECIAL MENTION.

The Chicago House Wrecking Company announces bargains in the electrical material used in the construction and equipment of the St. Louis World's Fair. This material has seen but limited service and is said to be practically as good as new. The company is making a special "run" on its lead-covered cables, weatherproof and rubber-covered wires and incandescent lamps.

The Uehling-Decker Company of Passaic, N. J., manufacturer of the Rayflex flashlight, announces that it has just completed arrangements with I. A. Bennett to represent it in the western territory, and carries a full and complete stock of the flashlights and renewal batteries at his Chicago office and warehouse at 141 South Clinton Street. Mr. Bennett says that the Uehling-Decker Company, which makes a tubular flashlight with an aluminum case, is manufacturing these lights and batteries under the Hoggson patent, No. 520,429, dated May 29, 1894, which has been recently sustained by the United States Court of Appeals, and that it will protect all its customers against infringement.

The National Battery Company of Buffalo, N. Y., has closed a contract with the Syracuse and Suburban Railroad Company of Syracuse, N. Y., to install an electric storage battery consisting of 240 cells of type W-9 Unit accumulator in W-13 glass jars. This battery will be installed out on the line at DeWitt to boost the voltage at that point and help carry the heavy summer load. This installation is now under way.

The Chicago Solder Company of Chicago has a new representative, Mr. R. B. Cairns, who is now taking the territory of Illinois and Indiana, and is visiting electric generating plants and telephone exchanges showing an attractive line of self-fluxing solder, and soldering fluxes. These goods have been on the market long enough to prove their superiority. The name Kester on a box of soldering paste or self-fluxing solder signifies, the company maintains, that the goods are the best obtainable, and the manufacturer stands ready to redeem every ounce of goods it makes when returned in proper condition.

A fast train for busy people from Chicago to New York—a day's work may be disposed of before leaving Chicago at one p. m. on the Manhattan Limited over Pennsylvania Short Lines. Passengers reach New York the next afternoon in time to meet an afternoon engagement, dress and dine, and attend the theater or make an evening call. C. L. Kimball, assistant general passenger agent, No. 2 Sherman Street, Chicago, is ready to tell how time can be saved on an eastern trip.

# WESTERN ELECTRICIAN

**EVERY SATURDAY**

Vol. XXXVI. CHICAGO, JUNE 10, 1905

## Electrical Features of the Mardi Gras.

Mardi Gras in New Orleans is a celebration of the end of the joyous and the beginning of the Lenten season of 40 days of fast, prayer, sack cloth and ashes. Mardi Gras, or Fat Tuesday, is the ending of the carnival, which word is derived from the Italian carnevale, meaning a farewell to meat. New Orleans in this celebration excels any other city of the country, and the day is given to happiness and joy, processions, displays and balls until the midnight hour sounds the knell of the parting day and the jesters draw the veil across, shutting out the temptation of the flesh and the devil.

New Orleans, this year through the assistance of the New Orleans and Carrollton Railroad and Light and Power Company (New Orleans Railway Company), presented the greatest electrical display ever known in its history. There were on the buildings and in the streets very nearly 25,000 electric lights, multi-colored and of various sizes from eight to 50 candlepower. In addition, many of the enterprising firms in the city took occasion to decorate the fronts of their stores. The number given does not include the various electrical signs nor those used in the interior of the buildings, but what were used exclusively for the outside electrical display on account of Mardi Gras. Large streamers were run on various streets. On Canal Street, the distance covering about three-quarters of a mile, there were 1½ miles of streamers; on St. Charles Street the distance covered was half a mile, making one mile of streamers. On Royal Street there were about 820 feet, and on Dauphine Street there was a stretch of one block or 300 feet in which the streamers crossed the street instead of being placed longitudinally. The accompanying illustration presents some idea of the appearance of the streets and prominent buildings during the celebration.

Various clubs vied with each other in making their displays. The Pickwick Club had a magnificent design of two cornucopias, or horns of plenty, encircled with colored lights, and the whole connected together with graceful streamers of lights reaching down to supports on the outer edge of the platform, which was erected in front of the club, so that the guests might occupy seats upon the grandstand thus formed and view the processions as they passed by. The windows were all outlined with handsome opaque lamps. All of the other clubs also were provided with similar stands in front.

The Boston Club, the front of which is white, was ornamented with garlands and hundreds of dazzling white lamps. Stars and streamers were run from one end of the building to the other, presenting the effect of a beautiful white building studded with diamonds represented each by an electric light. The arrangement showed up to great advantage.

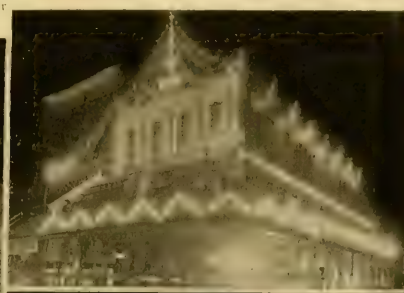
The Chess, Checkers and Whist Club, in addition to the name stretched across the top of the building, had each of the window openings outlined in frosted electric globes, the whole being surmounted by a crown of electric lights, representing the games, such as chess and checkers, and a pack of cards representing whist.

The Louisiana Club was artistically arranged with festoons, window ornamentations, parallel strips of light running from one end of the building [illegible] colors representing the colors of the rainbow, the lights [illegible] as to make the effect artistic and beautiful in every respect.

The City Hall [illegible] ning from one end of the building to the other.

The effect produced by the various electrical illuminations throughout the entire city was such as to attract general attention, and the electric-lighting company in view of that fact had photographs taken of the main points, which illustrate to everyone the magnificent [illegible] produced by artistically designed electrical exhibitions.

The Pickwick Club
Chess, Checker and Whist Club



The Louisiana Club.
The Harmony Club.
Illuminations on St. Charles Street.

The Boston Club
Illuminations on [illegible]

ELECTRICAL FEATURES OF THE MARDI GRAS IN NEW ORLEANS.

## A Three-phase Booster.

A three-phase transmission line is fed from central-station bus bars through raising transformers. It was [illegible] per cent. above that given by the raising transformers. How this was done is described by J. M. Weed of Denver, Colo., in the "Wrinkles" department of the National Electric Light Association. Three single-phase transformers, with primaries wound for the bus-bar pressure and a lowering ratio such that the secondary pressure gives the desired boost are used. This ratio being 10 to 1, a 10 per cent. boost is obtained by connecting the primaries star fashion, the secondaries being in series with the respective legs of the circuit. With

the primaries connected delta fashion, no change being made in the secondary connections, the boost is about 15 per cent.

The primaries should not be switched in an ordinary manner from one arrangement to the other while the circuit is loaded, since the large current flowing in the secondary, with an open primary, produces dangerously high pressures in the primary coils.

If it is desired to change the percentage of boost with variations in load, this may be accomplished by means of a special switching device which will short-circuit the secondaries immediately upon opening the primaries, and which places the secondaries again in circuit immediately before closing the primaries in the other way. With transformers of the three-wire type and some auxiliary switches it is possible to obtain four different percentages of boost, as five, 7.5, 10 and 15 per cent.

## New Plant at the American Museum of Natural History in New York.

The accompanying illustration (Fig. 1) shows one of the two new 250-kilowatt compound-wound direct-current generators recently installed in the new engine room at the American Museum of Natural History, at Seventy-seventh Street and Eighth Avenue, New York city. This plant, which is housed in an entirely new building, will not only supply light and power to the museum, but will also form an integral part of the exhibits of the museum and will be open at all reasonable times for the inspection of visitors.

The installation possesses some unusual features. In the first place, it is perhaps the only instance in or around New York city of a three-wire generating plant being used to supply an old two-wire lighting system. A second novel feature lies in the fact that there are no cut-outs at the generators, all operations being controlled from the main switchboard.

The contractor for the entire work was the Charles L. Eidlitz Company, electrical engineer, of New York city, which also put in the original installation about 14 years ago. The eight old 25-kilowatt dynamos in the basement of the museum have been taken out, a handsome new engine room and boiler house has been erected and the two 250-kilowatt generators installed, either of which will meet the normal peak load. These generators were built by the General Electric Company and are driven at 100 revolutions a minute, delivering current at 120-240 volts. The generators are direct-connected to two Hamilton-Corliss engines, made by the Hooven, Owens, Rentschеler Company of 39 Cortlandt Street, New York city.

The switches at the generators have been abolished and there are accordingly seven cables, partly shown in Fig. 1, between each generator and the

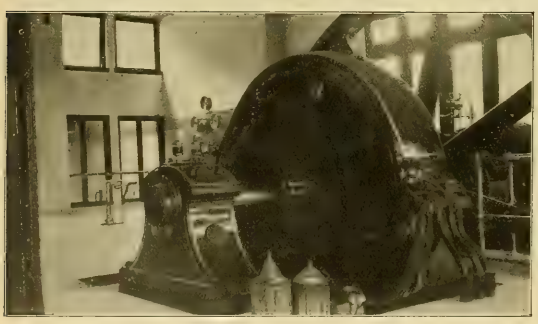


FIG. 1. A GENERATOR IN THE AMERICAN MUSEUM OF NATURAL HISTORY.

main switchboard, namely, the positive, negative and neutral feeds, positive and negative equalizers, and two transformer leads. The generators are designed for a 25 per cent. overload, and the oil transformers in the cellar are of a similar capacity.

The main switchboard is of gray Tennessee marble, two inches thick, and measuring about 7½ by 14 feet. Fig. 2 is a diagram of the connections at the rear of the board, dimensions being given and the bus bars indicated. The positive bus bar is indicated at (A), the negative at (B), while (C) is the neutral. The bus bars are arranged to take future switches. The generator end of the board is on the right, and the feeder end on the left. There are bent-type lugs on the feeder panel. Wire connections are also shown in the cut.

This board, together with the distributing boards and panels, were all supplied by the Metropolitan Switch Board Company, New York city.

The distributing boards, of which there are four, located at convenient points around the building, form the links between the three-wire supply cables and the two-wire lighting system. The method used is to connect one group of about 500 lights with the positive and neutral wires, and another similar group with the negative and neutral wires, both groups being normally lighted at the same time. Doublethrow switches enable the load to be instantaneously changed over from side to side, either on the readings of the meters, or on receipt of a telephone message from the exhibition galleries above. Doublethrow switches on the distributing board allow the negative and positive connections to be thrown over to the neutral wire.

There are altogether about 7,000 16-candlepower lights in the building, of which 700 have recently been put in. All the new wiring is in steel conduits, with drawn cables. In 1891 there were about 3,000 lights, and the original wiring was done by attaching the wires to staples, the whole being embedded in the plaster walls. This method no longer complies with the regulations of the New York Board of Fire Underwriters, but when tested a few days ago it was found that the insulation of a circuit equivalent to 12,000 lights had a resistance of over two megohms, with 1,500 amperes, or about 50 per cent. better than present-day requirements. The old wiring is therefore to be left undisturbed, for it is perfectly dry and the rubber is still springy, after 14 years service. The condition of this old wiring is all the more remarkable when it is remembered that in 1891, when it was put in, there were no elaborate methods of testing insulation, and electricians and insurance men generally were satisfied if the lamps lighted properly without the insulation burning when the current was turned on.

The boiler house adjoining the engine room is a model of lightness and airiness. Here there are two Babcock & Wilcox boilers, supplied by Baker, Smith & Co., heating and ventilating engineers, New York, each boiler having 126 four-inch tubes, 18 feet in length. For the casual daylight load there is a General Electric marine dynamo, working at 555 revolutions a minute at 120 volts. There are also three motors for operating the ventilating apparatus.

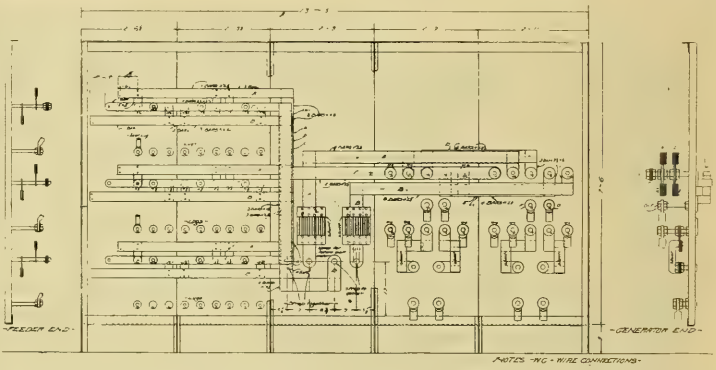



FIG. 2. SWITCHBOARD CONNECTIONS IN PLANT OF AMERICAN MUSEUM OF NATURAL HISTORY.

## Boston Electrical Exposition.

From all indications the coming International Electrical Exposition in Mechanics Building, Boston, July 15th to 22d, will be a big show. Manager C. I. Campbell, 5 Park Square, Boston, has already been notified that 39 states will send delegates to the fifth annual convention of the National Association of Electrical Contractors, beginning July 19th at the same place, and a large and efficient reception committee will extend welcome and entertainment. The entire building, comprising 83,000 square feet of floor space, will be occupied, covering the widest possible range of exhibits in any manner relating to electricity and including many of the very latest achievements of electrical science. The number of working electrical exhibits will, it is said, far exceed those of any previous exposition, while the presence of several inventors of world-wide celebrity has been assured. Architects, electrial and mechanical engineers, insurance inspectors, electric-lighting and street-railway companies of America will be the guests of the committee during the exposition. One day of the convention will be devoted to an open session, when the trade will be invited to be present and participate in the proceedings.

## Street Railway Employment in the United States.

An exhaustive report on street-railway employment in the United States has been printed in a bulletin of the bureau of labor of the Department of Commerce and Labor of the United States. The report was compiled by Walter E. Weyl, Ph. D., and from it the following interesting facts are taken: The street railways show a far greater increase in the number of their employes than do most industries of equal age. The introduction and extension of electric traction have more than doubled the number of employes, so that in 1902 there were some 140,000 men, including officers and clerks, upon the pay rolls of the street railways of this country. No other country has as many as one-fourth of this number of street-car employes.

According to the special report of the United States Census Office, published in 1903, the number of employes on street railways of the United States, including the territories, was 140,769. While no definite statistics exist for former years, the data furnished by the census enumerations and occupations for 1890 and 1900 show a rapid increase in the number of street-railway employes. Of the 140,769 persons employed in 1902 upon street and electric railways, 7,128, or five per cent. of the total number, came under the list of salaried officials and clerks. In that year there were 1,480 general officers with an average annual income of $2,021, 1,327 other officers, managers and superintendents with an average annual salary of $1,371, and 4,321 clerks with an average salary of $609 per year. The average annual earnings of these 7,128 men was $1,044. The remaining 133,641 employes may be properly classed as wage-earners.

From returns furnished by a number of street-car companies it was found that the great majority reporting limitations upon age fixed the minimum age at which a conductor would be employed at 21 years.

The average weight required of conductors is about 145 pounds. One company insists on a weight not less than 120 pounds and two upon 165 pounds. The minimum weight required of motormen is somewhat higher, ranging about 150 pounds.

The railway companies prefer to have an entirely free hand in the promotion of the men. Somewhat over one-half of the companies pay their men more with each successive year of service up to five years, while almost one-half of the companies pay a flat rate for all men engaged at the same occupation. Promotion for motormen and conductors within the street-car service is largely from the worse to the better runs. Time tables are necessarily arranged with relation to the probable traffic, and as a consequence the opportunities for work and earnings vary in different lines.

The 133,641 employes of the street-railway companies earned in 1902 the sum of $80,770,449, or an average of slightly over $600 per man. The employes are divided into 10 classes, the first class earning less than $1 per day, the last class earning $3 or more per day. Of the total number of men employed as wage-earners on the street railways

of the United States whose wages were given, 39,693, or 42 per cent., earned between $2 and $2.24 per day. This appears to be the prevailing wage in the industry, especially for conductors and motormen.

The statistics of accidents on street railways, according to an investigation made by the census bureau for the year 1902, show that in that year 1,218 persons were killed and 47,429 persons injured on the street railways of the United States. Of the total number of persons killed 265 were passengers, 122 employes, and 831 "others," the persons included under "others" being pedestrians, people on wagons, bicycles or other vehicles, and all other persons except those employed by the company or riding on its cars. Of the total number of persons injured, 26,690 were passengers, 3,699 employes, and 17,040 "others."

With the change from horse cars to electric cars has come a marked improvement in the character of the men employed.

## Winter-Eichberg Alternating-current Motor.

Much has been written concerning the Winter-Eichberg alternating-current motor, particularly in relation to single-phase railway work. From its bearing therefore on street-railway motor operation the patent issued on May 23d to Messrs. Gabriel Winter of Vienna, Austria-Hungary, and Friedrich Eichberg of Berlin, Germany, for a motor of this description will be of considerable interest. The patent has been assigned by the inventors to the General Electric Company of Schenectady, N. Y.

The invention relates to alternating-current machines of the commutator type with the object to improve the commutation of such machines. In

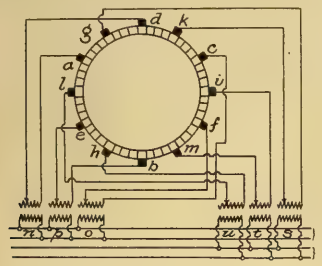


FIG. 1. WINTER-EICHBERG MOTOR CONNECTIONS FOR SIX-POLE MACHINE.

machines of this type, whether single-phase or polyphase, it is advantageous to prevent short-circuiting the coils of the armature, since the coils are always subject to a pulsating field which induces heavy currents whenever a coil is short-circuited. The ordinary means employed heretofore for avoiding short-circuiting a coil during commutation consists in employing brushes narrower than one commutator segment, or if n parallel and independent windings are used, brushes narrower than n—1 segments. In a machine having two p poles, in which there are p equipotential brushes distributed around the commutator, it is customary to connect all these equipotential brushes togther. This arrangement, which is satisfactory in direct-current machines, gives rise to trouble in alternating-current commutating machines, since it short-circuits the portion of the armature winding between each pair of equipotential brushes. In a series winding the portion of the armature winding between each pair of equipotential brushes consists of a single coil, and since this coil is subject to an alternating field, heavy short-circuiting currents will flow.

The invention consists in a novel arrangement of the commutator brushes and their connections for multipolar alternating-current machines. In accordance with the invention the equipotential brushes are not directly connected to each other as in ordinary arrangements; but each brush of one polarity is connected to a single brush of opposite polarity, either through a direct short-circuit or through a source of potential, according as the armature winding is to be short-circuited or supplied with or delivering current. The brushes are thus connected in independent pairs, and short circuits of the armature winding between equipotential brushes are avoided.

Fig. 1 shows diagrammatically how the invention may be applied to a six-pole two-phase armature. Fig. 2 shows a modification in which one phase is applied with current to the other two circuited.

Referring first to Fig. 1 the brushes (a) and (d) are shown connected to the secondary terminals of the transformer (u). Brushes (c) and (f) are connected to the secondary terminals of the transformer (t), and the brushes (b) and (g) are connected to the secondary terminals of the transformer (p). All the primaries of these three transformers are connected to one phase (q). The remaining brushes (g), (k), (i), (n), (h) and (l) are similarly connected to the secondaries of the transformers (s), (t) and (u), the primaries

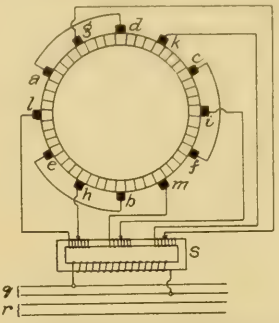


FIG. 2. WINTER-EICHBERG MOTOR CONNECTIONS WITH BRUSHES SHORT CIRCUITED.

of which are connected to the other phase (r). It will be seen that with this arrangement all the brushes are connected in independent pairs, no electrical connection existing between equipotential brushes, except through the armature winding. Consequently no short circuits can be produced.

It is evident that the ratio of transformation of the transformers may be varied as desired, as is indicated in Fig. 1. When all of the secondary winding of the transformer is cut out, the pair of brushes connected thereto is short-circuited. Thus in Fig. 2 the brushes corresponding to one phase are short-circuited, while the brushes corresponding to the other phase are supplied with current. The short-circuited brushes are still maintained in independent pairs, as in the first arrangement.

In order to utilize to greater advantage the surface of the commutator, each brush may be replaced by two brushes separated by the width of a segment. The brushes for one phase are on the inside of the commutator. All the brushes for the other phase are outside the commutator. These latter brushes comprise four pairs of brushes instead of four brushes, thereby giving twice the bearing surface of the commutator.

## The Acyclic Dynamo.

The acyclic or homopolar dynamo was the subject of considerable discussion among engineers and others some months ago. New light was thrown on the subject of the acyclic dynamo at that time by the perfection of a machine of 300 kilowatts capacity by Mr. Jakob E. Noeggerath of Schenectady, N. Y.

Acyclic dynamos are especially adapted for op-

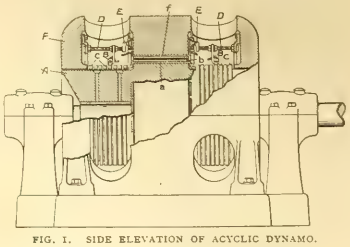


FIG. 1. SIDE ELEVATION OF ACYCLIC DYNAMO.

eration at high speeds, since the construction is simple and difficulties of commutation do not arise. Furthermore, the machines may be designed to develop readily at high speeds the necessary counter-electromotive force for operating at ordinary voltages.

It will be noted with interest that a patent has just been granted Mr. Noeggerath upon the acyclic dynamo, and a description of the details of its parts is here given, embodying the latest phases of its development.

conductors.

no field coil is shown in the figure. An armature conductor (a) is held in place by a cylindrical binding ring (b). The armature conductors have connection at each end to collector rings (CC), (BB) representing brushes bearing on the collector rings and mounted on bars (DD), which are carried by the adjustable rings (EE). These rings are mounted in the manner ordinarily employed for brush-holder yokes, enabling the rings to be rotated so as to shift the position of the brushes. A return conductor or frame conductor (f) is employed, by means of which any two brushes at opposite ends of the machine may be connected so as to place two armature conductors in series. The frame conductors are formed in the same shape as the armature conductors, and since they are adjacent to the armature conductors, and are carrying an equal amount of current in opposite direction, they serve to neutralize the armature reaction.

Referring to Fig. 2, it will be seen that each brush (B), instead of being connected to the nearest frame conductor, is connected by a flexible connection (h) to a frame conductor (f), which

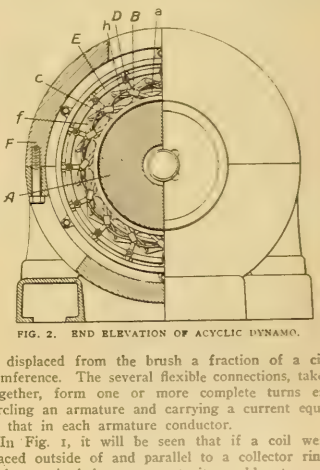


FIG. 2. END ELEVATION OF ACYCLIC DYNAMO.

is displaced from the brush a fraction of a circumference. The several flexible connections, taken together, form one or more complete turns encircling an armature and carrying a current equal to that in each armature conductor.

In Fig. 1, it will be seen that if a coil were placed outside of and parallel to a collector ring, and energized by a current, it would set up a flux, which would pass down from the central portion of the frame across the central air gap of the machine into the armature, cutting the armature conductors, then outward axially to the end of the armature, and across the outer air gap to the end of the frame. In other words, such a coil would produce a flux which would generate an electromotive force in the revolving-armature conductors. It is evident from Fig. 2 that the flexible end connections form just such a magnetizing coil, and since the end conductors carry the armature current the machine will act as a series-wound machine, and as a motor will exhibit the characteristics of a series motor. Furthermore, it will be seen that by shifting the brushes in one direction or the other the effective length of each flexible conductor, and consequently the effective turns of the field, will be varied. This furnishes a convenient means for controlling the speed of the motor or for reversing the direction of rotation. The excitation produced by the end connections can be supplemented, if desired, by a field coil. But for high speeds the end connections themselves will ordinarily be found to furnish sufficient excitation.

## Elgin Lighting Plant Lease Stands.

The injunction by which the Elgin, Aurora and Southern Traction Company was restrained from taking possession of the municipal electric-light plant of Elgin, Ill., leased to the traction company by the City Council, has been dissolved. The injunction was granted three months ago by Judge Bishop on the complaint of A. E. Price, C. H. Potter and E. L. Wilson, citizens of Elgin. In dissolving the injunction Judge Bishop finds no ground for the hints of irregularities in the transaction.

The terms of the lease were printed in the Western Electrician of March 4th. Possession of the plant was to have been given the traction company on April 1st for a period of 10 years. Since possession was not given at that time the traction company has served notice that it will sue the city for a sum of money sufficient to cover its losses as a result of the delay. Traction attorneys hold the city is liable for each day from the time the writ was dissolved until actual possession is given. To compensate the municipality for these damages demanded by the traction company the aldermen, it is said, are planning to sue Potter, Price and Wilson for an equal sum.

## Electric Power for Chattanooga.

Further details of the proposed electric power plant, and the dam and lock scheme for the improvement of the Tennessee River, which is to be undertaken by the Chattanooga-Tennessee River Power Company are now at hand. The company, as was stated in the Western Electrician last week, has been incorporated with a capital of $3,000,000 by C. E. James, J. C. Guild and associates. The improvement, which Mr. James announces will be commenced within 60 days, has been agitated for 15 years, during which time plans frequently have been suggested for the development of the large amount of power running to waste at "The Suck" in the Tennessee River, 12 miles from Chattanooga.

The history of the present movement dates from a report made in 1900 by Major Dan C. Kingman, then in charge of the Tennessee River improvements, by which he showed how the plant could be built and the river improved at the same time. In January of last year a bill was introduced in Congress by Judge Moon providing for the erection of this plant. It was signed by President Roosevelt on April 26, 1904. By the provisions of this bill the city of Chattanooga was granted the right to build this dam and operate the power plant if it should take advantage of the clause within four months, and give a bond of $100,000 to complete the work. The city, failing to do this, has since that time expressly waived its rights, which then vested in Messrs. James and Guild, who then made the proper bond for the construction of the lock and dam. The dam must be built under the supervision of government engineers and the plans must conform in every detail to those required by the government. The grantees are given the right to use the surplus water for power purposes. The bill also provides that the government shall have the plans prepared, and the work shall be done under the supervision of inspectors to be paid by the government. These plans have already been prepared.

The power plant will have a minimum continuous output of 36,000 horsepower, furnishing enough electricity, it is said, to operate all the factories of the city of Chattanooga and many new enterprises which are expected to follow the construction of the plant. It was first estimated that the plant would furnish but 28,000 horsepower, but careful examination by the leading engineers of the country has proved that 36,000 for the entire year is a conservative estimate.

The dam and lock, according to the estimates of the government engineers, will cost $1,180,000. The dam will be built of cement. It will be 57 feet at the base, nine feet at the top, 35 feet in height. The river at the exact point at which the plant will be erected is 1,250 feet wide. The lock will be located on the South Pittsburg bank of the river. The gates for the lock, which will cost $150,000, will be furnished by the government. The power plant will be located on the east side of the river, and will be 60 by 300 feet in dimensions and 57 feet in height. Thirty-six turbines will furnish the power to the generators, which will be especially constructed for the use of the plant.

The city of Chattanooga and the Board of Trade are extending every encouragement to the company on account of the industrial development which it is expected will come to the city with the completion of the plant. A number of large manufacturing industries, it is said, have already made propositions with a view to locating in Chattanooga where raw material and cheap power can be secured. Aside from the construction of the power plant itself and the full effect it will have on the industrial growth of the city, the dam will render the Tennessee River navigable during the entire year from Paducah to Chattanooga. The completion of the dam will give the river 44 miles of slack water and will furnish a stream in which the largest boats can be operated to carry manufactured articles and produce to other markets at a lower rate than the railroads afford.

## Chicago Street-railway Situation.

As the result of conferences between the interests back of the Chicago City Railway Company and the Union Traction Company the indications at the time of this writing are that the two companies have decided to act as a unit in future dealings with the city. Under this plan a proposition will be made to the city for taking over the roads, which shall leave the present owners of the lines the right to operate under what might be called a lease from the city. Determination of the question of price when the city finally takes the property is to be postponed until such time as the respective rights of the city and traction companies under the "99-year acts" have been passed upon by the Supreme Court of the United States.

An agreement has been entered into between Corporation Counsel Tolman for the city, Col. E. R. Bliss for the Chicago City Railway Company, and Mr. Gurley for the Union Traction Company whereby the three suits by the city against the traction companies involving questions pertaining to the 99-year act are practically consolidated. They will be heard by Judge Dupuy of the Superior Court early in September, and each side is compelled to have its pleadings on file by July 1.

Judge Grosscup in the Federal Court of Appeals recently granted the motions for appeals made by the North Chicago, West Chicago and Union Traction companies in four cases recently decided in the federal courts, establishing the rights of the city and the traction companies in the matter of franchises. The courts previously held that franchises granted since 1875 for periods of more than 20 years were illegal, but that long-term franchises granted previous to that date were valid. By the granting of the appeal, in which the city concurs, the whole franchise question will go to the United States Supreme Court for final adjudication.

In another column of this issue will be found an outline of the plans prepared by Bion J. Arnold for the construction of a municipal street-railway system which is proposed to take the place of the Chicago passenger-railway system, operated by the Union Traction Company, and on which the franchise has expired.

## Western Association of Electrical Inspectors.

About 40 electricians representing the electrical inspection departments of various cities of the Central West and the electrical departments of the underwriters met in Chicago on June 1st and 2d and formed a permanent organization, the object of which will be, as stated in the Western Electrician last week, to improve the methods of controlling the fire hazard of electricity, to obtain and circulate information on the subject and to establish a more efficient and

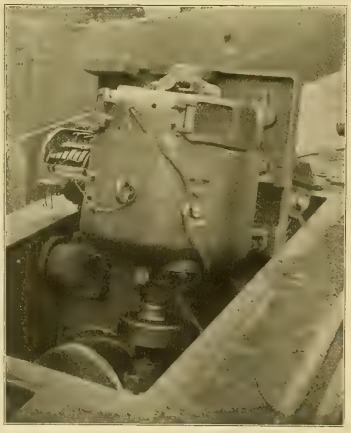


FIG. 2. ELECTRIC CAPSTAN BEING TILTED FOR INSPECTION.

uniform practice in supervising the installation and maintenance of electrical wiring and apparatus.

The association will be known as the Western Association of Electrical Inspectors, and includes in its membership those engaged in the supervision of electric wiring and apparatus in the Central West. The officers elected at the meeting are the following-named: President, F. D. Varnam, city electrician of St. Paul, Minn.; first vice-president, W. B. Hubbell, underwriters' inspection bureau, Cincinnati, Ohio; second vice-president, Edward B. Ellicott of Chicago; secretary and treasurer, W. S. Boyd, electrician, National Board of Fire Underwriters, Chicago; executive committee, E. R. Townsend, F. V. Sackett and George D. Bayle of Chicago, G. W. Gono of Louisville, Ky., F. W. Duston of Minneapolis, Minn., and Waldemar Michaelsen of Omaha, Neb. Several other committees were named on codes, interpretation, etc., and these are to report at the next meeting, which will be the first annual, to be held in the forepart of October, the date and place to be selected later.

The members of the new association inspected several interesting wiring installations while in Chicago, and witnessed various tests in the laboratories of the fire underwriters. A theater party and banquet were included in the entertainment.

## Electric Capstans.

The motive force which was formerly used almost exclusively in connection with heavy moving machinery in harbors was hydraulic power. This system is, however, far less advantageous than electric operation, electricity affording the advantage that both the installation and attendance are less and the consumption of energy smaller. In fact, water conduits under a pressure of 40 to 50 atmospheres are rather costly, while leakages are of frequent occurrence, and, finally, there is the dan-

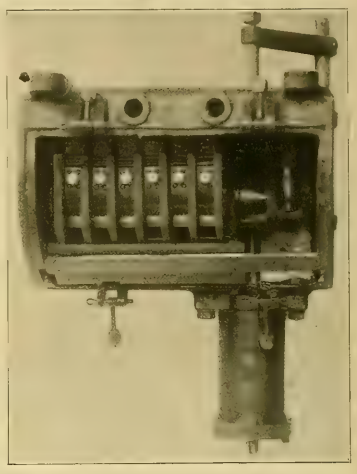


FIG. 1. CONTROLLER FOR OPERATING ELECTRIC CAPSTAN.

ger of their breaking when frozen. On the other hand, the work performed by a hydraulic accumulator depends only on the volume of compressed water consumed, and not on the useful work. In the case of small loads the water is choked in conduits by means of valves, and the mechanical efficiency of hydraulic capstans is accordingly extremely low.

The managers of the Antwerp (Belgium) harbor are engaged at present in tests on a number of electric capstans, supplied by the principal firms, both Belgian and foreign. The International Electrical Company of Liege has been entrusted with the supply of a capstan giving a tractive power of 1,250 kilograms, at a rate of 1.1 meters per second. This capstan has been for some time in practical operation at the Antwerp harbor and has given excellent results.

In one case the construction had to be confined to a small area, one by two meters. The whole mechanism was accordingly located in an excavation about one meter in depth, dug on the spot. It comprises a cast-iron casing containing a 22-horsepower direct-current enclosed motor of the Pieper system, the shaft of which terminates in an endless screw, which actuates a helical wheel, placed immediately on the shaft of the capstan wheel.

The motor is of the compound type and allows of a rather considerable power being developed in starting, while on the other hand it does not get out of order on running at no load. The compounding is calculated for a speed of 1.75 meters a second at no load, so that for small loads higher speeds are obtained without any overload on the motor. The controller (Fig. 1) is actuated by a pedal, a dash-pot filled with oil warranting a slow starting. By means of a string the pedal is lifted automatically on being left to itself. At the end of the stroke a rather energetic electrical braking action is produced, the motor receiving no more current from the circuit, but rather giving off current to the resistances to which it is connected. This braking action results in the capstan being stopped on one-fifth of a revolution.

A special feature of this capstan is that the whole mechanism is mounted on a horizontal axle and fixed by bolts. If the outfit has to be inspected

for lubrication, the bolts are removed, and as every thing is in equilibrium, a minimum amount of power will allow of the whole outfit being tilted (shown in Fig. 2) and of the mechanism being brought out of the casing to a position shown in Fig. 3. As the bolts are in the same horizontal plane as the pivots of rotation and quite symmetrical, they take the place of those arranged in front and keep the whole in position during inspection. The same applies to the current interrupter, one part of which is stationary, while the other, turning through 180 degrees, strikes other contact pieces placed on the other side. The outfit can thus be started and its working tested before everything is placed in position again.

Another feature is that the cast-iron reservoir serving as a foundation carries at its lowermost point a valve opening from above downward, and preventing any water from entering at high tide from the surroundings, at the same time enabling

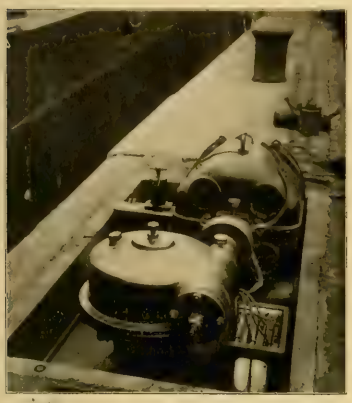


FIG. 3. ELECTRIC CAPSTAN INVERTED FOR INSPECTION.

any rain or other water penetrating through the upper plate, to escape readily.

The motor screw, intermediate gearing, controller and its resistance are obviously well enclosed. Four similar capstans have been supplied to the Bahia Blanca harbor authorities in Argentina.

It may be mentioned that electric capstans are by no means confined to harbor installations, but are employed extensively in railway stations, as well as in iron and steel works.

## Foreign Trade Possibilities.

The tramways at Porto Alegre, Brazil, are to have electric traction.

The municipality of Vlaardingen, Holland, will build tramways.

Electrical works are to be established at Feldbach, Styria, Austria-Hungary.

The municipality of Baeza, Spain, will award a contract for the installation of electric lighting.

The municipality of Saaz, Bohemia, by Mr. Riesesser, will build an electric railway from Waidbruck to Grödnerthal.

Mr. Otto Birken and a syndicate at Zurich, Switzerland, have obtained the concession for building an electric cable road up Mount Bre.

The town of Hanau, near Frankfort, Germany, projects the building of electric tramways. Several of its lines are to be extended to smaller towns in the vicinity.

At the following places in Austria-Hungary electric works are projected: Debant, near Lienz (Tyrol), cost, $105,000; Bad Ischl, cost, $52,000; Zizkow, cost, $201,000.

The Egyptian government contemplates the installation of electric traction on the Matarieh railroad, and it is reported will construct a railroad from Cairo to the Matarieh oasis.

## Cement Protection for Poles.

In Zurich, Switzerland, experiments have been made with cement-covered wooden poles for electric wires. After three years' use they are said to prove entirely satisfactory. A covering of cement and mortar 1½ to two inches thick is used, being held in place and reinforced by a sheet of wire netting, which is wrapped around the pole and held a short space away from the wood by iron brackets. The poles used at Zurich are 39 to 46 feet long and measure about eight inches at the top and 13 inches at the butt (after coating).

## Plans for Chicago's Municipal Car Line.

Much interest has been [illegible] few month concerning the [illegible] line which it is proposed to [illegible] generally referred to as the "Ad[illegible]" The latest development [illegible] the completion of the [illegible] by Bion J. Arnold of Chicago [illegible] the city for the work.

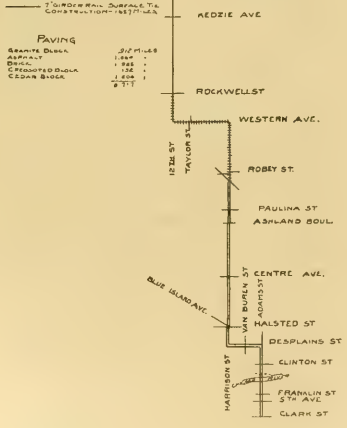
The proposed railway is to begin at [illegible] and run west on Adams to Desplaines Street, [illegible] south on Desplaines to Harrison Street, [illegible] Harrison Street to Western Avenue, [illegible] to Twelfth Street and west on Twelfth to Homan Avenue. The total distance is 5.72 miles. The accompanying illustration shows the location of the proposed line, and indicates the construction on various sections.

Underground conduit construction is to be used on 2.353 miles of the line, extending from Clark Street to Ogden Avenue. For this distance the track is to be built with nine-inch girder-groove side rails, seven-inch Z-bar slot rails, cast-iron yokes spaced five feet, center to center, and T-iron conductor rails, supported every 15 feet by porcelain insulators, and every 105 feet a drainage and cleaning manhole is specified. The girder rail will be nine inches in depth and weigh 120 pounds to the yard.

The conductor-rail called for weighs 21 pounds to the yard, T section. It is to be supported every 15 feet by porcelain insulators suspended from the slot rail in handhole yokes. After lining the slot rail the conductor-rail and insulators are to be bolted in place, and each joint bonded with two No. 00 copper bonds.

There will be 5,500 feet of four-duct, 5,400 feet of six-duct, 1,500 feet of eight-duct, 7,200 feet of 12-duct, 9,100 feet of 16-duct and 1,500 feet of 20-duct conduit. There will be required 40,000 feet of 500,000-circular-mil, 650-volt cable, 57,000 feet of 1,000,000-circular-mil, 650-volt cable, and 54,000 feet of 1,500,000-circular-mil, 650-volt cable. The overhead work calls for 2.96 miles of cross-suspension construction.

The rolling stock will consist of 50 standard pas-




ROUTE OF PROPOSED MUNICIPAL CAR LINE IN CHICAGO.

senger cars, one sweeper, one repair car, one snow plow, one sprinkler, one repair wagon and 50 contact plows.

Bids are invited for two types of generating unit for the power plant—a 3,000-kilowatt turbo-alternator and a 3,000-kilowatt alternator driven by a 4,500-horsepower, compound, reciprocating engine.

The turbo-generators are to be designed to furnish three-phase alternating current at 25 cycles, 22,000 volts. The steam pressure is to be 125 pounds per square inch, with a superheat of 150° F. The turbines are to be operated in parallel and be controlled from the switchboard, the speed variations to be not more than two per cent. from full load to no load.

The reciprocating engines specified are to be of the cross-compound, Corliss, heavy-duty type, for direct connection to alternating generators of the revolving field type, which are to be located between the cranks of the engines. Each generator will deliver three-phase, 25-cycle, alternating current, and will have a rated normal capacity of 3,000 kilowatts at 22,000 volts when operated at a normal speed of 75 revolutions per minute. The steam pressure for this type of engine is to be 175 pounds per square inch, superheat 150° F., vacuum 27 inches.

The boilers called for are to be of the water-tube type, with all parts supported independently of the brickwork. Each boiler is to have a minimum heat-

strikers, condensers, pu[illegible]

[illegible]

the remote control will be, a[illegible]

Sub-stations [illegible] converter equipment [illegible] designed to receive [illegible] line and convert it [illegible] mately 600 volts [illegible] the armature type [illegible] secondaries, with [illegible] each. The [illegible] sional temperature of [illegible] perature of 80° [illegible] installed. Beds are [illegible] and motor-generators.

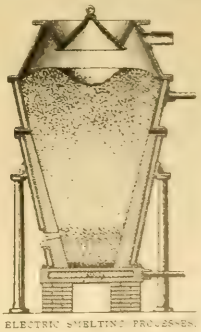
The storage battery [illegible] will consist of [illegible] capable of discharging [illegible] a period of 10 hours. The battery current for control apparatus and for lights.

A telephone system is planned, also, in connection with the railway.

## Electric Smelting Processes.

A series of nine patents upon [illegible] processes and the reduction of metallic compounds, including ferrochromium, were issued on May 23d to Edgar F. Price of Niagara Falls, N. Y. The first two of the series, relating to a process of reducing metallic compounds, describe slightly varying methods whereby charges of the compound are heated in electric furnaces along with a reducing agent. In one case the scattered particles of the reduced metal are collected by introducing a metal into the furnace and allowing it to percolate downward through the charge. In the other case the compound and reducing agent are heated together in an electric furnace, keeping the maximum temperature of the charge at a point which will substantially prevent volatilization, and removing the metal from the region of maximum temperature as it is reduced.

The other patents which are of interest relate to



ELECTRIC SMELTING PROCESSES.

a process of [illegible] of the apparatus [illegible] panying figure [illegible] mite and a predetermined amount of carbon is [illegible] sistance conductor between the superposed electrodes. The lower electrodes consist of ferrochromium, a portion in the liquid and a portion [illegible] temperature requisite for reduction. The molten metal is then permitted to settle and collect upon the lower electrode.

H. W. Buggeln, Engineer, Beloit, [illegible] plate erecting an electric-light plant at the waterworks power house in Beloit, Wis.

# WESTERN ELECTRICIAN

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**CORRESPONDENCE** relating to electricity or any of its practical applications is cordially invited, and the co-operation of all electrical thinkers and workers earnestly desired. Clear, concise, well written articles are especially welcome; and communications, news, news items, local newspaper clippings, or any information likely to interest electricians, will be thankfully received and cheerfully acknowledged.

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## DATES AHEAD.

American Institute of Electrical Engineers (annual convention), Battery Park Hotel, Asheville, N. C., June 19th to 23d.

National-Interstate Telephone Association (first convention of consolidated telephone associations), Auditorium Hotel, Chicago, June 20th and 21st.

Canadian Electrical Association (annual convention), Montreal, June 21st, 22d and 23d.

National Electrical Contractors' Association (fifth annual convention), Mechanics Hall, Boston, Mass., July 19th, 20th and 21st; electrical exhibition, July 15th to 22d.

Ohio Electric Light Association (annual convention), Hotel Victory, Put-in-Bay, August 16th to 18th.

International Association of Municipal Electricians (annual convention), Erie, Pa., August 29th, 30th and 31st.

Old Time Telegraphers' and Historical Association (annual meeting), New York city, August 29th to September 1st.

American Electrotherapeutic Association (annual meeting), Academy of Medicine, New York city, September 19th, 20th and 21st.

American Street Railway Association (annual convention), Bellevue-Stratford Hotel, Philadelphia, September 25th to 29th.

NAVAL engagements today differ materially in one respect from those of even the more modern wars, such as Spanish-American war, and that is in the matter of communication. Space telegraphy has passed from the experimental to the practical stage within the interval of two or three years, and how quickly its advantages in naval warfare have been recognized and utilized is seen in the use to which it was put in the recent engagement between the Russians and the Japanese, which saw the downfall of Admiral Rojestvensky. By the aid of this modern appliance it is possible for the officer in command to keep in touch with all the ships of his fleet, whether they are in sight or miles away beyond the horizon, and the advantages of its use for scouting purposes are self-evident. It was a wireless message that first brought the news of the approach of the Russian fleet to Admiral Togo, and from then until the time the actual engagement began it played a prominent part in the maneuvers.

ONE OF the early uses of the galvanic current was electroplating, but many attempts were made before non-conducting bodies were made susceptible to electroplating currents. This was finally accomplished in various ways by sprinkling the bodies with a fine powder of metal or graphite, or immersing them in a solution of a metallic salt. One of the latest applications of this method of electroplating makes possible the electroplating of lace, and the creation of wonderful effects in metallized embroideries. A chemist of Brussels, Belgium has devoted his attention to this subject and has invented a process which is said to be of much practical value, although the details of the invention are as yet a secret. Laces are mainly treated, and by the process are made conductors in a few minutes, when they are placed in a plating bath and subjected to current at about three volts. They soon become coated with an exceedingly delicate metal surface. The coating is said to be so fine that not the slightest irregularity can be noticed, and the laces remain perfectly soft and flexible.

THAT BUENOS AIRES is a progressive city is shown by the report that the German Transatlantic Electric Company of that city, which controls the electric lighting and the street railways of the city and suburbs, has decided to utilize its large plant in an endeavor to supplant with electric vehicles the 3,000 cabs of the city. Mr. Mauro Herlitzka, the manager, says that his company intends ordering 100 electric cabs by way of experiment, and that he is thoroughly convinced that the demand will be such as to warrant a considerable increase at an early date. The vehicles will be of the light landaulet pattern, approaching in style the light victorias which have found favor there in the cab service, and which are well fitted to the climatic conditions. In Chicago the electric cab venture did not do as well as expected. The service given was excellent, but the financial results were not satisfactory. This was partly due to the ever-present tire difficulty, and it may be that the pavements of the streets of Argentina's metropolis will prove more conducive to economical operation. The topography of the city, the habits of the people as to cab riding, and the condition of other means of transportation will also enter into the problem.

JUDGING from telegraphic reports of the Denver-Colorado Springs Convention of the National Electric Light Association, received as the Western Electrician goes to press, the meeting will be one productive of much benefit, as well as much pleasure to those in attendance. Although the number present is not as large as was anticipated, an attendance of about 1,000, as the reports would indicate, makes the convention well up among the largest held in the history of the association. People of Denver and Colorado Springs have certainly contributed all in their power to give the electrical men a hearty reception, and their efforts as well as those of the railroad companies running the special trains for the delegates will be gratefully remembered. The choice of the place of meeting, as expressed by President Davis in his address, was "a tribute to the development of the central-station industry in the West and was intended to bring our western members in close touch with the work and object of the association, and to secure closer personal relations among our members from all sections of the country." A complete report of the proceedings of the convention will be given in the Western Electrician next week.

COMMUTATOR trouble is one of the bugbears of the station operator, and one of the worst forms of trouble in direct-current dynamos and motors is the forming of a short-circuit between adjacent commutator bars. This gradually burns down into the mica insulation, leading eventually to a burnout. Scraping away of the burned insulation will allay the trouble for a short time, but carbon dust will soon accumulate and bridge from bar to bar. A permanent cure for this trouble is described in the "Wrinkles" department of the National Electric Light Association by the Cleveland Electric Illuminating Company. This is accomplished by digging out all the dirt and burned mica and filling the cavity with a thin paste of litharge and glycerine. The commutator is then heated at this point with a soldering iron or blow torch, baking the paste to a hard compound which can be filed off smooth and even with the commutator surface. It is essential to remove the short-circuit entirely before applying the paste, and it is best to test across the insulation, using a voltmeter or incandescent lamp as an indicator, first disconnecting one of the bars from the armature winding. Holes three-fourths of an inch thick are said to give no trouble after this treatment.

MORE data of lasting value bearing on the possibilities of high-speed electric-railway operation were collected during the three years of tests made on the Berlin-Zossen experimental line than most people realize. Much interest attaches therefore to the lecture which was delivered by Mr. Charles A. Mudge before the New York Electrical Society recently, upon the subject of these tests and which appeared in abstract in last week's issue of the Western Electrician. Mr. Mudge was formerly chief engineer of the railway department of the Allgemeine Elektricitäts Gesellschaft, and he is therefore thoroughly familiar with the equipment supplied by that company for the tests, his lecture being confined to the description and results attained by the equipment of his company. One conclusion which is of interest relates to the matter of braking. It was shown conclusively that it is a difficult matter to keep the retardation at a constant value with the braking apparatus at present at our disposal. The curves of retardation show an undesirable peak at each end, indicating that, for ideal conditions, it is necessary to increase the brake pressure a few seconds after its application and then leave it to an automatic device to decrease the pressure as the speed decreases and as the coefficient of friction increases.

For operation at speeds of over 100 miles an hour it seems advisable to place the tracks of a double-track line farther apart than is now the practice, not only because of the fact that the lateral movement of the cars is liable to be greater, but also because it has not yet been proved that the rush of air which would occur when two cars pass each other going at 125 miles an hour might not act with disastrous results.

Differences of opinion as to the relative merits of single-phase and polyphase operation for such high-speed service naturally exist, but at present it seems impracticable to use the single-phase motor for the purpose. The single-phase motor is, however, only in a transitory stage. How long a time will elapse before it will be built in sizes to do all that the polyphase motor can do is a question for the future.

# NATIONAL ELECTRIC LIGHT ASSOCIATION.

[*By Telegraph to the Western Electrician.*]

## Opening Proceedings.

Denver, Colo., June 6.—About 700 persons had registered as attending the convention when the first session of the twenty-eighth convention of the National Electric Light Association was called to order in the Brown Palace Hotel, Denver, on Tuesday morning, June 6th. There was a large attendance in the hall, which was handsomely decorated. Mayor R. W. Speer of Denver delivered the address of welcome. In pleasing phrase he "boosted" Denver and Colorado. He said it was in the air of Colorado to "boost," and he did so in a good speech, and was greeted with a long-continued burst of applause. President E. H. Davis of Williamsport, Pa., responded. Letters and telegrams in response to invitations were read from a number of ex-presidents and from Professor George Forbes of London.

President Davis then delivered his annual address. He recommended a standing committee on legislation and the formation of state or sectional associations. The total membership is now 824. The president's address was referred to a committee consisting of L. A. Ferguson of Chicago, F. W. Frueauff of Denver, George R. Stetson of New Bedford, Mass., Samuel Scovil of Cleveland and General S. T. Carnes of Memphis. T. C. Martin of New York then made the report of the committee on progress.

The special report of Dr. Louis Bell of Boston on the tantalum lamp was also presented by Mr. Martin, in the absence of the author. Samples of tantalum lamps were exhibited. Dr. Bell said two lamps gave a life of 800 hours before falling below their usual candlepower, giving 16,000 candlepower-hours at extremely high efficiency. The light is as white as the Nernst light or the acetylene flame. Some doubts have been expressed as to the endurance of these lamps on alternating circuits. Tests at both 25 and 60 cycles showed not so much difference between carbon and tantalum filaments as was anticipated. As an illuminant the lamp is excellent. It is a bona-fide two-watt lamp. There is good reason to believe it to be generally applicable. The price abroad is about one dollar apiece. But, even at that, it shows economical results, even compared with free carbon lamps, with current at 10 cents a kilowatt-hour. The new lamp consumes, roughly, about two-thirds of the current required by the carbon filament for an equal amount of light. But cheaper light will mean more lights and more customers. All improvements help the business and should not be opposed. The important thing is that from now on the central-station man must deal with a two-watt-lamp proposition.

In discussion, Arthur Williams of New York said that he thought that at present the new lamp would not prove a serious competitor to the ordinary incandescent lamp. The present price of the lamp offsets the economy of current. J. F. Gilchrist of Chicago asked if it would not be wise to sell light on a lamp-hour basis rather than a kilowatt-hour basis. Dudley Farrand of Newark, N. J., spoke of two tantalum lamps that showed an efficiency of less than two watts. The new lamps would not come fast enough to work any revolution. W. H. Gardiner, Jr., of Boston said that the 16-candlepower standard was not important, as was proved by the history of the gas-lighting industry.

David Hall of Cincinnati read a paper on the importance of standardization in machinery and apparatus. E. F. McCabe of Lewistown, Pa., said it would be a good idea for the manufacturers to get together and standardize their machines. H. T. Hartman of Philadelphia thought engine and dynamo builders should get together and standardize speeds.

C. E. Skinner's paper on insulation testing was read by the author, whose home is in Pittsburg. Adjournment for luncheon was then taken.

## Tuesday Afternoon's Session.

Denver, Colo., June 6.—At Tuesday afternoon's session Paul MacGahan of Pittsburg read his paper on "Automatic Synchronizing of Generators and Rotaries for Lighting and Power Systems." This was followed by a paper on "Rotary Converters and Motor-generators for Lighting and Power Systems," read by its author, Louis E. Bogen of Cincinnati. Clarence Renshaw of Pittsburg discussed the paper, differing in some particulars from Mr. Bogen. Alex Dow of Detroit also took part in the discussion. Mr. Bogen and Mr. Dow said that motor-generators are inadequate [illegible] service. Mr. Renshaw favored [illegible].

Arthur Williams discussed the report of the committee on progress, presented in the morning. He referred to the practical value of the mercury-vapor light and to other points in the report. Electric light in signs is now one of the great advertising mediums, and Mr. Williams [illegible] should look closely to the [illegible]. W. C. L. Eglin of Philadelphia and Alex Dow of Detroit also discussed the report. The latter referred to electrochemical processes that could be carried on without interfering with peak hours—that is, intermittently. The 4,600-volt overhead transmission in Detroit was adopted because it seemed the potential best adapted to local conditions. Mr. Dow said that $500,000 had been invested in steam-heating central-station mains in Detroit. The area in the residence district is about one-half by one mile; in the business district it is about half a mile square. Selling current at the Delray station at the board—4,600-volt, three-phase current—Mr. Dow said the Detroit Edison Company was willing to accept from one cent to 1.2 cents per kilowatt-hour—that is, at the bus bars. Some of the underground transmission is at 22,000 volts, the highest voltage at which the manufacturers would guarantee underground cables.

W. P. Hancock of Boston read his paper on "The Organization of Working Forces in Large Power Houses." He gave the association the benefit of his extensive practical experience in organizing the men operating a large electrical power house. W. B. Jackson of Madison, Wis., praised the paper, and said that operators of small plants, as well as large ones, could get much of value out of it. Several other gentlemen discussed the paper.

Steam turbines were then taken up. W. C. L. Eglin presented the report of the committee on the investigation of the steam turbine. Associated with Mr. Eglin on the committee were A. C. Dunham, I. E. Moultrop, George W. Cato and J. D. Andrew. The report was read in abstract. By a formal resolution a vote of thanks was extended to the committee and it was continued. August H. Kruesi of Schenectady, N. Y., read his paper on "Operating Features of the Curtis Steam Turbine." Discussion was postponed until Wednesday morning.

## Wednesday Morning's Session.

Denver, Colo., June 7.—Two motor papers were read by the authors on Wednesday morning, "Series Alternating-current Motors for Industrial Work," by Clarence Renshaw of Pittsburg, and "A New Type of Single-phase Motor for Elevator Work," by S. Percy Cole of St. Louis. There was a brief discussion, but little that was new was brought out.

The steam-turbine discussion proved to be very short. Mr. Eglin said that in a later report more information would be given on the operation of turbines by exhaust steam. He said the committee had some other information not published, which members could obtain by correspondence.

The report on protection from lightning and other static disturbances, by Alex Dow and Robert S. Stewart, both of Detroit, was presented by Mr. Dow. Mr. Maunsell of Topeka, Kan., Mr. Hayward of Salt Lake City, E. P. Dillon of Colorado Springs, Mr. Stetson of New Bedford, Mass., Mr. Hummel of Salt Lake City, Mr. Hartman of Philadelphia, W. B. Jackson of Madison, Wis., and Mr. Dow participated in a valuable discussion.

The paper of John A. Britton of San Francisco on "High-tension Transmission in California," was read by title, in the absence of the author.

E. R. Roberts of Pittsburg read the paper on "The Nernst Lamp." Arthur Williams of New York, in discussion, said the quality of the light was very satisfactory. Mr. Dunham of Hartford, Conn., said that as a replacer of the gas arc the Nernst lamp was infallible. In Hartford the central-station people keep track of the commercial Nernst lamp, mostly single-glower, and replace the glowers at the end of 450 hours.

There was no Wednesday afternoon session, but instead the convention people attended a "broncho-busting" contest at Denver Athletic Park, which proved very interesting. Indeed, the features of the Denver entertainment, which are numerous and carefully planned, are being thoroughly enjoyed. There was a handsome reception on Monday evening, a tally-ho ride and country-club luncheon for the ladies on Tuesday, and a summer theater party [illegible]

## Wednesday Evening's Session.

[illegible] P. [illegible] Wednesday [illegible] Mr. [illegible] Schenectady, [illegible] in operation [illegible] made by [illegible]

Samuel Scovil of Cleveland [illegible] proposed amendment [illegible] retiring president is made a member of the executive committee for one year. [illegible] Newark, N. J., made a [illegible] on "Advertising Me[illegible]." [illegible] in the hall at this meeting an interesting display of advertising designs, forms and literature arranged by T. C. Martin of New York.

John Craig Hammond of Denver and [illegible] of Newark, N. J., read their own papers. Mr. Lee's paper was on "[illegible]"; he also abstracted the paper of LaRue Vredenburgh of Boston, on "Sign and Decorative Lighting." The discussion on advertising methods was opened by Mr. Hammond, who, representing the Denver Gas and Electric Company and other companies, has had valuable experience in designing advertising for central-station companies. Mr. Hammond has planned some of the cleverest advertising of this character that has been put out. Self-supporting advertising is what is arrived at. Educate the public to use more current. In Denver, the local company does not copy; it originates and creates. Denver was made the "city of lights" by an advertising campaign. You must advertise something that is legitimate; you can't "bunco" the public.

J. F. Gilchrist of Chicago said that the advertising display in the hall made by Denver and the other cities represented was a liberal education. Denver was far ahead of other cities in electric signs and in advertising methods. Mr. Gilchrist said that he thoroughly believed in a considerable amount of advertising, and described the Chicago central-station methods. Advertising brings business that can be obtained in no other way. From two to 2½ per cent. of gross sales should be spent in getting business—say, two-thirds on canvassing and one-third on advertising. Mr. Ingalls said advertising of central stations seemed to be as good in small towns as in large ones. Several others discussed the subject, and then the association adjourned to attend an athletic smoker.

Denver, Colo., June 8.—Three sessions to be held today will conclude the business programme. The association elected as officers the following-named gentlemen: President, W. H. Blood, Jr., of Seattle, Wash.; first vice-president, Arthur Williams of New York, and second vice-president, Dudley Farrand of Newark, N. J. The new members of the executive committee will probably be C. L. Edgar of Boston, John Martin of San Francisco, F. W. Frueauff of Denver. W. C. L. Eglin will probably be secretary. [A full report of the convention will be given in the Western Electrician next week.] W. E. K.

## Chicago "Special" and Those Who Rode on It.

The special trains from New York and [illegible] carried well over two hundred persons to the convention. The New York train left that city on Saturday morning, June 3d, and ran over the Pennsylvania road, via Pittsburg, arriving in Chicago on Sunday morning. Here the travelers, who numbered 1[illegible] in charge of George F. [illegible] [illegible] This handsome train left Chicago over the Burlington road for Denver shortly after 11 o'clock, and was followed [illegible] Burlington railroad people, which carried the Chicago contingent [illegible]. This train was made up of seven cars—a buffet-baggage car, a dining-car, two ten-section double drawing-room cars, two 16-section sleeping-cars and one

compartment-observation car. It was an exceptionally fine, well-appointed train, perhaps the finest ever run over the Burlington railroad. The party, which numbered 90, was in charge of Frank L. Perry of Chicago, assistant master of transportation, who was assisted by A. J. Puhl of Chicago and L. M. Whitehead of Omaha, who represented F. E. Bell of the passenger department of the Burlington Route. The Burlington people were very attentive and did all in their power to make the trip the very pleasant one which it proved to be. Mr. Puhl was compelled to leave the train at Ottumwa, but Mr. Whitehead accompanied the party for the entire trip. A letter to Mr. Enstis, passenger traffic manager of the Burlington Route, expressing thanks to the railroad people for their care and attention, was generally signed by the passengers on the train. The train equipment was noteworthy, and especial admiration was elicited by the dining-car, which is a beautiful specimen of the carbuilders' art, and which took first prize at the St. Louis exposition.

At Mendota, Ill., the official photographer of the railroad company took photographs of both the New York and Chicago trains. Messrs. Karschner and Munroe of the Denver Gas & Electric Company boarded the train at McCook, Neb., and said that everyone on board was provided with hotel accommodations. In this and in all other respects the Denver people showed themselves very thoughtful and hospitable.

Following is a complete list of the names of those on the Chicago train:

Aborn, W. G., The J. C. Pearson Co.....Cleveland
Aborn, Mrs. W. G.....Cleveland
Alderson, F. J., Stanley Instrument Co.....Chicago
Allen, A. S., Tonawanda Power Co.North Tonawanda, N. Y.
Arnold, W. L., The Arnold Co.....Chicago
Arnold, Mrs. W. L.....Chicago
Atkin, Godfrey H., Electric Storage Battery Co.....Chicago
Berg, Geo. H., Allis-Chalmers and Bullock Cos.....
.....Boston, Mass.
Bixby, W. A., Quincy Gas and Electric Co.....Quincy, Ill.
Bogen, Louis E., Bullock Elec. Mfg. Co.....Cincinnati, O.
Bogen, Mrs. Louis E.....Cincinnati, O.
Brooks, John W., Pass & Seymour.....Solvay, N. Y.
Carr, Geo. R., Dearborn Drug and Chemical Wks..Chicago
Carrier, A. E., National Carbon Co.....Cleveland
Cotabish, N. C., National Carbon Co.....Cleveland
Cotabish, Mrs. N. C.....Cleveland
Crider, J. S., National Carbon Co.....Cleveland
Crouse, J. Robert, National Electric Lamp Co....Cleveland
Diall, Oliver M., Lockport Gas and Electric Co....
.....Lockport, N. Y.
Doane, Samuel Everett, Bryan-Marsh Co.....Chicago
Doane, Mrs. Samuel Everett.....Chicago
Donahoe, Francis E., American Electric Works.....Chicago
Donahoe, Mrs. Francis E.....Chicago
Earnshaw, Charles, Standard Paint Co.....Boston
Eddy, Henry C., American District Steam Co.....Chicago
Ferguson, Louis A., Chicago Edison Co.....Chicago
Ferguson, Mrs. Louis A.....Chicago
Ford, Edward R., Western Electrician.....Chicago
Ford, Mrs. Edward R.....Chicago
Foster, Geo. B., Allis-Chalmers, Bullock and Wagner
Cos.....Chicago
Gilchrist, John F., Chicago Edison Co.....Chicago
Gilchrist, Mrs. John F.....Chicago
Gillette, J. W., National Battery Co.....New York
Gray, Geo. A., Thomas G. Grier Co.....Chicago
Grier, Thomas Graham, American Circular Loom Co.Chicago
Hall, David, Bullock Electric Mfg. Co.....Cincinnati
Hardy, J. W., H. W. Johns-Manville Co.....Milwaukee
Houck, H. C., General Electric Co.....Cincinnati
Jackson, W. B., Electrical Engineer.....Madison, Wis.
Jackson, Mrs. W. B.....Madison, Wis.
Jeffrey, John, Bullock Electric Mfg. Co.....Cincinnati
Johns, S. C. D., Cleveland Electric Illuminating Co.
.....Cleveland
Johns, Mrs. S. C. D.....Cleveland
Johns, Miss .....Cleveland
Karshner, G. M., Denver Gas and Electric Co.....Denver
Keily, W. E., Western Electrician.....Chicago
Keily, Mrs. W. E.....Chicago
Kerlin, F., National Carbon Co.....Cleveland
Korst, P. H., Janesville Electric Co.....Janesville, Wis.
Lanphier, R. C., Sangamo Electric Co.....Springfield, Ill.
Livsey, J. H., General Electric Co.....Detroit
Livsey, Mrs. J. H.....Detroit
Lloyd, E. W., Chicago Edison Co.....Chicago
Lloyd, Mrs. E. W.....Chicago
Low, W. W., Electric Appliance Co.....Chicago
Low, Mrs. W. W.....Chicago
Merrill, W. W., Chicago Fuse Wire and Manufacturing Co.....Chicago
Miller, M. C., Allis-Chalmers Co.....Milwaukee
Montague, J. E., Buffalo and Niagara Falls Electric Light and Power Co.....Niagara Falls, N. Y.
Moser, A. G., Winona Railway and Light Co.Winona, Minn.
Mordock, C. T., Terre Haute Traction and Light Co.
.....Terre Haute, Ind.
Munroe, R. G., Denver Gas and Electric Co.....Denver
Niesez, H. E., Chicago Edison Co.....Chicago
Niesez, Mrs. H. E.....Chicago
Packard, W. S., New York and Ohio Co.....Warren, O.
Park, F. C., National Carbon Co.....Cleveland
Perry, F. L., Western Electrician.....Chicago
Pinckard, W. R., Westinghouse Electric and Mfg. Co.....Chicago
Pinckard, Mrs. W. R.....Chicago
Post, Hoyt, Peninsular Electric Co.....Detroit
Post, Mrs. Hoyt.....Detroit
Post, Miss .....Detroit
Rau, O. M., Milwaukee Electric Railway and Light Co.....Milwaukee
Richmond, F. S., Oak Park Yaryan Co.....Chicago
Sawyer, L. P., Buckeye Electric Co.....Cleveland
Scribner, Jesse, General Electric Co.....Chicago
Scribner, Mrs. Jesse.....Chicago
Smith, W. F., General Electric Co.....Minneapolis
Stranahan, O. A., Allis-Chalmers Co.....Milwaukee
Tucker, A. L., Western Electric Co.....Chicago
Tupper, C. A., Allis-Chalmers and Bullock Cos..Milwaukee
Tupper, Mrs. C. A.....Milwaukee
Van Bergen, C. E., Duluth General Electric Co....
.....Duluth, Minn.

New York Train.

Chicago Train

SPECIAL TRAINS TO THE CONVENTION.

Van Bergen, Mrs. C. E.....Duluth, Minn.
Wakeman, J. M., Electrical World and Engineer..New York
Wakeman, Mrs. J. M.....New York
Wallace, R. S., Peoria Gas and Electric Co.....Peoria
Wallace, Mrs. R. S.....Peoria
Wiley, J. R., Standard Underground Cable Co....Chicago
Wilkins, C. W., National Carbon Co.....Cleveland

## Address of President Ernest H. Davis.

For the first time in the history of the National Electric Light Association its annual convention will be held west of the Missouri River, and no more typical city of the West could have been selected than the progressive municipality of Denver, and no more beautiful spot than Colorado Springs.

The choice of our place of meeting was a tribute to the development of the central-station industry throughout the West, and was intended to bring our western members in closer touch with the work and object of the association, and to secure closer personal relations among our members from all sections of the country.

The present convention may therefore be termed as somewhat missionary in its object. The membership of the association generally grows proportionately smaller as we go westward, and it is expected that the Denver-Colorado Springs meeting will result in a large increase in our membership from the West. The state of Colorado is, however, an exception, in that an unusually large proportion of the central stations located within its borders are now members of the association.

In this connection it will not be amiss to refer briefly to the work done by the association in recent years. The annual conventions offer the only general opportunity of a personal exchange of thought and experience among a large number of central-station managers, as well as for the presentation of papers and discussions on matters of general interest. But the field of the association is far broader than the benefits derived from such personal exchange of individual views, and the reading of papers and discussions founded therein.

The interest of the central station, considered as an industry, is what has lately received the best work and thought of your association; the vital questions being no longer pre-eminently those of management or type of plant, but rather those relating to the stability and legitimate earning power of the industry.

The one great and constant menace to the industry is unwise, burdensome and restrictive legislation, by the municipality and the state. The right to tax is the power to destroy. The power to regulate contains the germ of the danger of confiscation, in whole or in part. The regulation of the industry by a commission with powers such as are vested in the Gas and Electric Commission of the state of Massachusetts may be proper and satisfactory as safeguarding both the rights of the public and of the investor; but regulation by a commission brought into being by a manufactured public sentiment and having its inception in politics, and not primarily or honestly intended to remedy any admitted public oppression or properly to regulate the use of public franchises, cannot be fair either to the public or to the investor, and must result in gross injustice to the industry.

The association should not be passive while laws placing the industry under the regulation of commissions are passed by the several states without making proper suggestions whereby such laws would be made reasonable and uniform in their provisions. Nor should it permit, without protest, the passage of any laws admittedly unduly restrictive and burdensome. The object should be to have the general laws of the several states relating to the industry conform to some standard, fair both to the public and to the industry.

For one state to grant only very limited-term franchises under burdensome restrictions, and for another—and possibly an adjoining state—to grant perpetual franchises without restrictions; for one state to reserve the right to fix and change the rate of charge for service rendered, and for another state to empower any municipality to make any rate it may see fit, and to charge the same when and as it pleases, cannot but injuriously affect the stability of the industry from the standpoint of the investing public.

I would, therefore, recommend the appointment of a standing committee on legislation to aid in protecting the interests of our members, should occasion arise.

The formation of state or sectional associations whose object it shall be to call the attention of the interests affected to proposed legislation and to secure concert of action for mutual protection, should be encouraged; which associations could very advantageously act in conjunction with your association's committee on legislation. The good work in this direction already done by existing state or sectional associations has been very much appreciated by the interests benefited.

It was my intention to suggest a codification of the laws of the several states relating to the central-station industry for the benefit of our members and others interested, but the work has been done in a manner, and is now in book form.

Another important question is that of municipal ownership, which, while as yet limited generally to the construction and operation by municipalities of plants for public lighting, is more than likely to result in the general attempt to engage in private or commercial lighting in aid of the public lighting.

By way of self-protection, the central station should more than live up to the obligation of its franchises, should furnish public lighting at reasonable prices and serve the public so well that any agitation, started for political or personal ends, will not receive the support of a justly indignant public.

As the basis of the argument in favor of municipal ownership is largely that of a reduction in the cost of public lighting to the taxpayer, we should be prepared to answer this claim—as can be done—by the concrete results of the operations of existing municipally operated plants.

It is to be regretted that the League of American Municipalities has not accepted the proposition repeatedly made by the National Electric Light Association to join in a thorough and impartial investigation of the results of the operations of existing municipal electric-lighting plants in this country. We know, but the public generally does not, that such results do not justify or support even a part of the claims made by the advocates of municipal ownership.

The amendments to the by-laws adopted at the last convention, relating to various classes of members, have resulted in a satisfactory addition to

our membership. Members, Class B, are officers or employes of member companies, and now number 117; members, Class C, are instructors and teachers of engineering and related sciences, and now number 39, and associate members, Class E, are officers or employes of associate member companies, and now number 68. The total membership is now 824, as compared with 583 one year ago.

The Association of Licensed Manufacturers of Incandescent Lamps has appropriated the sum of $10,000 for the purpose of effectively co-operating with the central lighting stations of the country for the increased use, and in consequence, sale of, incandescent lamps. The plan contemplates its expenditure in two ways:

First, to be helpful in stimulating central stations along advertising and new business lines; second, to assume the cost of preparation of an effectual and comprehensive plan of advertising and soliciting, which, in consequence, could be furnished by some central bureau or advertising agency at a very low cost. As the plan suggested would be of value to the central station industry, I would recommend that a committee be appointed to work in conjunction with the Association of Licensed Manufacturers of Incandescent Lamps.

Our late president made some very pertinent suggestions as to the labors and difficulties attending the discharge of the duties of the president of your association, and of the value and necessity of having meetings of the executive committee, during the interim between conventions, to secure a continuity of the established policy of the association and to keep in close touch with the needs of our members in all sections of our country. The suggestions made, I indorse. The individual policy and efforts of succeeding presidents, no matter how able they may be, can no longer do full justice to the interests of our members, widely scattered as they are. The executive committee must be the connecting link between the work of succeeding presidents. Its members should be selected, so far as possible, to represent geographically the several sections of the country, and should meet often enough to place the president in touch with the needs of their localities.

Steps should be taken to provide a place and facilities for a library to contain papers, periodicals and publications, issued from time to time, relating to all subjects of interest to the central-station industry.

The original data collected by the several committees and reporters, appointed from time to time, should be filed in the office of the association, together with all the correspondence on the part of the executive officers of the association, and others, relative to the important questions that fall to their lot to deal with. Each president in turn is handicapped by finding substantially no record in detail of the work of any of his predecessors, and is therefore at a great disadvantage in attempting to deal with any important question that may overlap the term of more than one president or that may have some relation to events of the past.

A committee should be appointed to consider and report on the proper method of grounding secondaries of alternating-current distributing systems so as to minimize the risk and danger to property and life.

The suggestion made by the committee for the investigation of steam turbines, that its work be continued, is indorsed.

While not strictly within the objects of the association, it would be well for our members to consider the advisability of consolidating the street railways, gas and electric companies in any given locality, as not only would the public be better served, but the total investment would be more stable and the results equally satisfactory.

During the holding of the Louisiana Purchase Exposition in 1904 your association, through the kindness of the Association of Edison Illuminating Companies, was granted the use of part of its space at the exposition for the accommodation of our members, and I desire to take this occasion to thank our sister association for the courtesies extended.

At the meeting of the International Electrical Congress, held in September, 1904, at the exposition, your association was ably represented by the gentlemen selected at its Boston meeting. I desire, therefore, to thank Mr. George Ross Green, Prof. Frederic A. C. Perrine and Mr. George N. Eastman for their very able papers and the manner in which they sustained and added to the reputation of the association.

But few of us appreciate the tremendous power of the association; the great possibilities for good or evil that rest in the direction of its policy, and the importance of the interests involved. Our relations to the great public, to our customers, to the legislative power—to which we are all subject—to the municipality under whose franchises we operate, to the great manufacturers of apparatus and supplies, to the insurance interests with whom we must always maintain the most intimate relations, and last, but by no means least, to our stockholders and all others pecuniarily interested in the properties we manage, are the great and vital questions that are now uppermost. It will be for future administrations to deal wisely and conservatively with them.

## Electric Signs for Decorative and Advertising Purposes.

Two papers read at the [illegible] convention of the National Electric Light Association which were of much interest [illegible] general subject of sign lighting. One of these papers was read by Mr. C. W. Lee [illegible] Signs and Flat Rates." The other paper [illegible] was by Mr. LeRoy Vredenburg [illegible] with the Edison Illuminating Company of Boston. These papers cover an important field in the central station lighting industry.

As an avenue to publicity, the electric sign, as pointed out in Mr. Lee's paper, is of great importance, and the following paragraphs express his ideas as to the value of sign lighting and how it may best be obtained.

Publicity is the commercial watchword of today. Through divers channels millions of dollars are annually being poured in an effort to reach the buying public. That these efforts are productive of results cannot be gainsaid. The various methods followed in the outlay of this vast expenditure can be summed up in the one word—advertising.

In the development of electric lighting numerous new difficulties are constantly being presented, while but few of the old ones have been left behind. Of these accumulated troubles the majority, in one way or another, apply to that bugbear of all lighting companies, the peak hour. Try as we may, none of us has succeeded in persuading one-half of the public to use current during the day while the other half uses it at night. True, the development of the electric motor and the invention of numerous current-using devices have had a direct bearing upon making the station load more uniform, but at best they have only helped out during daylight, leaving the hours of darkness still to be taken care of.

Neither the great general advertiser nor the small storekeeper should be overlooked in an aggressive sign campaign; one has billboards to illuminate, the other a store front. By the introduction of aggressive methods electric companies can fill the night world with light. Why not seize upon this field? Tackle it with vigor. Give signs away, or, rather, loan them to your customers. Don't use half-hearted methods and try to sell them because of the fear of possible losses in the lending. Changeable and interchangeable signs are cheap, and by their universal use you can absolutely prevent losses.

I am familiar with the methods of a lighting company, covering a well-populated but scattered territory, which at the beginning of 1904 had less than 50 signs connected. This company adopted the free-sign proposition, gave away two standard types of signs, both of which were changeable, and at the beginning of 1905 had over 450 connected, containing a total of 29,749 four-candlepower lamps, returning an annual revenue of $59,130.48. This company charged off the first year the cost of constructing signs of changeable letters, as well as all erecting and connecting cost; together with 20 per cent. depreciation on the sign, five per cent. depreciation on station, line, meter and transformer investment. Charging the current used at cost, with lamp renewals and maintenance, it earned from 10 to 50 per cent. on the investment for each sign and its pro rata station and line cost.

Many of these signs are now on their second year's burning. This year's profits will be much greater, because all construction, wiring and erection items were charged against the first year. A few customers were lost at the expiration of their first contract, several failed or died after using their signs for only a few months, but those months paid part of the cost of erection, and all signs were immediately installed elsewhere. Signs were put up on one-year contracts, current sold at rates averaging over 10 cents per kilowatt-hour, and, to insure a proper use, a monthly minimum was required equal to about one and a half hours' daily burning. This is not the only company that has worked for its share of the sign business. However, its experience is typical, and the plan succeeded because the promoters had faith in signs and made it easy for their customers to obtain them.

With a view to further increasing the sign business this same company has recently placed in operation a plan whereby the greater portion of its sign lighting will be entirely removed from its peak during the months when the peak must be considered. Free signs on a flat rate for certain stipulated hours each night is the nucleus of this plan. The time of switching on is placed about half an hour after the peak load. The turning on and off of signs is controlled by patrolmen, who not only attend to these duties but inspect all signs as well as solicit new business. It is expected that, as soon as this plan is under full headway, the increased business will necessitate the running of special sign circuits from the station. In this event the expense of patrolmen would be eliminated. Isolated signs at some distance from the main streets are controlled by time switches.

The flat rates adopted are based upon current for the first two hours each night at regular rates and at a low rate for every hour's burning thereafter. Customers are thus induced to continue long-hour burning.

The meter has been a formidable obstacle in the [illegible] hour.

[illegible] ing the first half hour [illegible] has [illegible] Further, it has demonstrated the [illegible]

By the large national advertisers, billboards and sign boards are [illegible] and magazines as strong mediums for reaching the public purse. Recently, in conversation with one of the members of a large eastern billposting company, I discovered [illegible] illuminated billboard. There is no question but that the National Billposters' Association would welcome a plan whereby the efficiency of advertising space could be made more available. In the past it has fought rather shy of [illegible] difference in the lighting rates prevailing over the country. If there were [illegible] association could meet the National Billposters' Association on a fair footing, establishing a uniform lighting rate for the entire country (by that I do not mean necessarily a low rate), I believe that it would be the means of producing a splendid volume of new business in which all lighting companies would eventually participate.

Advertising appropriations are usually distributed through advertising agencies. Experts plan the campaigns with the expectation of obtaining certain results. Various mediums are used, according to the product to be sold. For their services the billposting companies charge a specific amount per foot for painting, a specific amount for position, and a specific rate per sheet for posting. This rate is uniform throughout the United States. All of the details of illuminated billboards would fall upon the billposting company; maintenance, posting and collections. It would then only rest with the lighting companies to furnish current at a uniform rate.

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Mr. Vredenburg took up the question of electric signs in his report from a purely commercial point of view rather than from the artistic side; he said that it is undoubtedly a safe assumption that the business world recognizes the increased drawing force of an illuminated sign over a plain one, not only on account of the additional hours of its usefulness, but also on account of the attractive efficacy of light. With this assumption granted, the central station desiring to increase the number of its sign customers has a good proportion of its work already accomplished, for there is no need of entering into an argument to establish the superiority of its commodity.

One of the large lighting companies has more than trebled the number of its sign customers during the last year and a half, another has increased its sign business 33 1-3 per cent. within a year, having [illegible] about 600 signs of all sizes. This company has adopted the policy of supplying and installing signs free of charge under contract, provided the customer will agree to keep the sign a certain length of time and burn it either fixed hours or a certain stipulated amount as governed by a minimum bill. In most of the signs so put out by the company referred to four-candlepower lamps are used, although in some cases two-candlepower lamps are used, and in a few, lamps of larger candlepower are installed. The consensus of opinion seems to [illegible] lamps are the best for general sign illumination. In most of the larger [illegible] until midnight, but some of the companies have a 10 o'clock switching hour, and most of the signs that burn [illegible] o'clock.

[illegible] enacted before the value of electric signs to the mu[illegible] directed effort on the part of the lighting companies will undoubtedly tend to the correction of this condition, as the benefit accruing to any town from the added illumination of its streets by means of signs [illegible] little argument is necessary. A revision of the antiquated ordinances re-

garding signs has been accomplished in Chicago; there is still a restriction as to size, and a license of a certain amount per square foot is levied annually to provide for a rigid inspection of hanging, etc. A certain minimum number of lamps is also required, in order to prevent anyone putting up an immense board sign with just enough lamps installed for it to be called an electric sign. The ordinance also requires that the lamps shall burn until at least half past nine every evening, so as to insure the municipality's receiving the benefit of the illumination. There is no doubt that a large number of the cities and towns in this country could be induced to enact similar ordinances. It would certainly be the means of making the cities much more attractive, and would give the lighting companies a greatly augmented revenue.

The method pursued by one of the large companies last year was a persistent and systematic advertising campaign by means of letters, folders, mailing cards, booklets, return postal cards and enclosed stamped envelopes, sent to a selected mailing list secured by a thorough house-to-house canvass, including all retail merchants in all lines of business whose stores were sufficiently pretentious to possess a plate-glass window. This campaign last year resulted in more than doubling the number of sign customers. The company referred to supplies four-candlepower lamps for signs only. The above result was obtained in a city where an ordinance restricts the projection of signs to two feet from the sidewalk line, consequently most of the signs installed are either vertical or flat against the face of the building. Most of the large companies use electric signs for their own advertising, thus proving their faith in what they recommend to others; the effect of this is undoubtedly in the right direction.

The rather large initial cost of electric signs has always militated against their use, but recently manufacturers have been directing their energies to the reduction of this first cost, with the result that some very effective signs are now on the market which may be purchased at a very reasonable cost. One of the recent improvements is the thermostat control, by means of which a sign is flashed without the use of a flashing switch. This is only practicable, of course, on comparatively small signs, mostly for interior use.

One of the larger companies (and possibly others) has placed the sign business in the hands of one man, who is especially qualified by experience and study to handle this branch of the business. The great majority of merchants when considering the subject are completely at a loss as to what size and style of sign to adopt, and invariably consult the lighting company for advice in the matter. An expert should be able to advise the prospective sign customer in all matters of detail, and as the conditions are so varied and the possibilities so unlimited, judicious advice from such a source is of great value to both customer and company. No effort should be spared to insure the installing of the most efficient and most economical sign. It can readily be seen that there is an opportunity for the exercise of a great deal of ingenuity and good judgment in planning or selecting a suitable sign. The candlepower of the lamps installed should depend upon the location of the sign, whether same is intended for long-distance exposure, for interior use, or in narrow streets low down on buildings, where from the nature of the surroundings the sign may be seen but at a comparatively short distance.

The subject of window lighting might justly be considered under this heading, as the conspicuous illumination of a show window has a distinct value apart from simply displaying the goods therein contained, for the well-lighted window attracts almost as much attention as a brilliant sign, and is the primary inducement tending to further investigation by stimulating curiosity. One notable case exists where a large store window is most strikingly illuminated with no goods displayed, nothing but cards and placards intimating what beautiful and attractive goods may be seen within. This might not prove altogether satisfactory as a permanent arrangement, but as a temporary change should prove effective, and might induce persons to enter in order to satisfy a curiosity which, were the goods in the window, would be satisfied without entering the store. Of course the main thing is to persuade people to come in—after that the salesman must do the rest. The Boston Edison Company has installed in its exhibition rooms a sample show window with five different schemes of lighting, illustrating the effect of concealed lamps, reflector lamps, overhead lighting, side lighting, Meridian lamps and various combinations of the above-named methods; this has undoubtedly been of service to customers in determining upon what method to adopt and to the company's salesmen in advising customers along this line.

A type of sign which appeals strongly to the general advertiser is the so-called "talking sign." This sign, although quite expensive to install and only adapted to use in larger cities is of such versatility and attractiveness, enabling the user to present such varied and extended arguments, that it should prove a profitable investment. The lighting companies cannot afford to overlook or neglect that branch of the business covered by sign and decorative lighting, for it has already assumed decided prominence and its future is almost unlimited. This is an advertising age, and the newer and more progressive methods are eagerly sought and adopted.

## Long-Distance High-Tension Transmission in California.[1]

By John A. Britton.

In the year 1888 attention in the engineering world was attracted by the Folsom Water Power Company determining to build a dam across the American River, near the town of Folsom, and to erect a power house some 2½ miles south of the dam on the river, conveying water by a canal having a capacity of 40,000 miners' inches, to low-head turbine wheels, under a head of 65 feet. Four 750-kilowatt units were installed, generating current at 800 volts, stepping up to 10,000 volts, and conveying the current thus generated to the city of Sacramento, 22 miles distant. The promoters of this enterprise were discouraged by the inability at that time of engineers to guarantee that 10,000 volts could be safely carried that distance for commercial purposes. In 1895 this dream became a reality,

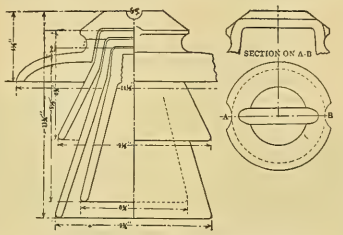



FIG. 1. LATEST TYPE OF FOUR-PART INSULATOR.

and Sacramento city was supplied with current generated at Folsom. While the insulation provided gave more or less trouble initially, this was gradually overcome. In 1892 the late A. W. Decker, electrical engineer, acting for the San Antonio Light and Power Company at Pomona, Cal., recommended the installation of electric equipment at the power plant of that company to convey by means of step-up transformers a pressure of 10,000 volts over approximately 16 miles of line to the city of Pomona. The generators as finally installed delivered single-phase current at a pressure of 500 volts and the transformers were wound in the ratio of 1 to 2. There were 10 transformers in service on the primary, giving 10,000 volts, with a capacity of six kilowatts each, installed. Glass insulators were used upon this line.

In 1895 there was begun the construction of a waterpower plant near Nevada City, in Nevada County, in the state of California, to transmit about 1,000 horsepower a distance of five miles, with generators wound direct for 5,000 volts. The water was conveyed from a dam on the South Yuba River through 3½ miles of flume, having a capacity of 8,500 cubic feet per minute, and delivered to a 42-inch pipe, 286 feet long, with a head of 190 feet. There were installed at that time two 330-kilowatt units.

From these small beginnings has grown a system throughout the state aggregating in generator capacity at present installed over 50,000 kilowatts and units of 5,000 kilowatts with varying heads up to 1,530 feet. In the central part of the state, utilizing the waters of the western slope of the Sierra Nevada Mountains, there are at the present time in continuous operation 577 miles of ditches, 25.5 miles of flumes, operating 14 waterpower plants, having installed 41 generators, with a rated capacity of 50,790 kilowatts, and having a water storage in numerous lakes aggregating over 3,000,000,000 cubic feet, or 1,500,000 miners' inches, for 24 hours. From these power houses there are in continuous service 715 miles of pole line and 734 miles of circuit operated at 50,000 to 60,000 volts, and 479 miles of circuit at voltages varying from 10,000 to 50,000, and 90 miles at lesser voltages, not including any local distribution. Power is delivered to 94 sub-stations, with 75,000 kilowatts in transformer capacity installed scattered over 21 counties and 33 cities in the state, representing a population of over 60 per cent. of the entire state of California and covering an area of 15,000 square miles. This power is regularly transmitted 232 miles, and by reason of certain conditions at times existing at the different power plants necessitating the transmission over all lines from one power plant, has been successfully operated 325 miles at 55,000 volts.

The first transmission line to reach the Bay shore was that of the Bay Counties Power Company, carrying current generated at Colgate on the Yuba River, about 28 miles northeast of the city of Marysville. This line was started at 44,000 volts, which voltage has since been raised to 55,000. The construction of the line was of round cedar poles, from the state of Oregon, an average height of 50 feet, and the character of construction substantially that now in use, but with a less separation in some instances than was subsequently found necessary. The greatest difficulty encountered in the carrying of the high potential was in and about the bays mentioned, due to the heavy salt fogs that for certain periods of the year hang densely over the land, sometimes lasting for days. In these particular districts the insulation has broken down at most unexpected places, causing the burning off of poles and shortening the line. The new four-part insulator, Fig. 1, with iron pins, has entirely overcome this defect, and for the last season under the most trying circumstances no trouble has occurred, the number of hours of shutdowns upon all of these lines being of a negligible quantity.

One of the greatest engineering feats ever accomplished and one that has never received from the engineering world the attention which it deserves, was the construction in 1901 of the famous Carquinez span of four steel cables, suspended from steel towers. This span crosses the Carquinez Straits, connecting San Pablo and Suisun bays, and is 4,427 feet in length between towers, having at its maximum point of dip an elevation of 206 feet above high-water line. The maximum sag of the wire between the two steel towers on the north and south sides of the straits is 257 feet. The main tower, in Solano County, on the north side of the straits, is 224 feet in height, and the bluff at the point of construction is 162 feet above tidewater; on the south side the tower is 64 feet in height and the bluff 400 feet above tidewater.

Experience has demonstrated that the form of lightning arrester which gives good service at low voltage is absolutely useless on high-tension lines. While these were first installed, they have since in every case been abandoned. At the present time nothing is used but the Horn gap arrester. As the voltage of the lines has been raised and the insulation increased the damage due to lightning is steadily decreasing. It is well to state that beyond the line of the foothills of the Sierra Nevada Mountains lightning rarely occurs; possibly once a year throughout the Sacramento and San Joaquin valleys and along the bay shore are there any discharges of lightning that would be detrimental to the lines.

The first construction of lines in this state was 40 to 50 poles to the mile, insulators being used at a maximum cost of 15 cents. All new lines are now being constructed on the basis of 20 poles to the mile, and the four-part insulators illustrated are being used, costing approximately $2 each, and weighing about 30 pounds.

Much work has been done in designing and carrying out the construction of outdoor switches, as shown in Fig. 2. Experiments have been continuous along the lines of oil switches, and experience has demonstrated sufficiently that this switch as at present constructed is entirely satisfactory and will handle heavy currents under high pressures.

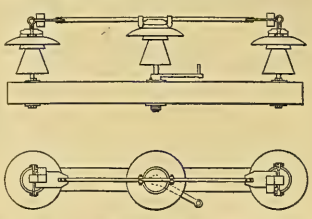


FIG. 2. FORM OF OUT-DOOR SWITCH FOR HIGH TENSION.

Double-break and quadruple-break oil switches are now being made, the latter being used for very heavy service in the large power houses. Fig. 3 shows one form of oil switch, and also shows the method of constructing fireproof switch galleries, the construction of which, so far as the writer is advised, is entirely original with the Pacific Coast. The switching is done by opening the three legs at the same time, the single-pole arrangement having been found to be extremely unsatisfactory for obvious reasons. Fig. 4 illustrates the present arrangement not only of the fireproof switch galleries but of modern construction of a power house, showing location of waterwheel, generator, exciter and switchboard.

As evidencing the care exercised in protecting low-tension circuits from high-pressure wires where the low-tension parallels the high-tension, in the event that there should be any fall to the ground of the insulation of the high-tension, Fig. 5 is fully illustrative.

The difficulties attendant upon conveying material to the power houses are great. Thirty-six horses were required to pull one machine over six miles of mountain road, from railroad to the head of the pipe line, and the descent from the penstock down the mountain side to the power house, over four miles of the roadway, having a grade of approximately 10 per cent., was attended with more or less dangers.

Other than the line heretofore mentioned, conveying power from Colgate to the Bay of San Francisco, the line of the Standard Electric Company to the power plant at Electra, on the Mokelumne River, a distance of 142 miles from San Francisco, is an illustration of the possibilities of the increase of the efficiency of the line by high

1. Abstract of a paper read before the Denver-Colorado Springs convention of the National Electric Light Association, June 7, 1905.

insulation. When first constructed the line was operated at 33,000 volts, which potential was maintained until March, 1904, when steps were taken to operate it in parallel with the other lines controlled by the California Gas and Electric Corporation, the Bay Counties and the Valley Counties companies, and it was at that time increased to 55,000, and has been so operated ever since. The type of insulator in use in March, 1904, has been substituted for the four-part type illustrated in such sections of the territory of the Standard as by reason of climatic conditions called for a higher insulation.

Outside of the immediate fog belt mentioned two and three-part types of insulators have been found extremely efficient for voltages up to 60,000, and experiments have been made to demonstrate that they will safely carry 80,000 volts without breaking down.

The progress made in the engineering and construction work of power houses has kept pace with the progress in pole-line work and insulating and switching devices. The chart herewith, Fig. 6, giving the area of power houses, graphically shows the contraction of areas in the installation of large units, as it follows closely in the line of distributing stations, where, as can be remembered, the belted units for alternating-current work have increased from 35 kilowatts to the large direct-connected units now in vogue, in some cases as high as 12,000 kilowatts. The first installation made at Electra, in 1899, of five 2,000-kilowatt units, called for a floor space equal to 1.16 square feet per kilowatt; the Colgate installation made in 1897, of 9,400 kilowatts, called for 0.98 square feet per kilowatt; the recent installation at the de Sabla power house of the Valley Counties Power Company of 9,000 kilowatts called for but 0.4 square feet per kilowatt. The installation now being made at Electra of two 5,000-kilowatt units calls for but 0.288 square feet per kilowatt. The areas given include room for transformers, switches and so forth.

It will be noted that the first installation at Electra required four times the floor space per kilowatt as compared with the work at present being done, and illustrates more clearly than words can convey the advancement in the last six years. It is believed that the floor area per kilowatt in the new Electra installation is less than that of any other power plant in existence today. In these plants there is no crowding of apparatus, and there is ample room for all operation or repairs, and in future work it will be safe to assume that this minimum of floor space can be still further reduced. Reduced floor area means, of course, reduced operating expenses as well as reduced cost of construction.

When it is considered that the operation of these power plants extends to an infinity of uses, from the moving of street cars to the operation of sewing machines; from factories using ponderous machinery and exacting conditions of demand to the most minute uses to which electricity can be applied, and that during the [illegible] the coast has [illegible] for the use of electricity [illegible] steam plants that might be operated with the cheapest fuel known (which [illegible] and 60 cents per barrel [illegible] tribute to the knowledge, perseverance and energy of the engineers that such work has been accomplished and so perfectly done in so short a space of time. Motors as large as 800 horsepower come on and off the line unnoticed.

Fig. 3. Elevations of High-tension Oil Switches.

Fig. 4. Arrangement of Power House and Switch Gallery.

LONG-DISTANCE HIGH-TENSION TRANSMISSION IN CALIFORNIA.

FIG 5. METHOD OF PROTECTING DISTRIBUTING SYSTEMS.

FIG. 6 CHART SHOWING COMPARITIVE POWER HOUSE AREAS.

## The Paramount Importance of the Selection of Standard in Preference to Special Machinery.[1]

By David Hall

The idea of this paper is to call your attention to the important advantages to both purchaser and manufacturer, in the use of standard, in preference to special machinery. This is not a case in which the manufacturer alone is benefited; the points of advantage are mutual. The purchaser in selecting standard machinery aids the manufacturer in producing a more efficient and a more perfect machine at a lower cost.

The most successful power plants must be characterized by reliability and economy of operation. There must be machinery sufficient to meet all emergencies, and the machinery should be of as simple construction as possible, as simplicity is the key to reliability, and complications insure troubles. The experimental stages of machinery of all kinds are examples of how complicated apparatus can be made, while its ultimate success depends upon the eradication and simplification of the parts so that the machine as a whole is easily understood and easily operated. With the advent of a new machine we say "how complicated;" when the same machine is perfected we say "how simple." It is therefore to the advantage of the purchaser that machinery become standardized. If only one machine is built from each design and we have an infinite number of designs the result is an infinite number of experiments, and it is only after one of these machines is thoroughly tried and perfected that we have a machine which can be called standard. However, if we assume that no two machines that are purchased are to be alike, there would be no incentive for standardization. This paper refers to "standard machinery" as machinery that is regularly listed for sale by a reputable company, such machinery having been built and standardized. The first machine of almost any description is capable of being improved upon. Sometimes the improvements suggest themselves after a very short test, while other improvements may be made only after a long period of operation. In fact, it may be said that the longer a machine of a given type is operated the more certainly can the good points be determined and the more pronounced are the bad features that are to be overcome. Consequently it is positive that the purchaser has everything to gain, in so far as operation is concerned, by selecting machinery that is standard and does not possess experimental features.

It is to the interest of the purchaser and operator of every machine to know that spare parts can be readily obtained, for in the operation of machinery in general there are certain to be requirements for new parts, made necessary on account of wear or accident, and it is usual that such parts are wanted on short notice. If the machine is standard, such parts are likely to be found in stock, or at any rate can be furnished quickly. On the other hand, if the machine is of special construction in part or throughout, there is great probability of delay, [illegible] In fact [illegible] cannot produce [illegible] men there must [illegible] to obtain an exp[illegible] At the [illegible] purchaser why a special request as to speed, [illegible] output or detail of construction of a machine may delay its delivery three months, whereas a standard machine differing only slightly from the specifications might have been delivered immediately. At the same time the standard machine might meet the requirements and do the work as well as or better than the special machine. Change of designs, change of drawings, new patterns, new tools and new castings are matters that are given little thought or consideration by the purchaser; yet these are the things that keep the non-productive element of a shop busy, make prompt deliveries impossible, and keep the management searching for profit when there is only loss. Do not overlook the fact that these numerous expenses, due to changes of design, must be paid for either by the purchaser or the manufacturer, and it is often the case that only a part of these extra expenses are paid for by the purchaser, and the rest is made up by a sacrifice of the profits by the manufacturer.

A certain manufacturing company has made 100-kilowatt direct-current generators at the following speeds: 100, 125, 150, 225, 240, 250, 260, 275, 580, 650, 750, 900.

Tomorrow they may be asked to make a machine of still another speed. Why? Because the purchaser's specification is drawn so fine as not to permit of a standard machine. It is true that they may be so drawn as to fit one manufacturer's standard machines, but every other manufacturer, in order to meet the specification, must bid on a machine that is special to him. The purchaser therefore receives one bid on a standard machine and five bids on special machines. Does such a specification give the purchaser the benefit of standardization? Assume that the specification is drawn for a [illegible] machine running [illegible] per minute—would [illegible] requirements? Had the specification been so drawn that each manufacturer could submit a bid on his standard machine, together with guarantees and full information regarding detail construction, then the purchaser or his technical adviser would have an [illegible] selecting the particular standard machine that was [illegible] considered. In other words, the purchaser should act as judge and not as designer.

Another point to which your attention is directed [illegible] Extension of business often necessitates larger machinery, and [illegible] to dispose of the machinery on hand. The price that can be obtained will [illegible] depend upon how well the machinery is suited to the demands of some other purchaser. If you have a motor with a special shaft, a special

1. Paper read at the Denver-Colorado Springs convention of the National Electric Light Association, June 6, 1905.

end head, or a special foot a sale at any price is difficult to make. At the same time there is always a market for standard machinery.

The price of machinery is usually a base of comparison in purchasing, but operation is the test of quality. Poor operation is dear at any price; it is therefore of interest to the purchaser to determine how he can best obtain full value for the money invested. Certainly not by asking for that which is special or out of the regular line. The development charges on all new machinery constitute a large item, and it is only by standardizing that development charges can be distributed. The purchaser should realize that in selecting standard machinery he will not be burdened with development charges, and he will have the advantage of all the refinements of manufacture whereby standard apparatus, in virtue of being made in quantity, is made both better and cheaper than it could otherwise be. It is, therefore, plain that the purchaser should make known his requirements to the manufacturer by stating fully the conditions to be met and the work to be done; by so shaping his requests that the manufacturer can offer to him apparatus that is standard and that has been "tried out" in all its details. Each specific condition that the purchaser inserts in a specification reduces the probability of standard apparatus meeting the requirements. In other words, the purchaser, in making inquiries for machinery, should state all necessary requirements, but should carefully avoid the addition of unnecessary requests. If the specifications are so drawn the manufacturer can offer the purchaser standard machinery with guarantees, and the price of the machinery may be considerably lower than if the purchaser had filled his specifications with a number of unnecessary conditions. Many specifications would be more to the advantage of both purchaser and manufacturer if they were cut short at the end of one page instead of being drawn out to the extent of 20 pages. Let the purchaser define the work to be done, and let the manufacturer prescribe the machine to do it. If the purchaser wants his machine made to order he may be sure that it will be too small in the waist or too long in the leg to suit his neighbor, and that he will have to settle a tailor's bill in addition to a manufacturer's cost.

## Progress of the Steam Turbine.

Many interesting facts concerning the progress made in steam-turbine construction and operation were contained in the report of the committee of the National Electric Light Association investigating this subject, which was given at the Denver-Colorado Springs convention. The members of this committee were W. C. L. Eglin, Philadelphia (chairman), A. C. Dunham, I. E. Moultrop, George W. Cato and J. D. Andrew. The following extracts, from the report, cover the main points brought out.

The committee has endeavored to keep in touch with the progress made in steam-turbine practice during the last year, and has visited a number of plants, besides being in communication with the manufacturers. Letters have been sent to all of the users of steam turbines in central stations in the United States who have turbines operating generators under regular load. Inquiry has also been made of certain isolated plants which are operating fair-sized units.

The committee also visited the works of the General Electric Company at Lynn and Schenectady, Westinghouse Machine Company at Pittsburg, and the Hooven-Owens-Rentschler Company, Hamilton, Ohio, and discussed with the engineers of these companies those subjects which came to the attention of the committee, and in its judgment deserved consideration.

The best index of progress made in steam turbines is shown by the number of turbines now installed, or manufactured ready for installation. There are in operation 224 turbines, of an aggregate capacity of over 350,000 horsepower in the larger size units in the United States, the greater number of which have been installed within the last two years. The committee has made selections from these, and has conducted tests in the stations of the owners to obtain data as to results of steam turbines under actual operating conditions.

It has also endeavored to bring to the attention of the manufacturers any weaknesses or defects that have developed in their machines during the last year.

A special inquiry has been made into the condensing apparatus most suitable for steam turbines. This inquiry was conducted on the same lines, and letters were sent to all of the users of steam turbines, asking specific questions; also to the manufacturers of condensing machinery.

Ninety-five different companies were written to for information in reference to the use of turbines, and 59 companies furnished as complete reports as their operating conditions would allow. This portion of the report, therefore, presents a summary of data from 57 Curtis turbines, having a total capacity of 83,500 kilowatts; 34 Parsons turbines, having a total capacity of 19,800 kilowatts; 19 De Laval, having a total capacity of 1,686 kilowatts.

All troubles reported were of a minor character, and, considering the aggregate capacity of the machines in use and making due allowance for the reticence of the people owning them, the troubles and difficulties experienced in turbines are very few and comparatively insignificant. In fact, they seem to be much less than might be expected in the use of reciprocating engines of similar size.

The committee has also endeavored to obtain some information on the operating costs of turbine-driven units, in order to draw a comparison between the efficiency of turbines and reciprocating engines as prime movers. Very few stations were able to give any satisfactory data on this, which is mainly due to the fact that in many stations turbines are being operated in connection with engines, so that it is difficult to separate the charges. In a number of other stations, the installation was comparatively new, and the company did not feel that it could give any satisfactory information under this head. Sufficient replies, however, were received from various parts of the country to give a very good general idea of what should be expected from a turbine installation.

Broadly speaking, the operating cost, exclusive of fixed charges, is lower than that of reciprocating engines operating under the same conditions, on account of the reduction of labor and incidental expenses.

The turbine works of the General Electric Company, both at Lynn and Schenectady, were visited, and the committee discussed with the engineers of the company at both works the use of the mechanically operated valve in place of the electrically operated valve, which is at present the standard practice. One mechanical type is operated by power transmitted from the turbine shaft by means of a wormwheel and gearing. The valve mechanism is similar in many respects to a poppet-valve gear, the governor controlling two dogs, one of which is arranged to open and the other to close the valve. The other mechanical type is operated hydraulically, a water piston giving reciprocating motion to a rod controlling a bank of valves that are opened by means of a cam and closed by a spring.

The brake applied to some of the earlier types of turbines has been abandoned, and is not considered part of the standard machine. It has been found in practice, however, that the brake was useful in holding up the weight of the revolving parts when repairs or examinations were being made on the machine, and the company was asked to take under consideration the advisability of adopting on all of the larger sized machines an attachment similar to the brake for this purpose, and they will furnish in the larger sizes such an attachment as part of the standard machine when so specified.

The question of the changes in speed of the standard 1905 turbine as compared with the 1904 was discussed, and it was found that there were only two sizes in which any changes in the speeds as previously given were contemplated.

The question of noise in the generator was also discussed. It was found that there are several sizes of generators that operate practically noiselessly, while others make considerable noise. This is being overcome by changes in the design of the revolving field, in order to obtain a smooth surface. The revolving field of the machine making the most noise has been redesigned, and the field windings used being distributed windings, which remove all of the sharp edges, leaves practically a smooth running surface, so it may be said that this question is now solved.

A lengthy discussion was held to determine the advisability of using a two-piece shaft with a coupling on the larger sizes of turbines. At first these machines were built with a two-piece shaft, and later a one-piece shaft was adopted as a standard. The committee was unanimous that the two-piece shaft was better adapted for the requirements in the central station in facilitating the removal of the revolving field, and there was less danger of the shaft being sprung than the one-piece shaft, in which case the revolving field would require to be drawn off the shaft. The company stated that the use of a coupling will increase the total height of the machine, which is serious where head room is limited. A coupling can always be furnished when specified. However, the company does not think it advisable at the present time to adopt the two-piece shaft as its standard construction.

In the works at Lynn the smaller size of turbines are being built, up to and including 1,500 kilowatts. At Schenectady the larger sizes are being built, up to and including 5,000 kilowatts. Extensive improvements were evident in both shops.

The committee visited the works of the Westinghouse Machine Company, Tuesday, March 21st, and discussed with Messrs. Sniffin and Brinsmeade the question of proposed tests on the Westinghouse-Parsons machines installed in regular stations.

The various sizes of turbines are now being standardized, and the number of standard sizes has been very materially increased. A year ago there were only three or four standard sizes, and this year the company is prepared to offer 12 sizes of turbines.

The type of the turbine remains practically the same, although some of the modified forms experimented with last year have been abandoned, the type known as the two-stage having been dropped. This was really not a two-stage turbine, but the wheels of larger diameter were placed in a separate casing, by which, at that time, it was thought some advantage could be gained in economy by reheating the steam between these two stages. It was found in the experiments this could not be accomplished, and, as it was more expensive, it was dropped. Now all the sizes are practically on the same line, merely increasing in size to provide capacity, with the exception of certain sizes operating at lower speeds. In these sizes the diameter of the wheels is very much increased.

Particular attention is now being given to the blades, and some of the machines now being built have steel blades, and some blades of various alloys. The most important improvement in the construction of the blading is the addition of a flat lace of steel, which is threaded through openings near the outer edge of the blades and fastened by twisting the flat steel lace between each blade. This performs two functions—first, it maintains a uniform spacing between the outer edges of the blades; and, second, it increases the mechanical strength of the blades and prevents vibration. In the larger sizes the longest blades are made from drop forgings with special ends which are machined so as to fit in a dovetailed groove and fastened at the outer end by means of the band lacing previously described.

The joint in the lacing is made by introducing a second lace nearer the shaft, the blades at the joint having two holes punched, and a short piece of wire is arranged at the break of the outer lacing strip to lap the joint. Tests have been made to see whether this band strip in any way affects the efficiency. Thus far, however, these bands have not shown any change. It is expected that this lacing will overcome most of the trouble that has been experienced in the failure of blades.

The committee visited the works of the Hooven-Owens-Rentschler Company, Hamilton, Ohio. This company is the builder of the Hamilton-Holzwarth steam turbine, but it has but few of the machines in actual service. It is at present building several sizes, varying from 200 kilowatts to 1,000 kilowatts. The operation of the turbine is as follows:

Steam is admitted through a stationary diaphragm in which is placed a continuous row of nozzles; this diaphragm could be called a fixed wheel. The steam is expanded in the nozzle and attains a certain pressure and velocity, which is nearly exhausted in the running wheel; then it passes through another series of nozzles arranged in the stationary wheel, the accelerating velocity being absorbed by the following wheel. This series of stationary nozzles and revolving wheels is increased until practically the entire energy of the steam is absorbed.

The mechanical construction is relatively simple. The cast-iron casing is bored to receive the stationary disks. These stationary wheels or disks are turned on all surfaces and a slot cut in the rim. Into the wheels are riveted drop forging, which form the nozzles, and a band is shrunk around the outside, so as to make a tight fit to the casing. The length of the buckets and the area of the nozzles are increased in each succeeding stage, so as to take care of the increased volume of the steam due to its expansion through the machine. In the sizes now built the first row of buckets is about one-eighth inch long and the last about two inches.

The turbine is controlled by means of a centrifugal governor mounted on the end of the shaft outside of the casing of the turbine. The governor valve is a balanced throttle valve, operated by a friction drive, which is controlled by a centrifugal governor, the shaft driving the governor being operated from a worm-wheel attached to the turbine shaft. Means are provided in the governor mechanism, so that the friction wheel is not in contact with the disk except when the governor is in action, necessitating a change in the amount of steam admitted into the turbine, or vice versa.

The Allis-Chalmers Company is now building a steam turbine similar in principle to the Parsons turbine, but with certain changes in the mechanical construction. This particularly affects the blading. The blading to be used by this company is known as the Fullagher system. This blading is made in sections, a single row of blades being made in two sections, which are held by bands at both ends, those bands in turn being peined in slots in the turbine casing.

The principal use to which the De Laval turbine has been put in central stations is in the operation of auxiliaries, principally pumps. There have been no new developments in this turbine during the last year.

The Zoelly steam turbine is now being manufactured in this country by the Providence Engineering Works, Providence, R. I. No additional facts concerning it were obtained in time for the report.

There still remains a small vestige of the reciprocating-engine opinion in regard to the degree of vacuum at which to work. This matter has received much attention in the last three or four years, and the practice seems pretty definitely settled in this respect.

In a recent test made by the committee on a 2,000-kilowatt turbine, different vacua were run for the specific purpose of obtaining the vacuum effect; it was found that for this turbine running at 1,800 kilowatts, the increase in economy is 5.2 per cent. from 26-inch to 27-inch vacuum and 6.75 per cent. from 27-inch to 28-inch.

An important feature of operation with high

vacuum is the necessity of having air tight stuffing boxes and pipe joints, lack of which results in loss of economy to the turbine and increased consumption of steam by the dry vacuum pump and circulating pumps. The committee suggest the following as some of the remedies:

All joints after being made up can profitably be gone over with any heavy homogeneous paint (this preferably should be done when working under vacuum), such as black asphaltum, or shellac and red lead, both of which dry readily. This is a simple remedy, and when carefully applied is very effective. There often is considerable air brought into the feed water at pumps and open tanks, and it is desirable to work the water of condensation on a closed system, or, when an open system is used, to arrange that the water is as little stirred up as possible; liberation of entrained air might be assisted by the use of steam coils in the bottoms of tanks.

In pressure pipes, when the velocity of the water is slow, it is possible to trap off considerable air by the use of a standpipe communicating with the feed pipe by a narrow slot and having at the top a float-actuated valve.

Unless close supervision is used to see that lazy or indifferent engineers do not cover up the existence of air leak by pushing their air and circulating pumps at a greater speed and power than would be necessary with tight joints in exhaust piping, condensers and stuffing boxes, the operating costs can be very appreciably added to in a manner that often defies detection. Connections from turbine to condenser and condenser to pumps should be as short as possibile, to avoid the chance for leaks and consequent uneconomical operation.

Where a surface condenser is of the counter-current type, an independent air cooler appears to be an unnecessary expense and care if the condenser cooling surface is of the proper amount. In the parallel-flow type, however, an air cooler is undoubtedly of considerable benefit in reducing the tension on the air and non-condensable vapors.

Many types of condensers are laid out with a solid bank of tubes presented to incoming steam. Naturally, the steam has to seek its way between the tubes to get to the body of the condenser, and in narrow condensers the net area between tubes of each layer may be even less than the area of exhaust pipes, and consequent velocity of the steam through these passages may mount into tens of thousands of feet per minute. The aim in a condenser should be that the incoming steam should immediately spread out over the whole cooling surface in its proportionate amount, otherwise only a limited area of surface will be devoted to the act of condensing and the remainder to cooling down condensed water.

It is recommended to members that on all new contracts they insist upon complete and adequate means of inspecting the ends of tubes and for obtaining admittance to the condenser above and below the tubes.

Undoubtedly the best arrangement of the condensing plant is the use of a counter-current condenser placed as close to the exhaust nozzle as possible, and with the dry-air pumps drawing from the condenser at the point of coolest circulating water; this pump also so placed that the minimum of pipe connection can be used. With this arrangement the possibility of air leaks would be greatly reduced, the quantity of circulating water would also be lessened, owing to the lower tension of the air which has just left the coldest tubes of the condenser.

In the matter of pumps, while those driven from motors are less objectionable from the point of appearances, yet the steam-driven units that many of us use can be vastly improved in the direction of their own appearance and any surrounding object that is within reach of their dirt.

Manifestly the oil from auxiliaries carried in exhaust steam will coat the tubes of the closed heater and will also be sufficient to make useless for feed water the condensation of the turbine if put into the condenser. As often happens in a plant where there are many steam auxiliaries, the amount of exhaust sometimes exceeds the requirements for heating feed water, and in such instances it would be very profitable to throw this exhaust to the condenser and obtain an increased efficiency on those auxiliaries. It would then appear to be wise to have the steam ends of such auxiliaries so designed that they can accept superheated steam without the assistance of oil. With piston-valve engines this might be attained by the use of plain plug-piston valves without rings, and plug pistons also without rings.

Considerable trouble has been reported from carbonization of the oil in the air cylinders. This has led in some instances to the use of a high grade of mineral oil especially produced for use in air compressors. There have also been reports that this has not cured the trouble. While the temperature in the cylinder does not rise to an excessive amount, yet if a temperature could be maintained below a possible critical point this trouble might be eliminated. The simplest way to do this would seem to be to jacket with cold water the valve casing and covering over which the hottest air, that of compression, is continually sweeping. The metal surrounding the ports in the cylinders is perhaps the greatest accumulator of heat, and if these port passages were cast with walls [illegible] further supplemented by [illegible] water [illegible] trouble would be minimized.

Some stations have reported trouble with foot valves for circulating pumps. Where proper piping arrangements have been installed it would seem that foot valves are unnecessary. A good steam air ejector or a connection to the condenser where there is a dry air pump, is ample sufficient to raise the water to the pump runner in installations where the suction lift is not greater than 24 feet. It is also generally true that clearing the foot valves where the water is dirty consume the greater part of the time taken in starting up.

As there seems to be considerable divergency in the matter of cooling water supply for condensers operating under the same conditions, it may be well to go over the very simple theory involved.

Total heat of steam at 28-inch vacuum = 1112.4.

With cooling water at 70 degrees and condensed water at 100 degrees it is possible for the cooling water on leaving the condenser to have gained 30 degrees of heat.

1112 − 68 = 1044 B. T. U. heat lost by the steam per pound.

$1044 \div 30 = 34.8$, ratio of circulating water to condensed steam, assuming that cooling water took up all of the heat in the steam in reducing it to water and left the condenser at the temperature of the vacuum. In actual practice, however, the cooling water usually leaves the condenser at a temperature fully 10 degrees in counter-current condensers and 17 degrees in co-current condensers lower than that of the vacuum. To show the effect of the above:

$30° - 10° = 20°$, rise in temperature of the circulating water.

$1044 \div 20 = 52.2$, ratio of cooling water to condensed water in counter-current condensers.

$30 - 17 = 13$ and $1044 \div 13 = 80$, ratio of circulating water to condensed water in co-current condensers.

This shows the relative efficiency of the counter-current and co-current surface condenser and also how much the condenser question is purely one of temperature. Also take the case of water during the winter season and assume a temperature of 40 degrees for the cooling water:

$100° - 40° = 60°$

$60° - 10° = 50°$ possible gain in temperature of cooling water in counter-current condenser.

$1044 \div 50 = 20.9$ times the amount of condensed water for cooling water.

In actual practice for temperature of cooling water ranging from 60 to 70 degrees circulating pumps have been installed for volumes of cooling water ranging from 40 to 70 times that of the condensed water. At the low ratio of 40 to 1 the cooling water temperature must be close to 60 degrees for so high a vacuum as 27.5-inch, and even then considerable difficulty is experienced in maintaining the 27.5 inches unless the ratio of cooling surface to pounds of steam condensed is 1 to 8 or better.

The turbine installation concerning which information was received, where 28 inches of vacuum is maintained with a cooling-water temperature of 70 degrees Fahrenheit, shows a minimum ratio of cooling surface in the condenser to steam condensed of 6.9 square feet per pound. But the more usual ratio, even where the cooling water is five to 10 degrees lower in temperature, is eight to nine square feet per pound. In the first instance noted above it is to be remarked that the ratio of circulating water to condesed water is 70 to 1; with greater cooling-surface ratios the proportion of cooling water is reduced.

## Power-transmission Plant on Upper Wisconsin River.

The Rhinelander Power Company of Rhinelander, Wis., composed largely, if not entirely, of local people, has completed arrangements to develop the waterpower of the Wisconsin River at a point about six miles below the city of Rhinelander. A dam will be built giving a head of about 24 feet, and sufficient water is obtainable to develop an average of about 600 horsepower. In the rainy season more than 2,000 horsepower at a conservative estimate is obtainable. The Allis-Chalmers Company will furnish the electrical equipment, which includes three 400-kilowatt, 1,100-volt, three-phase, 60-cycle generators, with three 70½-kilowatt, 120-volt, separately driven exciters, six 150-kilowatt, 10,000-volt transformers and complete switchboards at both the generating station and the sub-station at Rhinelander.

Current will be carried at 11,000 volts over a single three-phase circuit to the sub-station at Rhinelander, a distance of about 6½ miles, and from this sub-station will be distributed at 1,000 volts for illuminating purposes, both commercial and street lighting, and also at 440 volts to the mill of the Rhinelander Paper Company and other industries in the neighborhood of the sub-station.

This plant is one of the first long-distance transmission plants on the Upper Wisconsin River. It is expected that other enterprises of a similar character will be undertaken in that region within the next two years.

## Three-phase Power from Two Single-phase Lighting Feeders.

[illegible]

THREE-PHASE POWER FROM TWO SINGLE-PHASE LIGHTING FEEDERS.

the case Mr. Burt describes the bus-bar voltage is 2,300, three-phase. Voltage regulators are placed in each single-phase circuit, and the lighting voltage can therefore be kept anywhere it is desired. This scheme is used on a single-phase feeder that runs two miles to the outskirts of the town, along which are many lighting consumers. All that is necessary then is to run extra wire, tapping it off from the current-meter side of the other single-phase feeder.

## Electric Industrial Locomotive.

James Farrington, electrical superintendent of the La Belle Iron Works at Steubenville, Ohio, gives an interesting account of an accident which happened to a seven-ton General Electric locomotive owned by the La Belle company.

The La Belle Iron Works is a large iron manufacturing company, employing several General Electric locomotives to haul coal and iron to the furnaces. A careless operator who was driving one of the locomotives, an LM 101-C-1 machine provided with a light cab and equipped with two GE-60, 250-volt motors, allowed it to get away from him by failing to apply the brake and sanding device properly. The locomotive ran through the end of the gas-producer house, falling 25 feet, and then through the side of the blooming mill, carrying five cars of coal with it. The sides of both buildings were completely wrecked.

Beyond knocking the cab off and cracking one end casting of the frame, no damage was done to the locomotive. The operator was not injured, except for one or two bruises. In a letter describing the accident Mr. Farrington says: "In 36 hours we had the locomotive upon the trestle again and running, which shows how well made and strong the locomotive is. As near as we are able to find out, the operator did not cut off his controller on the locomotive until he was at the end of the building, and we are inclined to believe that the accident was entirely his fault and in no way due to defective material or the locomotive."

## Efficiency Tests of 400-kilowatt Steam Turbine.

Some interesting tests were recently performed to determine specifically the fulfillment of the builder's guaranty of the steam consumption at various loads and under various conditions of a Westinghouse-Parsons steam turbine, and, incidentally, to observe the general adaptability of the steam turbine for its intended work.

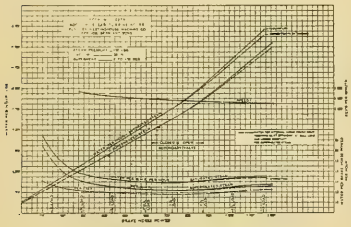
[illegible] & Sons and comprised a turbo-generating unit con- [illegible] direct-connected to a 400-kilowatt Westinghouse polyphase generator of the revolving-field type. [illegible] standard construction employed by the builders for machines [illegible]

It was particularly desired to determine the efficiency of the turbine independent of the generator, consequently separate tests were made on [illegible] tests were made on the

turbine. The exhaust steam from the turbine was condensed in a surface condenser and the condensed steam weighed.

Eleven official tests were made to ascertain the economy of the turbine. These were made with both saturated and superheated steam. When running superheated the degree of superheat varied from 93.1 to 102.9° F. The speed in all the tests varied from 3,454.5 to 3,597.3 revolutions per minute. The tests were made at twice full load, 1½ load, full load, three-quarters load and one-half load. The steam condensed per hour varied accordingly from something about 17,000 pounds down to about 4,000 pounds. The efficiency as ascertained from these tests averaged 92.2 per cent.—dividing brake horsepower by internal horsepower. The steam per internal horsepower for the 11 tests was 12.7, 12.02, 11.7, 11.65, 12.06, 12.25, 14.12, 13.00, 12.96, 13.5 and 13.58 pounds.

The tests also showed the turbine capable of



CURVES SHOWING EFFECT OF SUPERHEATED STEAM.

carrying great overloads. It will be noted that an overload of 108 per cent. was carried by the turbine with excellent economy. This desirable feature is brought about by an automatic secondary governor valve, with which the turbine is fitted, which valve begins to operate only when the load on the turbine has reached about 700 horsepower, or about 15-per cent. overload. This feature is valuable as it permits the turbine to operate at its best economy at or near full load and at the same time it provides ample means for sustaining large overloads.

The governor of the turbine is so constructed that its sensitiveness may be altered within broad limits. This turbine unit is intended ultimately to operate in parallel and therefore required a speed regulation at or near four per cent.

The effect of superheated steam upon turbine economy is well indicated by the divergence of the two water lines corresponding to the tests with saturated and superheated steam. This divergence is practically uniform, as shown in the accompanying illustration. Expressed in approximate terms, the results of these tests indicate that the steam consumption is reduced 10 per cent. per 100° F. superheat throughout the range of tests.

## Fostoria Incandescent-lamp Salesmen Hold Meeting.

Quite a number of incandescent-lamp salesmen gathered at Fostoria, Ohio, last week, the occasion being the annual meeting of the members of the sales department of the Fostoria Incandescent Lamp Company, called by Sales Manager H. H. Geary. These annual meetings have been made a yearly event with the company and last for three days. It is the idea of the Fostoria company to use this period every year for discussion of the scientific and business methods of the company as applied to increasing the sales of Fostoria lamps. There were present at the meeting the following-named gentlemen: Sales Manager H. H. Geary, Superintendent Manufacturing Department F. H. Blackburn, R. D. Thompson, Alec M. Mungle, F. G. Kratzer, W. J. Trott, F. D. Ross, J. S. Maurer and C. W. N. Money. In addition to the above-named gentlemen General Manager F. D. Phillips of the American Electrical Supply Company, Chicago, was on hand two days of the meeting.

A number of the Fostoria sales force were unable to put in an appearance, owing to being occupied with too urgent business or being at too great a distance from headquarters. A pleasant event in connection with the meeting was the dinner given the assembled salesmen by the 14 young ladies of the Fostoria sales department at the "Log Cabin" at Meadowbrook Park, near Fostoria, and concluded with a dance.

Incidentally it may be said that under Sales Manager H. H. Geary the sales department of the Fostoria Incandescent Lamp Company has been brought to a splendid condition of prosperity. During the last several years the sales of the company have increased steadily and at a remarkable rate, so that the Fostoria company now stands among the leaders in the matter of lamp sales of the United States.

The Joliet Power Company of Joliet, Ill., has been incorporated with a capital of $5,000 by Fred Bennitt, Truman A. Mason and Cory E. Robinson of Joliet.

## Fort Wayne Prepayment Wattmeters.

Prepayment wattmeters often fail to act properly, due to the fact that the prepayment mechanism requires too great a torque for its operation and the light-load registration of the meter is effected. The Fort Wayne Electric Works of Fort Wayne, Ind., is now placing upon the market, however, a prepayment wattmeter which, it is said, requires such an extremely low torque for the operation of its prepayment mechanism that the smallest amount of energy which will cause the meter to run will operate the device perfectly.

The new prepayment mechanism is compact in

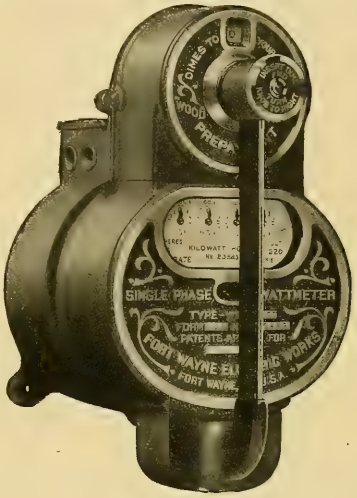



FIG. 1. OUTSIDE VIEW OF TYPE K PREPAYMENT WATTMETER.

form and very neat in appearance. It has been applied to the popular type-K induction integrating wattmeter, which has met with success in the past as well as to the new Wood type-W meter which was described in the Western Electrician of May 20th.

Fig. 1 is an outside view of the type-K prepayment wattmeter, while Fig. 2 shows the same mechanism applied to the type-W meter.

These meters are at present designed to operate

FIG. 2. OUTSIDE VIEW OF TYPE W PREPAYMENT WATTMETER.

with a dime and may be credited with $2 worth of energy at one time. The capacity of the money box is $10. The Fort Wayne Electric Works will soon place upon the market, however, a meter whose operating coin will be the quarter, as considerable demand has already been made for such a meter. This meter may be credited with $5 worth of energy at one time and will have a total capacity of $12 in quarters.

Upon inserting a coin into the slot at the top of the meter the former acts as a key, locking the crediting device to the knob so that one-half turn of the latter credits the coin upon the dial and deposits it in the money box. This operation is accomplished as follows:

Upon the further end of the crediting spindle is a pinion which engages an intermediate gear. This intermediate gear also engages the inside annular gear of the escapement mechanism. The coin acting as a key in rotating the pinion causes the intermediate gear to roll about the pinion as an axle. This forces the numbered dial ahead under the tension of a flat coiled spring. Thus power for debiting operation is stored up in the spring. This operation of crediting may be repeated until the dial at the top of the meter shows 20 dimes credited.

After the coin has once been inserted and the knob turned it is locked within the meter and can only be obtained by opening the money box. It is only by turning the knob one-half revolution that the consumer can obtain credit for his payment. After 20 dimes have been credited the slot is closed, preventing the insertion of another coin until a dime's worth of energy has been used.

The same operation that credits the first coin in the meter causes the circuit to be closed by means of a cam on the crediting drum. This cam operates a lever arm which in turn engages the switch-bar and closes both circuits under the tension of a coiled spring. Fig. 3 shows the details of this switch.

After the amount of energy purchased has been used and the drum, in debiting the coins, has returned to its initial position, the same cam releases the spring and causes the switch to open.

The only connection between the prepayment device and the recording train of the wattmeter is a pinion upon the former which engages a gear in

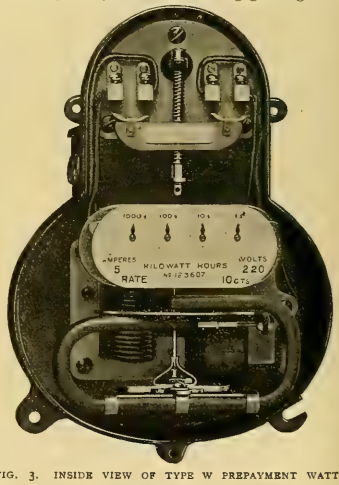



FIG. 3. INSIDE VIEW OF TYPE W PREPAYMENT WATTMETER.

the latter. In the operation of debiting every revolution of this pinion causes a stop to be removed from the gear train in the prepayment device by means of a cam mounted upon the pinion shaft. The gear train thus released is free to revolve. This train consists of three gears and three pinions; one of the latter, however, simply operates a retarding fan. (See Fig. 4.)

In debiting, the intermediate gear in rolling about the center stud under tension of the coiled spring, carries with it the internal annular gear and causes the whole escapement motion of the prepayment device to operate, providing the latter be unlocked by one rotation of the small pinion, as explained above.

The ratio of gears in the escapement train is fixed at such a value that when the dial has moved sufficiently to allow the next lower number to appear a pin upon the periphery of one of the large gears acts as a cam, forcing a stop lever into such a position that the latter immediately engages a pin on one of the lower gears and stops the whole mechanism. Thus it will be seen that for every revolution of the small pinion which engages the wattmeter recording train one number is subtracted on the dial and the switch cam is brought just so much nearer to the position in which it operates the switch and opens the circuit.

One of the valuable features of this prepayment meter is its ability to both credit money and debit energy at the same time. It is possible to accomplish this operation for the reason that the only connection between the crediting stud and the debiting escapement motion is an intermediate gear whose axis is not fixed.

In crediting, the intermediate gear rolls about the central pinion, in debiting, the annular gear together with the intermediate gear, rolls about the central pinion. Thus, when both operations take place at one time the pinion and the annular gear turn in opposite directions at equal speed, causing the intermediate gear to simply revolve upon its own axis without changing the numbers on the dial

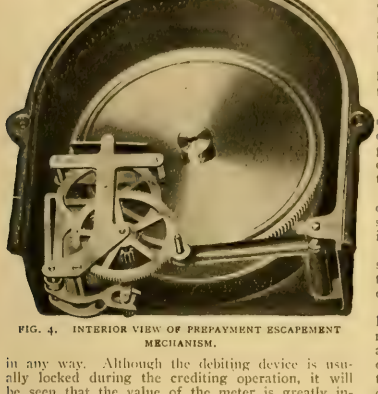


FIG. 4. INTERIOR VIEW OF PREPAYMENT ESCAPEMENT MECHANISM.

in any way. Although the debiting device is usually locked during the crediting operation, it will be seen that the value of the meter is greatly increased by its ability to perform both operations simultaneously when such an occasion arises.

The money box of this meter has been designed with the idea of making it as nearly tamper proof as possible, for it is not possible to gain access to the lock without first breaking an auxiliary seal. When the lock is reached it is found to be of the concealed Yale type, which cannot be picked, and can be opened only by one special key in the possession of employes. This operation of removing the box, however, can be accomplished without interfering with the meter in any way.

The flexibility of this meter will at once attract the interest of the central-station manager. It can be readily adjusted for any rate up to 20 cents per kilowatt-hour, and its principle of combining the time switch with the integrating wattmeter will gain for itself an entirely new field of service, especially in sign lighting.

The booklet "Notes on Prepayment Wattmeters," issued by the Fort Wayne Electric Works, clearly sets forth the advantages of this meter, while bulletins No. 1063 and 1066 explain its operation more in detail. This literature may be had upon application to the company.

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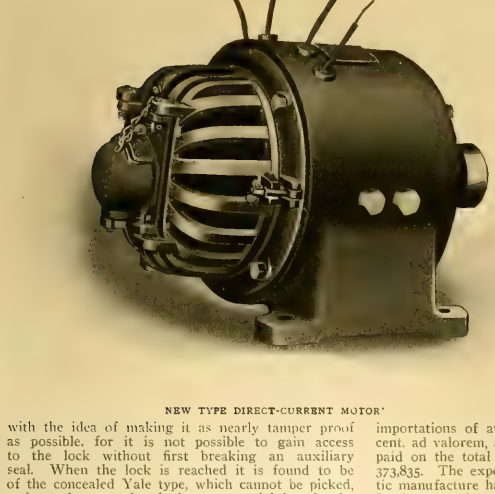
The Lima (Peru) Horse Car Company will receive proposals from the United States for the material which it intends to purchase in order to transform its present line into an electric trolley road. The company will need some 45 cars, with a seating capacity of 40 persons each. These are to be run by overhead trolleys. It will also purchase wires, rails, transformers, rotaries, etc. American exporters of these classes of goods should address D. Joaquin Godoy, Gerente, Empresa del Tranvia Urbano, Lima, Peru, sending plans and proposals, and not English catalogues merely.



NEW TYPE DIRECT-CURRENT MOTOR.

## New Type Direct-current Dynamo and Motor.

A new type of direct-current [illegible] being manufactured by the [illegible] Manufacturing Company of Pittsburg, [illegible] illustrated by the accompanying [illegible] motors are readily adapted to [illegible] various mechanical operations. [illegible] are free from complicated parts and [illegible] construction, with graceful outline. [illegible] names and motors are known as the [illegible] and are semi-enclosed, with hinged covers protecting the commutator.

The armature core [illegible] of the drum type and is built up of thin disks of soft annealed steel, slotted to allow the armature coils to sink below the surface, thus forming an ironclad construction. The coils are machine-formed and easily replaced, made of round insulated copper wire, ribbon or bar copper, depending on the size and purpose of the machine, and are without joint except at the commutator.

Commutator segments are made of drop-forged copper in the larger, and hard-drawn copper in the smaller sizes. The mica insulation is selected for its softness and will wear even with the segments.

The brush-holders are of the box type and are simple in construction, it being possible to adjust the brushes readily without interfering with the operation of the machine.

The machines are guaranteed to stand an overload of 50 per cent. for one hour, or 100 per cent. momentarily, without injurious heating and without adjusting the brushes. The insulation resistance exceeds one megohm, and the resistance is such that the insulation is capable of withstanding for one minute an alternating electromotive force of 1,500 volts between the frame and core of the machine.

All machines are provided with flexible terminals, thus making a permanent connection. The motors are said to be especially well designed, to be equipped with back gears, idler-pulley attachment, and for use as vertical motors.

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## Automobile Importation.

The first record of the importation of foreign-built automobiles into the United States was for the fiscal year 1901, when 26 automobiles, valued at $43,126, were imported into the country. Since that time, however, the imports have steadily increased, having grown to 423 in 1904, while their value (including automobile parts) has increased to $1,446,303 in the last fiscal year. During the last fiscal year France supplied 86 per cent. of the importations of automobiles into the United States. The rate of duty assessed on importations of automobiles and parts of is 45 per cent. ad valorem, and the aggregate amount of duties paid on the total imports thereof since 1901 is $1,373,835. The exportations of automobiles of domestic manufacture have been recorded only since 1902. In that year the total exportation of automobiles and parts thereof was $948,528; in 1903 the total had increased to $1,207,064, and by 1904 the total was $1,895,605; while for the 10 months of the fiscal year 1905, for which figures are available, the total is $1,876,063, thus indicating a record of over $2,200,000 for the complete year.

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## New Electrical Incorporations in New York State.

Among the new incorporations reported at Albany, N. Y., since those published last week are the following. Most of these concerns have been organized with a view of coming within the provisions of the existing law, which expired on June 6th:

Adirondack Power Company, Queensbury; George R. Finch of Glens Falls; Alden Lighting, Heating and Power Company, Alden, $200,000; F. G. Bagley of Buffalo; Associated Counties Gas, Electric Lighting, Power, Heating and Illuminating Company, New York, $10,000; F. R. W. Peters of Flatbush; Anderson Power Transmission Company, Albany, $15,000, John P. Brooks of Albany; Chippewa Gas Company, Jamestown, $30,000, G. V. Blackstone of Jamestown; Economy Light, Fuel and Power Company, Buffalo, $250,000, Henry C. Eddy of Chicago; Empire State Gas and Electric Light Company, New Rochelle, $50,000, W. H. Cooper of New York; Murray Hill Public Service Company, New York, $10,000, James Cremins of New York; Racquette River Transmission Company, to furnish electricity in the Adirondacks and the Mohawk and Hudson River Valleys, $50,000, C. H. Van Slyck of New York; Hydraulic and Electric Power Company, Potsdam, $25,000, G. W. Sisson of Potsdam.

## Storage Battery in a Modern Telephone Exchange

[illegible] inspectors' time to remedy the difficulties with the batteries and to [illegible] telephone [illegible] from storage batteries [illegible] of generator [illegible]

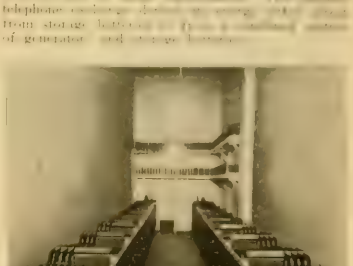


FIG. 1. VIEW OF BATTERY ROOM IN MODERN TELEPHONE EXCHANGE.

An example of a modern battery equipment for a telephone exchange is that of the Frontier Telephone Company of Buffalo, N. Y., an Independent system which is supplied with energy from two storage batteries of 11 cells each, situated in a room next to the terminal room. These batteries were manufactured by the National Battery Company of Buffalo, N. Y., about three years ago and consist of 22 elements of its type 9-X Unit accumulator, with a capacity of 540 ampere-hours

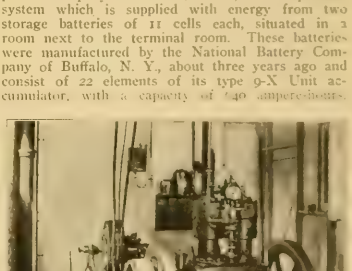


FIG. 2. GAS ENGINE AND CHARGING GENERATOR IN MODERN TELEPHONE EXCHANGE.

installed in type 15-X lead-lined wooden tanks. The large-sized tanks were used so that when the growing needs of the system required it, provision for increasing the capacity of the batteries might be made by simply installing additional plates to meet the demand, which is being done at present.

The cord circuits of this system are divided into two halves, being separated by condensers for talking purposes. One battery feeds the calling end of a pair of cords and the other battery feeds the answering end.

When a subscriber lifts his receiver from the hook a relay at the central office operates a 24-volt one-third to one-half-candlepower lamp in front of the switchboard operator. The operator connects with the subscriber by plugging in on the answering jack. This operates a cut-off relay, extinguishing the lamp and establishing connection between the operator and the subscriber who is calling. Upon getting the number with which the sub-

scriber desires to connect the operator plugs in on the multiple jack, and the circuit between the two subscribers' lines is completed. The line lamps and operators' transmitters are balanced or divided between the two batteries, the load on each battery being about the same. The present maximum draw at any time is about 24 amperes from each battery. Fig. 1 is a view of the battery room.

In the basement is installed a two-cylinder 10-horsepower Westinghouse gas engine (Fig. 2), which is used in lighting the building, and also operates a 5¼-kilowatt, 30-volt Holtzer-Cabot generator, which is used to charge the storage batteries. The batteries are charged at night. The generator starts up at eight p. m., charging at the normal rate of 80 amperes, until each battery is completely charged.

In the terminal room are located the power switchboard and mounting fuseboard. These boards

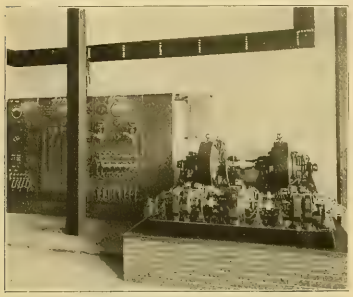


FIG. 3. POWER BOARD AND GENERATORS IN MODERN TELEPHONE EXCHANGE.

are equipped with the necessary switches, fuses, measuring instruments, etc., for the current supply to various circuits.

In front of the board are duplicate sets of ringing generators, four alternating-current machines in each set, driven by one-horsepower motors. One set can be operated from the 220-volt local lighting company's circuit and the other from the 22-volt storage battery. In this way provision is made for emergencies.

To the right of the power board and directly behind the ringing generators are two motor generators, each of a capacity of 5¼ kilowatts, 30 volts. These are run from the local lighting company's circuit and are used as a reserve with which to charge the storage batteries in case anything should happen to the gas engine and charging generator in the basement. Fig. 3 is a picture showing the power board and generators.

The central exchange and about 51 private branch exchanges are fed from these batteries. The number of calls per day averages between 65,000 and 70,000.

From the above some idea can be gained of the importance of the central-energy storage-battery system to this exchange and the economy that has been effected.

## New California Telephone Association.

A number of Independent telephone companies operating in Southern California met at the head office of the Home Telephone Company in Los Angeles last week and formed an association under the name of the California Independent Telephone Association. The officers are: President, John Van Liew of Los Angeles; first vice-president, D. S. Parker of Pomona; second vice-president, Roscoe Howard of San Diego; secretary, P. T. Spencer of Whittier; treasurer, Will F. Frew of Compton; executive committee, K. C. Wells of Redlands, W. J. Lambert of Riverside, A. L. Orton of Pasadena and P. Kerr Higgins of Los Angeles. Altogether, 16 companies were represented at the meeting, and it is given out that a total investment of more than $10,000,000 was represented. The 16 companies control 30,000 telephones and 30 exchanges, and their lines touch 110 towns.

## City Cannot Name Telephone Rates.

An important opinion handed down by the Supreme Court of Missouri at Jefferson City recently was in the case against the Missouri and Kansas Telephone Company in which it was held that the company could be compelled to place its wires under ground, if the city so desired, but that the city had no power to regulate the company's schedule of charges for its service. The case came from Kansas City and was the outgrowth of mandamus proceedings brought by James W. Garner to compel the telephone company to adopt a scale of prices for telephone service to business houses and residences which was incorporated in an ordinance adopted by the City Council. The figures so fixed were greatly below those the company was charging, and it ignored the order, denying the right of the city to establish or fix a schedule of rates.

## Ohio Telephone Notes.

A new switchboard has been ordered for the Lancaster Telephone Company, Lancaster. The sum of $75,000 has been set apart for improvements. Of this $60,000 will be spent on the city system and the remainder in extending and improving the country lines.

G. H. Johnson has taken up his duties as manager of the Citizens' Telephone Company at Columbus. Frank L. Bean, manager of the Ohio Independent Telephone Association, will open an office in the Outlook Building.

The Holland Telephone Company of Holland, Lucas County, has been incorporated with a capital stock of $5,000 by H. W. Lloyd, E. C. Hampton and others, to build a system in that place. It will connect with Toledo through the Home Telephone Company's plant.

The Perry County Telephone Company of New Lexington has been incorporated with a capital of $35,000 by John Amberge, T. M. Potter, M. E. Joyce and others.

The new switchboard of the Columbiana Telephone Company at East Liverpool has been installed to take the place of the one destroyed by fire in February.

Robert T. Larkin, manager of the Fremont Home Telephone Company, Fremont, committed suicide some days ago by shooting himself. No cause can be assigned for the deed.

Judge Dillon has granted a perpetual injunction against the Citizens' Telephone Company of Columbus, restraining it from laying conduits in High Street. The Supreme Court has held that the streets are for traffic only and cannot be used for any other purpose except by frontage owners' consent. The injunction was asked for by two residents of the street.

A report from Wellston is to the effect that the deal between the Bell people and the Independent interests in Jackson County has been put in the shape of a purchase of all the Bell local interests by the Jackson County Home Telephone Company, and the Bell company is to use the local wires for the transmission of long-distance messages. One exchange will be used for connections in Wellston, Jackson, Oak Hill and Coalton.

The Morganville Telephone Company, Morganville, has been incorporated by W. J. Warne, H. F Carter and others, with a capital stock of $5,000.

The Shelby Telephone Company, Shelby, has been incorporated, with a capital stock of $60,000 by Edwin Mansfield, G. M. Skiles, J. F. Lanning, T. J. Green and H. Sotzen. C.

## Southeastern Telephone Developments.

Managers of the Southern Bell Telephone Company's offices in North Carolina and a part of South Carolina, embracing the third district, met in Charlotte, N. C., recently for a three-day conference.

The Southampton Telephone Company of Courtland, Va., is chartered, with T. A. Saunders, president, and F. P. Pulley vice-president, the capital being $5,000 maximum. The company proposes to do a general telephone business.

The Ballard (Va.) Telephone Company is chartered by the state, with E. J. Hylton, president, and J. E. Hylton, secretary and treasurer. Capital stock, $5,000.

The returns of the Southern Bell Telephone Company in the state of Georgia for the last year are $1,072,630, showing an increase over the year before of $165,841.

The Virginia Central Telephone Company of Palmyra, Va., has been chartered, with $5,000 capital. C. E. Jones is president and L. O. Haden secretary.

There is talk of organizing a home telephone company at Burns, Tenn. L.

## Canadian Telephone News.

At a meeting of the directors of the Bell Telephone Company of Canada, held in Montreal on May 31st, and acting under the powers conferred upon the directorate by the shareholders at the special meeting in December, 1900, it was decided to increase the capital of the company from $8,000,000 to $9,000,000. Each stockholder of record on June 15, 1905, is entitled to take, at $125 per share, shares of the new stock in the proportion of one share for every eight shares now held.

Sir William Mulock, postmaster-general of Canada, and the chairman of the telephone committee of the Dominion Parliament, will visit some of the cities and towns of Great Britain this month where municipal telephone systems are in vogue. He will report the result of his investigations to his committee upon his return to Canada. He also proposes to consult with the authorities of the British Telegraph Department with a view to ascertaining how the trunk telephone system is being operated in the old country.

Mr. H. C. Webb of London, England, has appeared as a witness before the special telephone committee of the Dominion Parliament. Mr. Webb, who is regarded as an authority on the question of municipal or state control of telephones, stated in his evidence before the committee that a government monopoly of telephones was a blight on the development of the service. This he had gathered from investigations in Europe. He referred to Vienna, where people were obliged to wait as long as three years for telephone accommodation. In Paris conditions were similar. If companies owned plants in these places, he declared, they would be reconstructed at once. Where most freedom was enjoyed by private companies the development was greatest. The splendid service in Sweden was due to the enterprise of companies and not state control, as claimed by some. The municipal telephone in the old country, he said, was a dead issue. Of the hundreds who might have considered municipal schemes, only 100 did so. Of these, only six obtained licenses and went ahead with the enterprise. Other licenses obtained and not acted upon, the postmaster-general canceled in the last six months. A comparison of rates in Europe with those of Canada was not practical, because cost of raw and manufactured material and labor, as well as density of population, had all to be considered. W.

## Telephone News from the Northwest

The Granite Falls Telephone Company of Granite Falls, Minn., has been incorporated with a capital of $50,000, to build a local and rural service.

The Clarkfield (Minn.) Telephone Company will increase its capital stock from $3,000 to $30,000. Over 40 miles of country lines will be built.

The Claremont (Minn.) Telephone Company's lines have been sold to Springsted Bros. of Dodge Center, Minn.

The Alden (Minn.) Telephone Exchange Company is installing a new switchboard, made by the Western Electric Company.

The Citizens' Telephone Company of Sioux Falls, S. D., has announced a new rate schedule, with an increase of 25 cents on four-party lines and 50 cents on individual lines for residence service. The company has also arranged with the New State Telephone and Telegraph Company of Sioux City, Iowa, to handle its toll business. The latter will build a copper circuit from Sioux City to Sioux Falls.

Trinity Baptist Church of Minneapolis will install a telephone system for the benefit of pewholders whose deficient hearing makes the enjoyment of the services limited.

The Valley Telephone Company of Minneiska, Minn., has filed articles of incorporation with a capital of $5,000. John Peshon heads the incorporators.

L. W. Keyes is an applicant at Hammond, Wis., for a telephone franchise.

The Wells Telephone Company of Woodward, Iowa, has been succeeded by the Woodward Mutual Telephone Company.

Bids will be received by the Nevada (Iowa) Telephone Company for the erection of a new exchange building.

The Emerson (Iowa) Mutual Telephone Company has been organized with J. R. Jones as president and C. L. Brill as secretary.

The Tri-city Telephone Company is installing an entirely new equipment in its exchange building at Clinton, Iowa.

Representatives of 16 toll-line companies doing business in Iowa met at Webster City and decided to form a clearing-house company. C. C. Deering of Boone was appointed chairman of the committee on organization. The company will be capitalized at $10,000.

E. M. Sheffield is talking of organizing a stock telephone company at Belmont, Iowa. R.

## Indiana Telephone Items.

The Plainville Telephone Company has been incorporated to operate in Plainville and throughout Daviess County. The capital stock is $2,500. L. E. Killion heads the directors.

The stockholders of the Mutual Telephone Company of Shelbyville held their monthly meeting during the week and instructed the board of directors to let the contract for an entirely new plant, including an underground system. A new building will be erected to include a power plant. The estimated cost of this improvement is $65,000.

As evidence that the Independents do not intend to abandon the fight in Marion, an Independent telephone company has been organized, and, as a nucleus, purchased the Wilson and McCullough private line between Marion and Converse, and will establish a long-distance toll line between Marion and Indianapolis by way of Converse. Other lines will be constructed, it is said, between Marion and surrounding cities, where the Bell company has not purchased a controlling stock in the Independent exchange. Representatives of the Independent company have opened an office in Marion and will ask for a franchise at the next meeting of the City Council. The sale of the United Telephone exchange in Marion to the Bell interests has made it impossible for Marion citizens to reach adjoining cities which have the Independent telephone, as the Bell company will not give connections.

The Central Union Telephone Company has taken possession of its new warehouse and shop on Madison Avenue in Indianapolis. A distributing plant

for the entire state has been established, and the shops just opened will give employment to 70 mechanics.

The American Telephone and Telegraph Company is asking for franchises in a number of counties in the northern part of the state. The declared purpose is to build a toll line from Chicago to Pittsburg. Mr. C. D. M. Cole of New York is looking after the company's business concerning these franchises and says the company is only asking the right of way to construct a line across the state with the privilege of one toll station in each county.

The Central Union Telephone Company last week closed contracts which will give it exclusive long-distance service through the Jewett plant at St. Paul and the Independent systems at Batesville, Miland, Dillsborough, Moores Hill, Osgood and Versailles. The contracts with these plants open up a wide stretch of territory and indicates that the Central Union is proposing to take advantage of every opportunity for the extension of its business in Indiana. S.

## GENERAL TELEPHONE NEWS.

C. H. Edwards has been appointed division superintendent of the Northwestern Telephone Exchange Company, with headquarters at Fargo, N. D.

The Bell and the Independent telephone companies of Emporia, Kan., are said to have merged their business in that city. W. W. Finney will be the local manager.

All the telephone and telegraph lines in southern Nevada have been consolidated under the name of the Southern Nevada Telegraph and Telephone Company, with headquarters at Goldfield. F. Y. Williams is general manager of the new incorporation.

It is reported that the Shelby Home Telephone Company, which recently built a system at Shelbyville, Ky., has been placed in the hands of a receiver by the courts at Charleston, W. Va. H. W. Gillis of Cleveland has been placed in charge of the Shelbyville plant by the receiver.

The regular monthly instrument statement of the Chicago Telephone Company for May shows that the total increase in the number of telephones installed amounted to 2,560 instruments, of which 1,882 were installed in the city and 678 in the country. The company now has in service 127,914 instruments.

G. W. Byers of Evansville, Ind., has been appointed local manager of the Cumberland Telephone Company at Princeton, Ind., to succeed J. T. Haden. Mr. Byers will assume his duties at once and Mr. Haden will return to Nashville, Tenn., to take his former position in the auditing department of the company.

Mr. F. L. Middleton, sales manager of the International Telephone Manufacturing Company of Chicago, is making an extended business trip through Iowa. Mr. J. C. Murray, salesman for the same company, with headquarters at Des Moines, is at present at the Chicago office, having just recovered from three weeks of sickness.

A dispatch from Milwaukee, Wis., says that Judge Halsey of the Circuit Court has appointed John E. Reilly receiver of the Independent Consolidated Telephone Company under a bond of $30,000. This company is a large Independent telephone concern, having 700 miles of wire and more than 1,200 subscribers in Sauk, Richland, Iowa and Grant counties, Wisconsin. The business will be continued under the receiver.

The entertainment committee for the National-Interstate telephone convention to be held in Chicago June 20th to 22d, is planning a program which should make the affair a success. This committee has charge of the banquet on the 22d, which will be an elaborate one. The committee is composed of P. C. Burns (chairman), H. B. McMeal, W. H. McDonough, W. E. Doolittle, G. A. Briggs, J. P. Cracraft and S. A. Dinsmore. Other details of the convention were printed in the Western Electrician last week.

## MANUFACTURERS AND DEALERS.

The Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., reports having closed contracts for switchboards for the following places: McLain, Kan.; Oregon, Ill.; High Point, N. C.; Kampsville, Ill.; Cowden, Ill.; Plainville, N. Y.; Stanley, N. Y.; Mexico City, Mexico; Seattle, Wash.; Adrian, Mich.; Furley, Kan., and Elbing, Kan.

Novelty potheads and sleeves and Security specialties for telephone construction will be exhibited by the F. Bissell Company of Toledo, Ohio, on the convention floor of the Auditorium Hotel in Chicago during the National-Interstate telephone convention. Some interesting tests of the potheads and sleeves will be made to show that these devices may be submerged without deterioration. The various devices exhibited by the company will be in charge of several of its salesmen. It is understood that telephone poles will not be a part of this exhibit, but nevertheless the Bissell Company is an extensive dealer in poles and will talk poles at the convention.

## CORRESPONDENCE.

### Great Britain.

London, May 24. At last the long agitation on the question of the supply of electric energy to London has come to a termination. The House of Lords committee which has had the matter under consideration has been sitting practically continuously for two months, and the result is that London has been divided between two power companies. One of the schemes passed is the huge $25,000,000 scheme to which I have previously referred, but it has been shorn of about one-third of the area it asked for, and this has been allotted to one of the remaining six competitors. As power companies, all the others have been rejected, although one or two, being existing companies, have had some additional power granted them. The legal difficulty occasioned because an electric-supply authority cannot give a supply of energy for use outside its own area has been a stumbling block on many occasions, and in granting authority to supply for traction purposes, whether the current is used inside or outside the authorized area, the committee has done a signal service to the electrical industry. Of course it is unfair that only certain companies should have this privilege, but inasmuch as the government is promoting a bill this year which will deal with this matter in its general application, all supply authorities will soon be on the same footing. With regard to the big scheme above mentioned, it has yet really to get over the most difficult hurdle, for the local authorities who oppose have a very strong influence in the House of Commons, and there are three stages at which this influence can be exerted.

After many years of dissatisfaction both to the public and to itself the London County Council has solved the problem of converting the North London tramways to electric traction, although the price is a heavy one. As I have several times pointed out, the lines are in the hands of a company which has a lease until 1910. Owing to difficulties with the Borough Council, no hope of having the lines worked electrically was held out until 1910. The County Council—and most other people, too—considered this was too long to wait, and so an agreement was arrived at by which the lease should be terminated early next year. The terms of the agreement I have already given, and the council ratified the compact at its last meeting. At the same time it must be confessed that the difficulties have been largely of the council's own making, and the total expenditure in consequence of the acquisition of the lines and their electrification is put at over $25,000,000.

The following figures with regard to the tramway undertaking of the London County Council in general will no doubt be interesting. In addition to the sum above mentioned, the sum of $17,500,000 has already been sanctioned for the tramways on the south of London, and it is anticipated that for the next four or five years the annual capital outlay on tramways by the London County Council will be $10,000,000. Therefore at present the total commitments of the council as concerns tramways alone is some $60,000,000, irrespective of the cost of street widenings necessary in consequence of the tramways, but which in many cases is not charged to the tramway account.

After three or four efforts on the part of the postmaster-general the committee which it was suggested should be nominated to consider the agreement between the postmaster-general and the National Telephone Company for the purchase of the latter's system has been appointed. Many objections were taken to the constitution of the committee, the labor members of Parliament being specially anxious to be represented. These objections were eventually overcome by giving the committee power to see that the interests of the employes of the National Telephone Company are safeguarded. At the same time it is rather difficult to see what the committee can accomplish, for it has been stated that the agreement has been signed and sealed and cannot be altered. It is possible, however, that should the committee's report come to be discussed in the House—as it undoubtedly will—and any drastic recommendations are made, the postmaster-general's position will be practically untenable and modifications would have to be made.

The new Board of Trade regulations which cover the electric-supply business in Great Britain have been issued. The object of the new regulations is to bring them more into line with present conditions, and in this respect much has been done, for many restrictive regulations, as things stand today, have been abolished. They are too lengthy to go into details here. Further, they are of little interest except to electrical engineers in Great Britain.

An interesting legal case was tried a few days ago in which the London United Tramways Company, in which Mr. Yerkes has now a considerable interest, was concerned. Since Mr. Yerkes' association with the tramway company, tramway lines have been built in Surrey in more or less close proximity to the big generating station which will supply the underground railway. It thus being more economical to take power from this source than from the existing power house many miles off,

### New York.

[illegible] is associated with the Metropolitan street-railway [illegible] year.

[illegible] the surface and elevated traffic. The daily passenger average of the [illegible] by 50,000, the [illegible] less than 1,000,000, while [illegible] way for the three months ended March 31st has been as much as [illegible] though the older forms of transit are suffering, there is nevertheless a daily increase of 114,000 passengers on [illegible] now within one-fifth of the total estimated capacity of the line.

Among eight new bills which became law on Monday was one enabling the city to enter into contracts with any street-railway company with respect to car-license fees, percentages and payments other than taxes. This will allow the city to compromise in the litigation arising out of the franchise tax. Another law provides that a street railway shall not be built in Kings County without the consent of at least half the owners of abutting property.

There was a strike on Tuesday at the new Brooklyn Rapid Transit power house on [illegible] the employment of 35 nonunion boilermakers by the Babcock & Wilcox Boiler Company. About 300 men are affected and the strike will delay the completion of several contracts.

Mayor McClellan has signed and forwarded to the governor the bill which fixes the price of electric current supplied to the city of New York at 10 cents per kilowatt-hour. This was an amended bill, considered at a special hearing on account of an error of the engrossing clerk. The alleged error has excited a deal of comment, but Governor Higgins has expressed his view that the mistake was purely accidental and the matter may now be considered closed.

A Washington telegram states that the United States government will establish a space-telegraph station at Fort Hamilton, Brooklyn, to enable the fort to communicate with warships at sea. The work will be installed by a Detroit firm.

Bids are receivable on June 12th for installing electric bells, gongs, telephones and speaking tubes in public schools Nos. 9, 35, 72 and 74, in the Borough of Brooklyn. The probable value of the contract is about $3,000 or more. Bids are also wanted on the same date for putting in electric-ligh wiring and fixures in public school No. 18, at Muajer Street, Brooklyn, the probable cost of the work being in the neighborhood of $4,000 or less. Details are obtainable at the office of the board of education, Park Avenue, Manhattan.

J. W. W.

### New England.

Boston, June 3.—The control of the Springfield Street Railway Company has been formally handed over to the New York, New Haven and Hartford Railroad Company, and the old officers of the company have resigned, being replaced by the following board, representing the new ownership: A. W. Damond and Frederick Harris of Springfield, who have been acting president and treasurer, respectively; William Skinner, Holyoke; Charles S. Mellen, N. [illegible] president of the New York, New Haven and Hartford; D. Newton Barney, Hartford; James J. Storrow, Boston, and Charles F. Booker, Connecticut.

The Massachusetts gas and electric-light commissioners have authorized the issue of 2,000 new shares of stock by the Springfield Union Electric Company of Springfield. Of this, 829 are to be used for cancellation of outstanding notes, and the remainder for additional plant contracted for. The new issue is authorized at the price of $160 per share to stockholders. The last previous issue was at $135 to stockholders, and the same basis was desired by the company for this issue, but the commissioners fixed upon the higher figure.

A bond issue of $500,000 each by the Boston and

Northern and Old Colony street-railway companies, which are controlled by the Massachusetts Electric Companies, so called, a holding syndicate, has been authorized. These are 50-year bonds at four per cent., and provide the funds for added equipment, power stations and extensions.

An important recess committee of the Massachusetts Legislature was appointed in the closing days of the session, to be known as the special railroad and railway committee, to meet in the interim between adjournment and the session of 1906, with instructions to report not later than January 15th, next year. This committee will consider the important questions which were left unsettled relating to railroads and railways. Among them are the matter of authorization of purchases of trolley roads by steam roads in this state, and the measure relative to the taking of land for trolley lines by right of eminent domain. It was a matter of much controversy during the recent session as to whether public interests would best be served by the passage of a general bill giving trolley lines eminent-domain rights, or by special enactments in individual cases as they arise.

Farson, Leach & Co., bankers, will finance the development of the Bodwell Water Company's property at Milford and Oldtown in Maine, where plans for the building of a big dam and a power house will be carried out this summer. The scheme involves the expenditure, it is stated, of about $1,000,000, and a number of manufacturing plants in the vicinity will be supplied with electric power from the plant.

Edgar W. Atwater, a telegrapher who saw service under the government during the Civil War, being entrusted by the War Department with numerous important dispatches, died on May 30th in Burlington, Vt., his native place, at the age of 76. He had been employed in his younger days for many years by the Western Union Telegraph Company, having learned to operate in Burlington, and served the company in that city and in New York.

B.

## Ohio.

Cleveland, June 3.—F. M. Hanes, general manager of the Northern Texas Traction Company and a former Cleveland man, died a few days ago.

Chicago men have been in Fremont looking over the prospects of establishing an automobile road from Fremont to Tiffin, 18 miles. The plan is to build a regular standard roadbed with tracks. The wheels of the automobiles would be made with flanges to run on the track. If not satisfactory the road could then be converted into a trolley line with few changes.

The Defiance, Wauseon, Adrian, Ann Arbor and Detroit Traction Company of Wauseon has been incorporated with a capital stock of $7,000. The plan is to build an electric railway connecting the towns and cities named in the title. W. W. Campbell, C. E. Bennett, Jay H. Miller, F. J. Spencer and others are the incorporators

The Cleveland and Southern Traction Company is said to have disposed of over $100,000 five per cent. bonds to residents along the route of the proposed line from Chippewa Lake to Mansfield by way of Ashland. This will be a rival to the proposed branch of the Barberton, Wadsworth and Western from Ashland to Mansfield.

A dispatch to the local press from Lima states that W. Kelsey Schoepf has made arrangements for his syndicate to lease the local lines in the town of Lima and will have control over the Toledo and Lima Traction Company, which is building a line from Lima to Toledo. It is stated further that the Western Ohio has refused to lease its property on the terms offered and that a road may be built from Lima to Piqua to complete the plan of having a through line from Cincinnati to Toledo.

The plan for mutual protection in paying accident claims that was proposed some time ago has been held in abeyance by the electric roads and may not be taken up again. The larger companies considered an adjustment bureau, with a common fund, of greater benefit to the smaller roads than to themselves, and for this reason mainly the matter has been held up for the present.

A meeting of the directors of the Kansas City and Leavenworth Electric Railway Company was held in Cleveland this week for the purpose of getting the business in shape to turn over to the McClellen syndicate of New York, to which the greater portion of the Cleveland interests have been sold.

Ohio traction men are interested in the reports that George F. McCullough is arranging to build a traction line from Fort Wayne to Chicago. In the near future Fort Wayne will be connected with the Western Ohio Railway Company, and when the Toledo connection of the system is completed all Northern Ohio will have a line west to Chicago. Plans for the Chicago line are said to be rather indefinite as yet, however.

An increase in passenger rates to two cents a mile has been announced by Manager Theodore Stebbins of the Appleyard properties. This course had been decided upon some time ago, but the position was strengthened by the resolution adopted at the last meeting of the Ohio Interurban Railway Association. Mileage books will be sold at the usual reduction. Some other roads will probably take the same steps within a short time.

O. M. C.

## Indiana.

Indianapolis, June 3.—The South Bend Western Railway Company has filed articles of incorporation with a capital stock of $100,000. The officers are: President, William L. Taylor of Indianapolis; vice-president, M. H. Reed of South Bend; secretary, W. W. Babcock of South Bend. The Indiana Railway Company is really back of the new company, which is organized to construct an interurban line from Laporte to South Bend. It is also a part of the scheme for the final merger of the electric lines in the vicinity of South Bend to acquire the interurban road now operated between Laporte and Michigan City. A line is also contemplated to connect New Carlisle and Michigan City.

The Huntington, Upland and Matthews Traction Company has been incorporated to build an electric railway to connect Huntington, Van Buren, Upland and Matthews. O. S. Scott heads the promoters.

The promoters of the Indianapolis and Chicago Air Line Company announce their purpose of entering Indianapolis on elevated tracks in Cornell Avenue with their own terminal station at Alabama and Court streets. Charles F. Knowlton is in charge of the company's business here, with offices in the Terminal Building. Mr. Knowlton says his company will be the firs televated-track company in the city.

The sale of the Indianapolis and Martinsville Rapid Transit Company was finally consummated during the last week and the property has passed to the control of the Stone & Webster syndicate of Boston. The consideration is said to have been over $500,000. The old officers, H. S. New, president, and G. L. Payne, secretary, will remain, and Paul White will continue as general manager.

Enos Porter of Shelbyville, one of the original stockholders of the Shelbyville traction line, now a division of the Indianapolis and Cincinnati Traction Company's system, is promoting a new line from Shelbyville to Batesville by way of Greensburg, which would be in effect an extension of the Shelbyville line.

The offices of the Indianapolis and Eastern Railway Company (Greenfield line) have been moved to the Traction and Terminal Building and are now in the same room with those of the Indianapolis Coal Traction Company (Plainfield line).

Edward C. Elskes, maintenance-of-way engineer of the state railroads of Switzerland, visited Indianapolis during the week to observe the workings of the interurban traction roads with a view to reporting to his government the advisability of substituting electric for steam power in the operation of railroads. He said upon his return to Switzerland he would at once put on foot a plan to utilize the waterpower in Switzerland for the generating of electricity.

S. S.

## Michigan.

Detroit, June 3.—The Detroit and Bay City Traction Company, which proposes to build an electric railway between Detroit and Bay City, via Flint, Saginaw and Pontiac, has been granted an extension of 90 days to a franchise which was granted some time ago by the latter town. The work of construction through Pontiac should have been begun June 1st.

The Detroit and Cleveland Steamship Company will equip its new $800,000 steamer with a complete telephone system. A central switchboard will be installed connecting all staterooms, the captain, steward, baggagemaster and other offices. The system will be connected with the city exchanges as soon as the boat reaches the docks and give the benefit of long-distance service also. A space-telegraph system will also be installed.

The Dunkley-Williams boat line, which is seeking a franchise of the city of Kalamazoo for an electric railway from that city to South Haven to connect with its Chicago boat line, is meeting with considerable opposition from the Kalamazoo council. There is a municipal-ownership clause in the petition which is causing the trouble. The boat line may build to the city limits only and put on a line of automobiles to carry the business within the city. The name of the line is the Kalamazoo and South Haven Interurban.

As a result of a fire the village of Trenton may abolish its lighting plant. Figures have been asked for from private companies.

A request from every business man of Saline has been made on the Detroit, Ypsilanti, Ann Arbor and Jackson railway for heavy-freight service. It will probably be granted, as it is now in effect on other sections of the system.

Representative Stockdale of Allegan is author of a bill in the state Legislature which, if it passes, will give electric-lighting and power companies the right to condemn rights-of-way for their poles in the same manner as electric railways. It is contended that the present law does not authorize such companies to do business, and this is one of the bills recently introduced to give such companies a legal status.

A new boat line has been put on between Muskegon and Chicago which will be operated in connection with the Grand Rapids and Indiana railroad for Grand Rapids-Chicago business. This new line may take away much of the traffic from the electric line. The Grand Rapids, Grand Haven and Muskegon Interurban has handled most of this business between Grand Rapids and Muskegon.

The Electric Advertising Company of Detroit has been incorporated with a capital of $5,000.

C. G. W.

## Dominion of Canada.

Ottawa, Ont., June 3.—An electric generator of 12,000 horsepower has just been turned out by the Canadian General Electric Company of Peterboro, Ont., for the Ontario Electrical Development Company, being one of a series. This is one of the largest electric generators ever built.

Sir William Mullock, postmaster-general of Canada, has left for England to attend the Pacific Cable conference in London as the representative of Canada. Sir Sandford Fleming of Ottawa will also be present at this meeting, representing New Zealand. The meeting will be held on June 21st. The other countries interested have been ready for the conference for nearly a year and have been waiting upon Canada. It is understood that one of the matters for discussion is a scheme to make the cable enterprise pay better, as there has so far been a deficit in the operation of the cable. The all-British cable was first proposed by Sir Sandford Fleming in 1874. The cable, running some 8,000 miles, from Doubtless Bay, Queensland, Australia, to Bamfield Creek, British Columbia, cost upward of $9,000,000. It was opened on October 31, 1902.

The fourth annual report of the Montreal Light, Heat and Power Company shows a surplus of $448,789 as compared with $204,013 last year. The gross revenue for the year amounted to $2,901,264 and the net profits, after providing for fixed charges, interest, etc., to $1,128,789, being an increase over the previous year of $311,818 gross and $244,775 net. There have been declared out of the net profits four quarterly dividends of one per cent. each, amounting to $660,000, leaving a balance of $448,789, which, added to the surplus of $385,100, brought forward from last year, brings the surplus to $833,889. All the works and plants of the various subsidiary companies embraced by this big combine have been efficiently maintained during the year.

The Ontario Power Company, which has a franchise from the Dominion government to utilize water at Niagara Falls for the development of electricity, is making rapid progress. Ultimately it will have from 180,000 to 200,000 horsepower. Its plan of installation is unique. It is practically a reversal of the plan employed at the other Niagara plants and is a return to the old-fashioned mill race. The millpond, or forebay, is a mile above the falls. At the down-stream end are the gates. From these will extend three 18-foot pipes—the largest ever made for conveying water—which form the mill race. These pipes carry the water to the power house from whence the turbines are supplied.

The Duncan Electrical Company of Montreal has been incorporated to carry on the business of manufacturing all kinds of electrical apparatus. The incorporators are Charles Duncan, William Paisley Baird and others, all of Montreal, with a total capital of $90,000.

W.

Winnipeg, Man., June 3.—A large meeting of the Board of Trade and a dozen other representative organizations was held in this city a few days ago to take up the question of municipal waterpower. It was stated that in view of the immense waterpower going to waste by the Assiniboia and Red rivers a determined effort should be made to utilize the same for power purposes, and that a committee be appointed to urge upon the City Council the urgent necessity for immediate action in the matter so that power may be offered as an inducement to manufacturers to locate in Winnipeg.

The Perth and Huron Electric Railway Company has asked for incorporation by the Dominion Parliament. The company will operate from Stratford to Grand Bend, a village on Lake Huron, and from Stratford to Tavistock. The company has received permission to purchase 500 acres of land to be used as a park, but which shall not be open for picnics or excursions on Sundays. A clause was also inserted that cars shall not be run on Sundays and that the company must be incorporated under the electric-railway act. The road is to be of standard gauge and will make connection with the Grand Trunk at Stratford.

The Halifax (N. S.) Tramway Electric Company in its report just presented showed gross earnings of $379,464.81 for 1904, an increase of $14,009.85. The operating expenses were $211,841.57, a reduction of $28,871.10. This result was obtained by the economies attending the use of the new machinery and modern appliances installed in 1903, and the lessened consumption of fuel. A further expenditure of $31,209.17 was made on capital account on the completion of the new power house and plant.

Paul Wood of Sutton, Man., who will develop

a waterpower for an electric light and power plant and pulp mill, has retained the services of R. S. Kelsch, consulting engineer of Montreal.

The citizens of Napanee, Ont., will erect an electric light plant in the town at a cost of [illegible]

The Cataract Power Company is securing option on property in the vicinity of the present Radial Railway Station with a view of erecting a big station at James and Gore streets in Hamilton, Ont., for the use of the various electric railways controlled by the company.

Mr. K. L. Aitken, consulting engineer of Toronto, has been retained by the town of Exeter, Ont., to make a valuation on the electric-light plant at present in use in that place and now owned by C. B. Snell.

Alderman Gibson, chairman of the fire, water and gas committee of the Winnipeg council, has reported that 250 more arc lamps will be required to properly light the streets, owing to the rapid growth of the city. The council will order 100 to start with. H.

## Southeastern States.

Charlotte, N. C., June 3.—The directors of the Winchester (Va.) and Washington City electric railway announce that they have selected N. Wilson Davis of Harrisonburg to make plans for the power house and dam to be erected along the Shenandoah River east of Winchester. Mr. Davis will also be chief engineer of the work.

President E. D. Latta of the Charlotte (N. C.) electric-railway system is seeking to secure through the courts clear title to certain water rights purchased at Mountain Island, N. C.

It is stated that the present street-car system of Raleigh, N. C., will be considerably extended along the route of several streets.

It is rumored that Hugh MacRae of Wilmington, N. C., is interested in a very extensive scheme to build electric railways to numerous points within a distance of 20 to 30 miles of Wilmington, and that large developments are being anticipated by the promoters of the scheme.

The city of Durham, N. C., has installed a modern new system of the Gamewell fire alarm.

The Savannah Lighting Company is in the field for the franchise for municipal lighting against the Savannah Electric Company, which now has possession of the field and franchise.

J. E. Wadley, president of the Waycross (Ga.) Electric Light and Power Company, has bought a $40,000 lumber plant at Wray, Ga.

A $50,000 subway has been completed in Savannah, Ga., by the Savannah Electric Company, the Atlantic Coast Line and the city.

It is given out that the prospects for the building of the Raleigh-Durham (N. C.) electric railway are very bright. L.

## Northwestern States.

Minneapolis, June 3.—C. M. Harrison of Redfield and associates have applied for a street-railway franchise at Sioux Falls, S. D.

Modern equipment will be installed in the electric-light plant at Tecumseh, Neb.

The Wisconsin River Valley Power and Traction Company has applied for a franchise for a trolley line from Wausau, Wis., to Merrill and will commence work as soon as permission is secured. Waterpower at Trappe will be developed at a cost of $190,000, and the cost of the entire system will be about $500,000.

The City Council of Atlantic, Iowa, refused the offer of W. C. Williams for the purchase of the electric-light plant, the price of $30,000 being considered too small.

Practically all of the necessary $130,000 worth of stock in the Oskaloosa (Iowa) and Buxton Electric Railway Company has been subscribed locally, and the work of constructing the interurban line will be commenced at once. H. L. Spencer heads the new board of directors.

The Mankato (Minn.) and St. Peter Railway and Lighting Company has accepted the recently granted franchises for electric lines connecting those cities and has filed the required bonds. The only point of difficulty has been settled favorably to the company, and it will be allowed the use of the county bridge across the Minnesota River. It is expected that the work of construction will be started without delay. R.

## Rocky Mountain States.

Salt Lake City, June 2.—The Mormon and Gentile members of the City Council at Salt Lake City are at issue upon the proposition of granting an extension of franchise to the Utah Light and Railway Company, of which President Joseph F. Smith of the Mormon church is the president. Seven Mormon members favor the extension, while the eight Gentiles have pledged themselves to defeat it. It is conceded that the proposed franchise was practically killed by its reference back to the city attorney for correction.

Work is progressing rapidly on the electric power plant in course of installation at Cove, Wyo., and the plant will probably be in operation within the next few weeks.

The citizens of Winslow, Ariz., have voted in [illegible] of the granting of [illegible] Electric Light and Power Company.

[illegible] and [illegible] burg, Pa., have been [illegible] Sheridan, Wyo., with [illegible] an electric railway between [illegible]

M. J. Heller and [illegible] who recently purchased the [illegible] near Yerington, [illegible] on the Walker River, [illegible] miles from Yerington, where they will establish an electric generating plant to furnish power for [illegible] mine.

Work was begun recently at Lewiston, Idaho, on the proposed railway system of the Lewiston and Southern Electric Company. Probably $250,000 will be expended in the undertaking. G.

## Pacific Slope.

San Francisco, June 2.—M. V. McQuigg of the Monterey County Gas and Electric Company, with headquarters in the Mutual Bank Building, San Francisco, states that proposals for material and equipment for an extension of the company's electric railway from Pacific Grove to Carmel-by-the-Sea will be asked for in the near future. An 18-mile extension from Monterey to Salinas will be built later. These two extensions will necessitate an increase in the capacity of the company's power plant at Monterey.

Work began last week on the power plant of the Shasta Power Company of Redding, Cal. Water will be taken from the head of Hat Creek at the base of Mount Lassen and taken by ditch 25 miles to the site of the power plant, which will be located 24 miles from Redding. The power plant will generate 3,000 horsepower and the transmission line will carry a voltage of 30,000.

Electrical men are of the opinion that there soon will be strong competition between the California Gas and Electric Corporation and the Southern Pacific Railroad Company. The latter company, having decided to use electricity in conveying some of its transcontinental freight and passenger trains over the Sierra Nevada Mountains, is arranging to build and equip power plants of its own in the Sierras.

Bids will be received on June 12th by the city trustees of Long Beach, Cal., for the installation of an electric fire-alarm system.

Keller & Anthony of the Line Creek Light and Power Company, Lakeview, Oregon, have closed contracts with the municipalities of Cedarville and Bidwell, Ore., to supply those towns with light and power. They have also contracted to furnish power for the Cedarville Flour Mills.

The municipality of Ukiah, Cal., is arranging for the installation of an electric fire-alarm system in that place. Proposals will be received up to June 19th.

The Oceanside Electric Light Company has been incorporated in San Francisco by R. H. Fitzgerald, J. T. Boyd, Henry B. Young, J. H. Brenner and J. D. McGowan.

A special meeting of the stockholders of the San Joaquin Light and Power Company will be held at the company's office at Los Angeles on July 25th for the purpose of considering a proposition to create a bond of indebtedness of $3,000,000.

Col. William A. Patten, chief quartermaster, U. S. A., for the district of California, has been authorized to install an electric-light plant at the barracks at Benicia, Cal.

The Board of Public Works of San Francisco has adopted plans and an estimate of the cost of the reconstruction of the Geary Street railway as an electric line by the municipality. The total cost of reconstruction is placed at $667,595. This includes $99,000 for a lot and building, $60,500 for a storage battery, $203,390 for cars, tools and appliances, $179,432 for the reconstruction of the present Geary Street road, and $125,273 for extensions to the present road. The road as planned will be an underground conduit road.

The Globe Electric Company has been incorporated at Monterey, Cal., with a capital stock of $25,000 by W. H. McConnell, A. G. Metz, Thomas Scoble, S. W. Mack and others. A.

## PERSONAL.

H. C. Green has resigned as chief train dispatcher of the Indiana Union Traction system, with headquarters in Anderson, in order to accept a similar position with the Chicago and Milwaukee Electric Railroad Company.

Charles S. Davis, for the last six years master electrician of the Bureau of Construction and Repair, Charlestown navy yard, has joined the engineering staff of the Holtzer-Cabot Electric Company, Boston, Mass. Mr. Davis entered upon the duties of his new position June 1st.

Dickinson MacAllister, formerly president of the Metropolitan West Side Elevated Railroad Company of Chicago, who was taken suddenly ill on May 27th on reaching the family home at Rockville, Pa., after a business trip to New York city, is reported as being still very weak at the state hospital in Harrisburg. Mr. MacAllister is 49 years old. He came to Chicago in 1888 from the Brooklyn Union [illegible]

[illegible]

[illegible]

[illegible] years previous to 1870 he was in the employment of the Electric and International Telegraph Company, and when, in 1870, the telegraphs were taken over by the state, Mr. Gavey was made superintendent of a division. He was frequently promoted and in 1892 was appointed chief technical officer at the General Post Office, London. He is now engineer-in-chief and electrician of the General Post Office.

George Gibbs has been appointed chief engineer of electric traction of the Pennsylvania, New York and Long Island and the Pennsylvania, New Jersey and New York railroads, the Pennsylvania railroad's subsidiary corporations, under which the tunnels under New York and the North and East Rivers are being built. Later, it is said, the appointment will be extended to the Long Island railroad. The position has been newly created, and under it Mr. Gibbs will be in complete charge of the electrical work of the tunnels as well as the electrifying of a good portion of the Long Island road. He has been in the service of Westinghouse, Church, Kerr & Co., and is a member of the Pennsylvania Engineering Tunnel Commission in an electrical capacity.

W. A. Blanck has opened an office as consulting electrical engineer in the Fisher Building, Chicago. For a year past Mr. Blanck has been electrical engineer of the Chicago and Milwaukee electric railroad and had complete charge of the electrical operation and construction of the road, comprising 70 miles of track. He will still be connected in a consulting capacity with this company. Previous to that, Mr. Blanck was engineer of The Arnold Company for two years, and assisted Mr. Bion J. Arnold in carrying out the high-voltage railroad tests on the Lansing and St. Johns line in Michigan. He also did for a year some special work for the Chicago Edison Company, pertaining to the preliminary layout for the large Fisk Street station. Mr. Blanck is 33 years old and by birth a German. He was educated at the gymnasium at Wriezen and graduated as electrical and mechanical engineer at Mittweida College in Saxony. His engineering experience begun in Germany with Siemens & Halske, and before coming to this country he was for six years connected with Ganz & Co., Budapest, in the capacity of engineer for high-tension lighting and power plants.

## ELECTRIC LIGHTING.

Bonds are to be issued by the town of Marianna, Fla., for the installation of an electric-light plant.

The town of Bolivar, Tenn., is preparing for the installation of an electric-light system, for which bonds were recently issued.

The Florida East Coast railway, with headquarters at St. Augustine, Fla., has ordered two Allis-Chalmers horizontal Reliance engines and a Bullock alternating-current generator, with exciter, for the operation of an electric-light plant.

The Warren (Ark.) Light and Water Company, incorporated recently to operate electric-light and waterworks plants in Warren, has elected the following-named officers: President, F. L. Purcell; vice-president, W. J. Savage; secretary and treasurer, Carl Hollis; engineer, J. Weils.

Before departing from Albany Governor Higgins of New York announced his appointments to the recently created state commission on gas and electricity. The three men named are James R. Sheffield of New York, Judge Lester L. Shedden of Plattsburg and John C. Davies of Camden.

The Interior Department, through the bureau of Indian affairs, is inviting sealed proposals until July 18th for constructing an electric-light system at the new Indian school near Wahpeton, N. D. Detailed information will be furnished on application to C. F. Larrabee, acting commissioner of Indian affairs, Washington, D. C.

The Twin City Rapid Transit Company of Minneapolis will install in its power house at the lower dam, St. Anthony's Falls, a vertical cross-compound Reynolds-Corliss condensing engine, for direct connection to a 3,500-kilowatt three-phase alternating-current generator. This company has pre-

viously installed three Allis-Chalmers engines of the same size and type as the one now ordered, each having a normal capacity of 5,000 horsepower.

The Kearny (N. J.) Common Council has instructed Town Clerk T. C. Wildman to advertise for bids, according to plans and specifications adopted by that body, for the erection of a municipal lighting plant. It is estimated that the work will cost about $35,000. It is proposed to erect the plant at the foot of Johnston Avenue on property owned by the town.

## ELECTRIC RAILWAYS.

A Berlin newspaper announces a project said to be supported by railroad investors to connect by electric railway the principal towns of northwest Bohemia with Zittau on the Saxon border. The field is thickly populated and visited annually by great numbers of tourists.

A test case involving the point whether a passenger electric railway on a public highgway is required to fence its line was tried in the Circuit Court at Belleville, Ill., a few days ago, and decided in favor of the railway company. The case was that of Albert Boneau against the East St. Louis and Suburban railway for the loss of a mule, valued at $150, killed by a car of the defendant. The case will be appealed, it is said.

The annual meeting of the stockholders of the Elgin, Aurora and Southern Traction Company was held in Aurora, Ill., a few days ago. Manager John T. Huntington of Aurora, the outgoing director, was re-elected for a term of three years. President L. J. Wolf of Cleveland read his annual report and it is said that the prospects of the road are very bright. No less than four interurban lines will be in operation soon and will act as feeders to the Elgin, Aurora and Southern Traction Company's lines. One of these is the De Kalb, Rockford and Aurora line.

The Cleveland syndicate which owned the New York and Long Island Traction Company has sold the property to Sanderson & Porter of New York for the Belmont syndicate. The price paid was $1,450,000. The negotiations for the Cleveland syndicate were conducted by President George A. Stanley and Treasurer J. R. Nutt of the company. The road consists of about 35 miles of single track in operation on Long Island. The capital stock is $1,000,000, of which $750,000 is common and $250,000 five per cent. preferred. Half of the bond issue of $1,000,000 is outstanding. The road was built under the supervision of President Stanley.

There was a large gain in passenger traffic on all the elevated railways of Chicago for the month of May, compared with May, 1904. The Northwestern gained 12 per cent., the daily average of passengers for the month being 77,863, as against 69,232 for May last year. The South Side carried a daily average of 89,971 passengers, a gain of eight per cent., and the Metropolitan enjoyed the largest daily average for any month in its history. The average was 125,164 passengers daily, an increase of over nine per cent. The improvement in the Metropolitan is ascribed by the management to better facilities. The Aurora, Elgin and Chicago, which carries its passengers over the Metropolitan from Fifty-second Street, does not figure in the gain. Instead, its tendency is to lower the traffic record of the Metropolitan compared with last year, as they are now carried as passengers of the interurban road itself. The Chicago and Oak Park elevated gained in daily average of passengers carried from 41,379 in May, 1904, to 44,771 last month.

## POWER TRANSMISSION.

To take care of its rapidly increasing business, the Hamilton Cataract Power, Light and Traction Company is making extensive additions to its power plant at De Cew Falls. Two 6,400-kilowatt three-phase 2,400-volt 8,000-alteration generators, with motor-driven exciters and switchboard apparatus, and four 3,200-kilowatt oil-insulated water-cooled raising transformers will be added, the contract going to the Canadian Westinghouse Company.

Another waterpower electrical plant in the South is ready for operation. It is owned by the Talladega Electric Power Company of Talladega, Ala. The plant has developed 3,000 horsepower, which will be transmitted for lighting the city of Talladega, furnishing motive power for manufacturing enterprises, operating railways, etc. A 500-horsepower dynamo has been installed, together with accompanying apparatus to operate on the three-phase system; also two 250-horsepower horizontal turbines. About $75,000 has been invested in the plant.

## SOCIETIES AND SCHOOLS.

The mechanical and electrical engineering department of the State College of Kentucky at Lexington has 28 graduates this year, the largest in its history. The department is in charge of Prof. F. P. Anderson. The young men who graduate this year are all Kentuckians and all have positions awaiting them. Most of them go to the large electrical manufacturing companies, several coming to Chicago.

Douglas A. Brown of Lincoln Inn Court, Cincinnati, Ohio, will be the official reporter of the coming convention of the Ohio Electric Light Association, which is to be held in Put-in-Bay on August 16th to 18th.

Armour Institute of Technology, Chicago, will hold its ninth annual commencement on June 15th. The annual college address will be delivered by Dr. Charles S. Howe, president of Case School of Applied Science. The new Year Book of the Institute has also been issued, containing 195 pages. One of the important courses outlined is telephone engineering.

Purdue University at Lafayette, Ind., possesses good facilities for the department of physics, and a building 128 by 75 feet, three stories high, is devoted to this department. The university has recently issued a neat little publication devoted to the laboratory of physics, which contains pictures and plans of the building and numerous interior views of the lecture rooms, offices, etc.

## PUBLICATIONS.

A neat and attractive catalogue is that of the Replogle Governor Works of Akron, Ohio, describing water-wheel governors. The catalogue gives a good general idea of the capacity and characteristics of the governors, more detailed information being left to separate leaflets. The catalogue is well illustrated and a credit to the company.

The Westinghouse Electric and Manufacturing Company of Pittsburg has issued a new bulletin on its belted type of rotating field alternators, which is worthy of careful consideration. These machines are built for single, two or three-phase circuits, the polyphase machines ranging in size from 30 to 200 kilowatts, and wound for voltages of 220, 440, 1,100, 2,200 and 6,600, operating at either 3,000 or 7,200 alternations.

A well-printed catalogue of automatic motor-controlling devices has been issued by the J. L. Schureman Company of Chicago. It is illustrated with numerous half-tone cuts and diagrams on a fine grade of paper. The catalogue is bound on the loose leaf principle, allowing the separate sheets to be removed and replaced by superseding sheets as they are issued. Altogether the catalogue is deserving much praise and is a credit to the company's publishing department.

The Security specialty catalogue has just been issued by the F. Bissell Company of Toledo, Ohio. It covers a group of devices for telephone construction work which are thoroughly practical. The catalogue will be mailed on application, and in asking for it the company suggests that those interested ask at the same time for a complete set of its estimate blanks, which are convenient for figuring new work. It has often been considered impossible to compile a catalogue which will show complete switchboards with a price list which enables the purchaser or contractor to have "quotations on the spot," but that is exactly what the Bissell company has accomplished in another catalogue on this apparatus. The second issue of the switchboard catalogue is now ready for distribution and is even more comprehensive than the first.

## MISCELLANEOUS.

The Roberts & Abbott Company gave a practical illustration of smoke consumption at its office in Cleveland, Ohio, last month. Members of the Ohio Interurban Railway Association and their friends were present.

Commodore Fred A. Price and E. E. Meyer of the Columbia Yacht Club have purchased from the estate of Commodore C. C. Warren, late of Sandusky, Ohio, the fine yawl-rigged yacht Wemco II. The craft, in which Mr. Warren took much pride, is one of the fastest of its class on the lakes. The boat will be brought to Chicago at once, and it is said that the name will be changed.

What was part of the old Speedwell Iron Works, in which Prof. Samuel F. B. Morse and Stephen Vail perfected the first telegraphic instrument, was destroyed by fire a few days ago. The building has been unoccupied since 1870, when the factory was closed. The Speedwell works were erected in 1800. The boiler of the first steamship which crossed the Atlantic ocean, the Savannah, was built at the works in 1819, it is said. It is believed the building was set afire by tramps.

On its recent voyage from Liverpool to New York, the Cunard liner Campania is said to have been in continuous communication by space telegraphy with two continents. While 1,600 miles east of New York and 1,310 miles west of the Lizard the operator secured direct communication with Europe and America. After calling for about five minutes he shifted to the receiver and listened. Flashes of the world's doings were received, it is said, and messages were sent to both continents telling of the progress of the ship, the conditions of its passengers, and the ships it had passed.

Interurban service which the Chicago and Alton railroad has inaugurated on several portions of its line by means of light steam trains is said to be proving satisfactory, and the new service is to be extended. It is the purpose of the company eventually to install gasoline motors for this service. The first gasoline-motor car designed for the purpose is to be put in service, it is said, about July 1st.

## TRADE NEWS.

T. G. Grier of Chicago is one of the directors of the Knapp Electric and Novelty Company, incorporated at Albany, N. Y., last week, with a capital of $50,000.

The Hydrothern Electric Company has been incorporated at Trenton, N. J., with a capital of $1,000,000. The company is to manufacture and deal in electrical machinery.

The Home Electric Company has been incorporated and opened an electrical construction and contracting business in Market Street, Wheeling, W. Va. J. F. McCurdy and R. V. McCoy are the active members of the new company.

The Malcolm W. Hill Company has been incorporated, with an authorized capital stock of $30,000, to engage in electrical engineering, construction and contracting in Baltimore, Md. Malcolm W. Hill, Eugene L. Norton of Baltimore and William J. Norton of New York are the incorporators.

The Southern Electric Company of Wilmington, N. C., electrical contractor and dealer in electrical supplies, has purchased the business of the Terrentine Light Company. The offices and storeroom of the electric company have been moved into the store occupied by the light company and the business has been enlarged.

The bureau of supplies and accounts of the Navy Department is inviting sealed proposals until June 20th for furnishing certain eastern navy yards with incandescent lamps, carbons, globes and switchboard extension, embraced in schedule 288, which can be obtained on application to the navy pay office in New York or to the bureau at Washington.

A preliminary injunction has been ordered issued out of the United States Circuit Court for the Western District of New York restraining the International Trolley Controller Company, defendant, from infringing upon the claims of United States reissue patent No. 11,872, granted to the Thomson-Houston Electric Company, complainant, on the invention of Charles J. Van Depoele, for improvements in traveling contacts for electric railways.

In the case of the General Elecric Company, complainant, vs. the Detroit Trolley Wheel and Electrical Equipment Company, defendant, Judge Swan of the United States Circuit Court for the Eastern District of Michigan, has ordered an injunction restraining the defendant from infringing United States patent No. 412,155. This patent, which was the basis of the suit, was held valid. It was granted to Albert Anderson of Boston on October 1, 1889, for improvements in trolleys for electric-railway service and assigned to the General Electric Company, complainant.

## BUSINESS.

L. P. Brown & Co. of 71-73 West Jackson Boulevard, Chicago, report a large demand for their electric-soldering tools. These tools, which are made for light and heavy work, are noted for their efficiency, lightness and durability.

Union enclosed fuses and blocks, manufactured by the Chicago Fuse Wire & Manufacturing Company of Chicago have been perfected, after several years of experimental work, and the system now includes the styles known as the National Code Standard and, in addition, fuses in sizes to fit other styles of blocks in common use, as well as a large variety of switchboard fuses of all sizes. Union code blocks are made from the highest grade of electrical porcelain, with mountings of heavy brass and phosphor bronze springs. Extra fittings, suitable for panel and switchboard work, are also furnished, with or without fuses.

The Sociedad de Minas y Fundiciones, Carrizal, Bajo, Chanarcitos, has ordered from the Allis-Chalmers Company of Milwaukee the complete equipment for a 50-ton copper-smelting plant, to be erected at Carrizal, Bajo, Chili, South America. The installation will include a blast furnace and blower, with auxiliary apparatus, and a Bullock type-B generator to supply current for an electric-light plant. Mr. William M. Martin, the manager of the Chilian company, was in Chicago recently for the purpose of purchasing this machinery. Other plants of this sort have been ordered from the Allis-Chalmers Company by the Arizona Smelting

Company of Prescott, Ariz., and the Tacoma Smelting Company of Tacoma, Wash.

The American Electric Fuse Company of Chicago manufactures 50,000 joints each working day. The world connect a line of half-mile coil once around the world. "And yet," the company says, we lack because our telephone companies don't give us line enough." A specialty that this company is pushing this year is its tinned copper joints for iron wire. These have been adopted, it is said, by many of the large companies, which are well pleased.

Within the last week the Westinghouse Electric and Manufacturing Company reports that it has received several of the largest orders which have ever been placed for motors in industrial application, such as the driving of machine tools, hoists and paper machinery. In four orders were included 554 motors of different types and capaci-

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued (United States Patent Office) May 30, 1905.*

790,883. Electric Fuse or Cut-out. Leonard B. Buchanan, Woburn, Mass. Application filed March 20, 1905.

An electric fuse or cut-out having a terminal and a terminal clip engaging the terminal is supplied with a pair of spring-acting fingers and a terminal-clip support engaging the fingers of the terminal clip and consisting of a pair of spring-acting fingers and a head.

790,886. Insulated Rail Joint. Selden S. Deemer, Reading, Pa. Application filed August 15, 1904.

The rail joint comprises a base plate having a central groove, a lining of insulating material within the groove and fish plates adjustably connected to the base plate.

790,917. Electrical Measuring Machine. Franklin J. Perkins, Woburn, Mass., assignor to the Vaughn-Rood Machine Company, Portland, Me. Application filed September 17, 1903.

A rotatable bed roll provided with contacts has means to rotate the bed roll. A registering mechanism, an electromagnet to operate it, circuit terminals connected with the electromagnet, and circuit controllers governing the operation of the electromagnet and co-operating with the contacts and circuit terminals are the remaining parts.

790,922. Apparatus for Obtaining Oxides of Alkaline Metals. Charles W. Roepper, Philadelphia, Pa., and Willis E. Harmon, Mechanic Falls, Me., assignors to the American Electrolytic Company. Application filed July 22, 1903.

Apparatus for the practice of mercurial alkaline processes embodies a transferring wheel for effecting circulation of the mercury, formed of electrically conductive material and provided with pockets for carrying the mercury and also for increasing the extent of the discharging surface in contact with the amalgam.

790,931. Trolley Catcher. Lucean B. Stanley, Collinwood, Ohio. Application filed July 22, 1904.

In a trolley catcher are combined a casing, a shaft therein, a spring connected to and coiled around the shaft, a rope-winding drum having its shaft geared to the shaft, and carrying a ratchet, and a rope-actuated pawl engageable with the ratchet.

790,937. Trolley Wheel. Richard Voltz, Michigan City, Ind., assignor of one-half to Otto Ohming, Michigan City, Ind. Application filed February 21, 1905.

Two disks having tapered peripheries, and also having an oil chamber between them connected with the peripheries of the disks are provided with means for detachably connecting the disks with each other. A rim is formed with a peripheral groove to receive the trolley wire and having an inner annular tapered surface embraced by the disks.

790,939. Switch-operating Mechanism. James C. Waldo, Sharpsburg, and John J. Forster, Avalon, Pa. Application filed January 7, 1905.

Switch mechanism involving a movable part having two pivotally mounted arms connected to it is also supplied with a single-acting motor, a slide movable by the motor, a pawl mounted on the slide and adapted to alternately engage the arms, and means operative on the movement of the arms to shift the pawl.

790,940. Adjustable Suspending Device for Electric Lights. Arthur B. Wass and William Whitaker, Jr., Oakville, Canada. Application filed July 14, 1904.

The adjustable suspension device for electric lamps is provided with a protecting canopy. An insulated roller winds and unwinds the lamp cord, the adjustable feature being secured by a ratchet and spring device.

790,941. Electric Power System. James E. Weaver, Allegheny, Pa., assignor to the Weaver Electric Fire Engine Company, Pittsburg, Pa. Application filed April 27, 1904.

A portable electric fire engine is the subject of the patent, having a number of shunt-wound motors with permanent mechanical driving connection between them. The pumps are mechanically connected to one of the motors, and means for varying the electrical connections to throw the motors into series or parallel while rotating in the same direction are also provided.

790,942. Electric Power System. James E. Weaver, Allegheny, Pa., assignor to the Weaver Electric Fire Engine Company, Pittsburg, Pa. Application filed October 21, 1904.

In an electric fire engine having a number of motors, one of which is mechanically connected with the pump, the other being a compound-wound double-commutator machine, connections are provided for changing the relation between the commutator of the first motor and those of the double-commutator machine. A clutch device is arranged to mechanically connect two motors.

790,945. Telephone Transmitter. Walter L. Wilhelm, Buffalo, N. Y. Application filed March 4, 1902.

Combined with two separated diaphragms is a rigid support arranged between and spaced and insulated from the diaphragms and carrying a fixed electrode. A resistance-varying material is situated between each diaphragm and the adjacent portion of the electrode. Connections are provided for completing the circuit through the diaphragms and the electrode, and means for simultaneously directing the sound waves against the exposed surfaces of both of the diaphragms are provided.

790,952. Telephone Mouthpiece Protector. Joseph M. Carrere, Allentown, Pa. Application filed September 12, 1904.

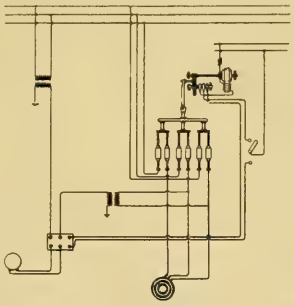
A holding member, a diaphragm and a retaining ring with means being provided for clamping the holding member to the mouthpiece are the essential parts.

790,957. Insulating Support for Third Rails. Ed. W. Farnham, Chicago, Ill. Application filed June 27, 1904.

In an insulating support for third rails there are combined a rail-holding member adapted to hold the I-shape base of a rail, means for insulating the rail from the member, a support for the rail-holding member and insulating material between the member and the support.

790,966. Indicator for Signal Transmitters. George W. Lorimer, Piqua, Ohio. Application filed July 22, 1902.

In an indicator for an electrical transmitter are a series of fixed contacts and a movable contact spring having a working face or contact portion oblique to the line dividing adjoining fixed contacts. This is adapted to engage in a correspondingly formed groove or depression in the fixed contacts.



NO. 791,116.—CONTROLLING APPARATUS FOR SYNCHRONOUS MACHINES.

790,975. Electric Spark Gap or Interrupter. Earle L. Ovington, Boston, Mass. Application filed February 11, 1905.

Associated in this device are a mercury interrupter and a spark-gap or interrupter other than the one employing mercury in a vacuum as its electrodes. The latter interrupter is placed in series with the mercury interrupter.

790,983. Switch for Electric Circuits. Benjamin P. Rucker, Wilkinsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed October 8, 1904.

The invention embodies a main switch and an auxiliary switch. Two magnet coils having a single stationary core and movable armatures are respectively connected to the movable members of the main and auxiliary switches. Means are provided for energizing either of the magnet coils to open one of the switches and close the other successively.

791,003. Railway Block-signal System. Frank E. Button, New York, N. Y. Application filed August 12, 1904.

A conductor leads from one side of each of two sources of current, along and parallel with the trackway, for a distance greater than the length of one block. Thus in each block there are two conductors leading from different sources of current. A number of signaling devices are carried by each train, and contacts carried by each train move respectively in engagement with the two conductors in each block for drawing current to actuate the signaling devices.

791,008. Snap Switch. Walter A. Church, Binghamton, N. Y., assignor to the Bristol Brass and Clock Company, Bristol, Conn. Application filed October 18, 1902.

A switch plate for a disk-formed switch having projecting necks on opposite sides of the main portion of the disk, a conductor comprising a pair of contacts located upon the flat surfaces of the disk and a part connecting the contacts and located within the substance of the switch plate are the features of importance in the device.

791,012. Strain Device for Electric Railways. Harry P. Davis and Theodore Varney, Pittsburg, Pa., assignors to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed October 19, 1904.

A two-part strain-clamp fastened to the messenger wire or cable and strain-wires branching from the clamp is the basis of the patent.

791,013. Supporting and Strain Device for Electric Railways. Harry P. Davis and Theodore Varney, Pittsburg, Pa., assignors to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed January 23, 1905.

[illegible]

791,020. [illegible] Peter [illegible] June 4, 1902

[illegible]

791,021. [illegible] Wilkinsburg, Pa., [illegible] Electric and Manufacturing Company, Pittsburg, Pa. [illegible]

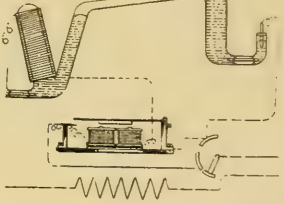
[illegible] closures for the winding.

791,025. Apparatus for Moving Switch Rails. Marquis D. Hanlon, Wilkinsburg, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed February 17, 1905.

Switch-moving apparatus [illegible] rails, two motors and connections for [illegible] ing the respective pairs of switch rails, a set of detector bars common to both switches and [illegible] nected to the detector bars and to both motors.

791,026. Apparatus for Moving Switch Rails. Marquis D. Hanlon, Wilkinsburg, Pa., assignor to the Union Switch and Signal Company, Swissvale, Pa. Application filed February 17, 1905.

Apparatus for moving two pairs of [illegible] locking means common to both pairs of points and two cam cylinders, one having a cam groove [illegible] one pair of points and the other two cam grooves, one for operating the locking means and the other for operating the other pair of points. An electric motor rotates the cylinders.



NO. 791,152.—MERCURY-VAPOR ELECTRIC LAMP

791,031. Supporting Structure for Trolley Wires. Budd J. Jones, Chicago, Ill., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed April 2, 1904.

A trolley wire or other conductor having a catenary suspension is supplied with an insulated steadying device one end of which is clamped to the trolley wire and the other end having a pivotal or hinge attachment to a stationary support.

791,035. Motor Mounting for Motor Vehicles. Ivert Larsen and Robert Hardie, Chicago, Ill. Application filed October 6, 1903.

The specifications call for a motor having its frame mounted on one of the axles in an approximately horizontal position, a connecting link between it and the body being supplied.

791,079. Rail Clip for Third-rail Insulators. George L. Courtenay and William Courtenay, New York, N. Y. Application filed August 27, 1904.

Combined with an insulator having a perforation in the direction of the length of the rail is a rigid yoke attached to the block at one end, the yoke having an integral upwardly extending arm at each side of the rail.

791,082. Trolley-wire Hanger. Harry P. Davis and Theodore Varney, Pittsburg, Pa., assignors to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed October 19, 1904.

A hanger for grooved trolley conductors comprises a rigid bar having a socket clamp at one end and a claw or hook clamp at its other end.

791,083. Curve Pull-off for Overhead Trolley Conductors. Harry P. Davis and Theodore Varney, Pittsburg, Pa., assignors to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed October 19, 1904.

A pull-off device for electric railways comprises a hanger having a socket clamp at one end, a hook clamp at its other end and projections adjacent to the clamps.

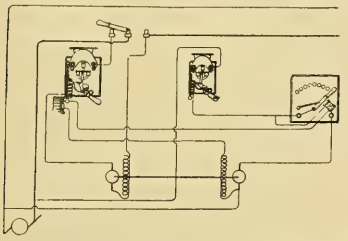
Pull-off wires or cables are fastened to the respective ends of the hanger and maintained in position by the projections.

791,085. Thumb Piece for Electrical Switches. Frank C. De Reamer, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 9, 1902.

The thumb-piece of the switch co-operates with an inclosing metallic tube, a nut movable longitudinally therein and held from relative rotary movement, and a spring located within the tube and thrusting against the nut.

791,095. Carbon-break Field Switch. Edward M. Hewlett, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed July 29, 1903.

A V-shaped support, pairs of contact-clips mounted thereon, secondary contacts connected to and extending



NO. 791,220.—DEVICE FOR PROTECTING BOOSTER SETS.

above the clips, and a duplex switch lever provided with co-operating primary and secondary contacts pivoted near the apex of the support are the several members of the device.

791,103. Telegraph Key and Switch. Thomas J. McAdams, Annapolis, Mo. Application filed May 19, 1904.

Normally closed circuit closers for the working circuits include contact springs, a key and a switch device having means to open any of the circuit closers and including the key in any of the working circuits at will. The circuit-opening means includes a revolvable conducting arm to engage and operate the contact spring and having a non-conducting radial extension to pass between the contact springs and their coacting contacts.

791,113. Electrical Door-opening Device. Frank Staehle, Newark, N. J. Application filed February 10, 1904.

In an electrical door-opening device are a keeper, toggle-links pivotally connected to the keeper, electromagnetic means for operating the links and keeper and means co-operating with one of the toggle-links designed to indicate at a distance that the links and keeper have been actuated.

791,114. Electrical Signaling Indicator. William Starkey, Chicago, Ill. Application filed February 6, 1905.

Incandescent lamps are carried by the target, which is operated by a plunger rod which in turn is moved by an electromagnetic device.

791,116. Control of Synchronous Machines. John B. Taylor, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 17, 1904.

An alternating-current dynamo-electric machine has a switch adapted to connect the machine to the circuit. Electroresponsive operating means operate the switch. A synchronism indicator is provided and also a switch member adapted to close simultaneously the circuit of the indicator and the control-circuit. (See cut on preceding page.)

791,124. Controller for Electric Motor. George Baehr, assignor to the National Tube Company, Pittsburg, Pa. Application filed February 10, 1905.

A controller for electric motors has a handle with adjustable stops adapted to limit the motion of the handle in forward and reverse positions.

791,152. Electric Lamp. Richard Küch, Hanau, Germany, assignor to the firm of W. C. Heraeus, Hanau, Germany. Application filed March 3, 1904.

Inclosed in a vessel are electrodes, one of the electrodes being of mercury. Electrically operated means create pressure behind the mercury electrode whereby it may be moved into contact with the other electrode. An electric source of supply having one terminal connected to one of the electrodes is supplied, also a switch for connecting the other electrode to the other terminal of the source. An electromagnet is connected in series with the electrically operated means between the first-mentiond electrode and the first-mentioned terminal of the source, the switch being operated by the electromagnet. (See cut on preceding page.)

719,178. Trolley-wire Switch. Joseph T. Bunn, Washington, D. C. Application filed August 3, 1904.

Combined with a divided trolley wire are an insulating plate located between the adjacent ends of the wire, means carried by the plate for continuing the circuit, crossing rails secured to the under face of the plate and means carried by the car for engaging the rails.

791,180. Electric Motor for Automobile Vehicles. Eugenio Cantono, Rome, Italy, assignor to Giovanni Mazzacorati, New York, N. Y. Application filed August 11, 1902.

Steering mechanism for electrically propelled vehicles comprise motors whose excitation coils are in series, and means to vary the potential at the point of union of the coils by connecting the point with the variable points between the terminals of the battery.

791,182. Thermostatic Circuit-closer. Albert D. Caywood, Chicago, Ill. Application filed August 12, 1904.

An outer casing, a contact member therein, an inner casing, a potentially movable contact member in the latter and separated from the outer contact member by the walls, and fusible means normally restraining the inner contact member from movement are the essential feature.

791,191. Trolley Guard. Mathias Hartz, Pittsburg, Pa. Application filed February 27, 1904. Renewed November 2, 1904.

Auxiliary wheels carried on an extension of the trolley harp keep the main trolley wheel in place.

791,220. Means for Protecting Booster Sets. Frank L. Sessions, Oak Park, Ill., assignor to the Siemens & Halske Electric Company of America, Chicago, Ill. Application filed December 18, 1899.

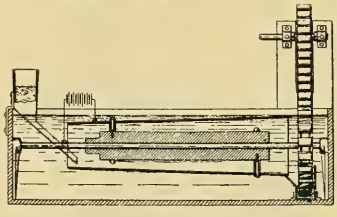
Means for protecting booster sets of that class comprising a generator connected in series in a main circuit and a generator-actuating motor connected in shunt across the line comprise a circuit breaker interposed between the main line and the booster generator and an auxiliary trip applied to the circuit breaker and controlled by an electromagnet connected in the shunt field circuit of the motor. (See cut.)

791,228. Electric-railway Signal or Alarm. Earl L. Tatum, Washington, D. C., and James W. Tatum, Durham, N. C., assignors of one-half to Robert B. Boone and John W. Smith, Durham, N. C. Application filed September 2, 1904.

An indicating board is equipped with an ohmmeter provided with an indicator upon which the ohms are graduated into miles. A telephone and a key signaling instrument are connected in multiple with each other and the indicator in series with a battery, and each is provided with a switch by which it may be cut out.

791,253. Regulating Means for Electric Lamps. Albert G. Davis, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed September 18, 1902.

An electric lamp comprises an exhausted envelop, means for causing a current flow in the envelope and automatic means for regulating the current flow responsive to temperature changes in the lamp.



NO. 791,305.—ELECTRICAL METHOD OF SEPARATING GOLD.

791,277. Ringing Generator. John C. F. Malthaner, Minneapolis, Minn. Application filed July 20, 1904.

The generator is filled with a permanent magnet, a fixed core provided with a secondary winding and with differential primary windings, contact points and an oscillating armature.

791,285. Electric Boat or Launch. Harlan Page, Germantown, Pa. Application filed March 26, 1904.

An electric boat or launch provided with an internal water-tight compartment is adapted to support current generating or storing means for actuating the motor.

791,289. Combined Manhole and Junction Box. Lyman C. Reed and Alexander H. McComiskey, New Orleans, La. Application filed September 19, 1904.

The device is made to be placed over a vault and consists of a combined manhole and junction-box having a cable-receiving chamber interiorly accessible independently of the manhole, the manhole being bottomless to provide access to the vault.

791,305. Art of Separating Gold or Other Diamagnetic Metals. Louis T. Weiss, New York, N. Y. Application filed August 26, 1903.

For separating solid particles of diamagnetic metal from accompanying matter, a coating of magnetic metal is first deposited on the diamagnetic metal by electrolysis. Such coated metallic particles are then separated from the accompanying matter by magnetic means. (See cut.)

791,308. Electrode. Mataichi Yasuda, Tokyo, Japan. Application filed January 21, 1905.

An electrode case is composed of insulating material and provided with a passage in which an electrode is disposed and through which the electrolyte enters the case adjacent the electrode.

791,310. Stationary Plate for Static Machines. Burton E. Baker, Hartford, Conn., assignor to the Baker Electric Company, Hartford, Conn. Application filed December 31, 1904.

Several sheets of insulating material and armatures interposed between the sheets, and insulated from each other thereby, compose the plate.

791,335. Electrical Appliance for the Feet. Eusebio Fernandez y Moreno, Madrid, Spain. Application filed October 25, 1904.

A voltaic element to be placed in the shoe for therapeutical purposes is described.

791,341. Electrolytic Deposition of Metals. Herbert C. Harrison, London, and Joseph Day, Weston-super-Mare, England, assignors to said Herbert C. Harrison. Application filed July 19, 1901.

Electrodeposition of metals is accomplished by causing the electrolyte to impinge upon the entire surface of a vertically-mounted cathode and by directing horizontally throughout the length a series of superposed jets of electrolyte arranged about the cathode.

791,350. Storage Battery. Roderick Macrae, Chicago, Ill. Application filed August 4, 1904.

A container is composed of two porus cups, one located within the other, the inner cup being filled with active material and the outer cup between its inner wall and the walls of the inner cup with an electrolyte. The outer cup is coated upon its exterior with active material.

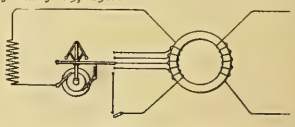
791,376. Illuminating Policeman's Billy. George R. Somes, Laconia, N. H. Application filed January 28, 1904.

A billy containing an incandescent lamp in the end and a battery and connections for the lamp is described.

791,401. Process of Extracting Zinc from Its Ores. Anson G. Betts, Troy, N. Y. Application filed February 20, 1905.

The process of extracting zinc from ores consists in extracting the zinc as a soluble salt in solution, electrolyzing the solution with a liquid-metal cathode for the production of zinc alloy and electrolytically extracting zinc from the alloy and depositing the zinc on a suitable cathode.

791,413. Telegraphic Transmitter. Alfred C. Gilmore, Chicago, Ill., assignor to James H. Peirce, trustee, Chicago, Ill. Application filed January 29, 1902.



NO. 791,440.—APPARATUS FOR THE OPERATION OF ALTERNATING-CURRENT MOTORS.

An individual finger key with the transmitter switch corresponding thereto are associated with a retaining latch normally holding the switch out of operation. A loose one-way connection intermediate the key and the switch, whereby the switch is shifted into operation by the key but arranged to permit the independent return of the parts to normal position is supplied, also means for returning the switch to the normal.

791,423. Alternating-current Electromagnet. John D. Ihlder, New York, N. Y., assignor to the Otis Elevator Company, East Orange, N. J. Original application filed July 31, 1903. Divided and this application filed December 2, 1904.

In a polyphase-current tractive electromagnet are more than two coils having parallel longitudinal axes, one of the coils being disposed at one side of a line extending between the axes of two of the other coils.

791,429. Electric Block-signaling System. William M. Murphy, New York, N. Y. Application filed August 31, 1904.

In an electric block-signaling system where a differential relay controls the semaphore circuit means are provided for utilizing the same source of power as for the propulsion of trains to control the operation.

791,435. Electric Speed-limiting Device. Bertus G. Barlow, Manchester, N. H. Application filed December 9, 1904.

An electric speed-limiting device involving a centrifugal governor contains a disk co-operative with the governor and laterally movable thereby and a contact device arranged to be engaged by the side face of the disk on the lateral motion thereof, the disk being rotative by the governor during the engagement to maintain an unbroken contact between the disk and contact member.

791,440. Method of Operating Alternating-current Motors. Alexander Churchward, New York, N. Y. Original application filed February 20, 1897. Divided and this application filed October 31, 1903.

Starting and maintaining a single-phase alternating-current motor, having a continuous or direct-current armature winding and commutator, at a desired speed, is done by impressing at starting an excess of electromotive force upon the terminals of the motor, subsequently reducing the electromotive force when the desired speed is reached and thereafter increasing the electromotive force whenever the speed of the motor falls below the desired speed and decreasing the electromotive force whenever the speed of the motor rises above the desired speed. (See cut.)

## EXPIRING PATENTS.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on June 5, 1905:

383,857. Governor for Electromagnetic Motors. C. F. Brush, Cleveland, Ohio.

383,899. Electrotherapeutic Battery. E. J. Murphy and J. Floyd, Lynchburg, Va.

383,901. Electric Power Controller. G. S. Neu, New York, N. Y.

383,913. Rheostat. E. W. Rice, Jr., Lynn, Mass.

383,919. Insulated Wire. H. Splitdorf, New York, N. Y.

383,933. Switch or Cut-Out for Electric Circuits. J. J. Wood, Brooklyn, N. Y.

383,941. Electric Signalling Box. W. D. Browne, Seneca Falls, N. Y.

384,035. Electromagnetic Separator. J. B. Hamilton, Springfield, Mass.

384,042. Lightning Arrester. P. O. Keilholtz, Baltimore, Md.

384,044. Rheostat. W. H. Knight, New York, N. Y.

384,077. Dynamo-electric Machine or Motor. A. L. Riker, New York, N. Y.

384,088. Electric Annunciator. C. E. Scribner, Chicago, Ill.

384,116. Electric Shunting Device. W. Baxter, Jr., Baltimore, Md.

384,117. Governor for Electric Motors. W. Baxter, Jr., Baltimore, Md.

384,144. Pneumatic Annunciator. R. P. Garsed, Morristown, Pa.

384,200. Magneto-electric Liquid-level Indicator. J. J. Ghegan, Newark, N. J.

384,201. Telephone Transmitter. E. T. Gilliland, Boston, Mass.

# WESTERN ELECTRICIAN

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## The 36,000-volt Transmission System from Malnisio to Venice, Italy.

By C. Smith.

An extremely interesting hydro-electric station and high-tension transmission line has recently been installed and put in operation in Northern Italy, on the Cellina River, in order to supply electrical energy to Venice and the surrounding district.

Although coal is scarce in Northern Italy, the country abounds in waterfalls, which are being constantly developed, aiding wonderfully in the rapid industrial growth of this section. Among the more important installations may be mentioned the hydro-electric station of the Societa Lombarda, at Vizzola and Turbigo, utilizing the waters of the Ticino; the plant at Tivoli, and at Gromo the recently constructed power house and 40,000-volt transmission line, which is probably the highest tension in actual use in Europe at the present time for power transmission. It will thus be seen that Italy is rapidly forging toward the front in electrical progress, and the newly completed 36,000-volt transmission line from the hydro-electric station on the Cellina to Venice is but another step in this rapid development of the hydraulic resources of the country.

The Cellina River rises in the Carnic Alps at an altitude of over 8,800 feet, and has a length of about 280 miles, being able at low water to deliver 7,900 gallons per second. The mountain was inaccessible and had no pathway up to the point where the dam has been erected, making the construction extremely difficult, and besides being costly, has caused the death of several workmen.

A dam was constructed at the intake, in order both to raise the water level there 3.5 meters above the normal and to form a reservoir holding about 300,000 cubic meters as a reserve in time of low water. The dam has a total length of 32.68 meters, with a height of 14 meters, the width at the top being four meters, and curving abruptly outward to a width of 16 meters at the normal water level.

The canal leading from the intake to the power house was another difficult piece of work, involving a large financial expenditure and much time. Two rectangular mouths, each three meters high and two meters wide, adjustable by sluices, form the intake proper. The first part of the canal is 4,328 meters long and is partly cut in the rock, leading to the larger tunnel, which was cut entirely in rock and has a length of slightly over one kilometer, with a section of four meters by 2.7 meters, the gradient being 0.6 meter per kilometer.

This tunnel leads to the open section of the canal, which in general has the same section and gradient as the tunnel, although it is not as regular. A small settling basin or reservoir with an area of 2,400 square meters has been constructed at the end of this open section before the water enters the two filtering chambers and the penstocks, of which there are seven; six for the large turbines, and the seventh, which is divided into two sections, for the exciter turbines.

The power house has been erected close to the small village of Malnisio, the head of water at this point being 58.64 meters. Besides the regular apparatus, it contains apartments for the engineers and workmen, as well as a repair shop. The minimum power available is 15,600 horsepower, with a discharge of 20 cubic meters per second, but with the aid of the reservoir 18,900 horsepower can be obtained. The Italian manufacturers, A. Riva, Monneret & Co. of Milan, furnished the Francis turbines for this installation. They are [illegible] wheel on a horizontal shaft, the larger turbines having two lateral discharges, one on each side, and the small exciter turbines but one discharge.

Four turbines are installed at present, but space has been provided for two more, which will be installed, making six large machines, each requiring 4,500 liters of water per second and developing 2,600 horsepower at the shaft, with a speed of [illegible] revolutions per minute.

There are three small turbines which are similar in construction to the larger ones, and develop each 200 horsepower at the shaft, with a speed of 500 revolutions per minute. They are used to drive dynamos which supply direct current for the fields of the alternators.

The four large 2,600-horsepower turbines are direct connected with rigid couplings to three-phase alternators of the revolving-field type, the magnet wheel being constructed of one piece of solid steel and having 16 alternate poles. These three-phase machines normally supply current at a pressure of 4,000 volts, with a frequency of 42 periods per second, but by varying the exciting current this pressure can be regulated and changed from between 3,600 and 4,800 volts. At full inductive load the alternators have a commercial efficiency of 95 per cent. and can run at 25 per cent. overload for three hours. The frames and windings have been carefully insulated and have been tested at 7,000 volts.

The exciter dynamos are three in number and supply a direct current to the fields of the alternators at 200 volts pressure. They are shunt-wound six-pole machines and have an efficiency at full load of 93 per cent. As mentioned above, they are direct connected to three 200-horsepower turbines, with a speed of 500 revolutions per minute.

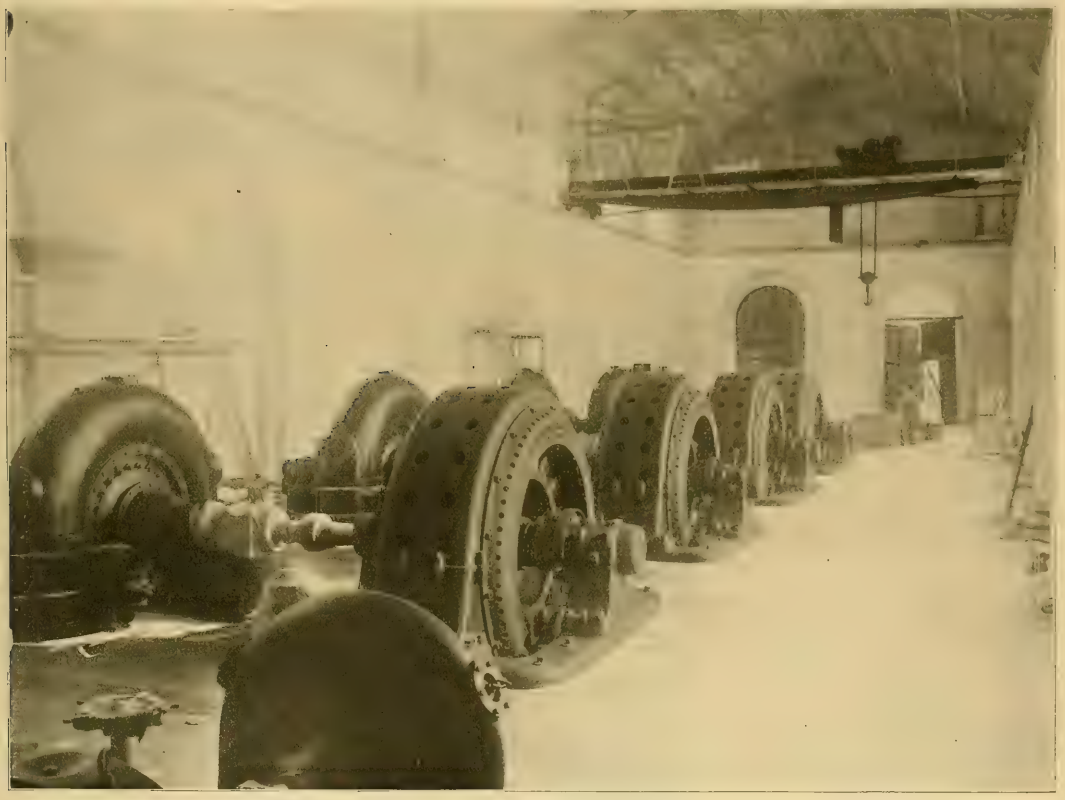

FIG. 1. VIEW SHOWING FOUR 2,600-HORSEPOWER TURBO-ALTERNATORS IN MALNISIO STATION IN ITALY.

The accompanying illustration, Fig. 1, shows the interior of the generating station at Malnisio, with the four 2,600 horsepower turbo-alternator groups already installed.

Twelve 1,000-kilowatt single-phase transformers will be installed when the station is complete, besides another group of three transformers to be held in reserve in case of injury to any other one of the four groups.

The power to be transmitted to Venice will amount to 12,000 kilowatts, which will be transmitted over a high-tension transmission line, consisting of four groups of three conductors each, so that each group of three transformers will feed one group of three wires. Each transformer set contains an automatic switch, which is worked from the platform, while the upper section contains the measuring transformers for the instruments on the board. Fig. 4 shows the arrangement of these partitions.

The automatic switches and measuring transformers for the circuits connecting the collecting bars, to which the alternators are connected, with the transformers, are also located here, in similar partitions. When the installation is complete, 13 36,000-volt switches will be installed, and of these four will be automatic. A storage-battery installation provides for the lighting of this station.

The high-tension conductors leaving the station pass through the switches mentioned before, in

## June Meeting of Indiana Electric Railway Association.

"Train Dispatching" was the chief topic for discussion by the members of the Indiana Electric Railway Association at the June meeting in Indianapolis on June 8th. The subject was presented in a talk by O. P. Spellman, chief train dispatcher for the Indianapolis and Northwestern Traction Company. Mr. Spellman said that in the dispatching of trains upon electric as well as steam roads there are three fundamental principals to be taken into consideration. First and above all is "safety"—not only to person but to property. No other consideration should be brought to bear when the limit of safety is in question. Next comes "dispatch"—the prompt handling of trains, giving them all possible dispatch

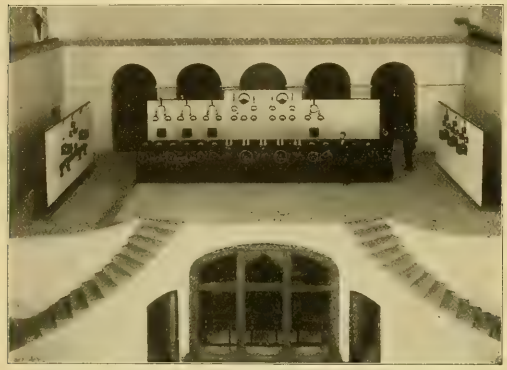

Fig. 2. Switchboard in Malnisio Station.

Fig. 3. Line Construction Crossing Lagoon.

THE 36,000-VOLT TRANSMISSION SYSTEM FROM MALNISIO TO VENICE, ITALY.

will be ordinarily connected with one group of wires without any parallel connection on the secondary side with the other groups, so that in case of an accident to one group, as, for instance, a lightning discharge on one line, only the transformers connected with that line will be affected.

Single-phase transformers were preferred for various reasons, among which might be mentioned the fact that the cost of repairs in case of accident is lower, and higher voltages can be obtained, if necessary, by changing the mesh connections to the star system. The ratio of the primary to the secondary is 7.5 to 1, and as the normal pressure of the current supplied by the alternators is 4,000 volts, the secondary voltage is 30,000 volts, while, if the primary tension is raised to 4,800 volts, the secondary pressure will rise to its maximum of 36,000 volts. The insulation between the frame and the windings of these transformers has been tested at 7,000 and 45,000 volts, respectively, and their efficiency is 98 per cent., with a power factor of unity. At present but two working groups of transformers have been installed, and are connected directly to the transmission lines through Wurtz lightning arresters. A double-horn lightning arrester, and a Gola arrester are also provided for further protection. A spare group is also installed and connected to auxilliary bars, which also permit connecting the transformers in parallel on the high-tension side.

The 4,800-volt oil switches are of the double-break type, while the high-tension oil switches for 36,000 volts have sextuple break and are enclosed in three separate boxes, one for each phase. The switches are all controlled at a distance by means of levers, and automatic circuit breakers open the circuit when the current reaches a predetermined limit.

The 4,000-volt and 200-volt circuits are in conduits, which are laid in a large tunnel underneath the main floor of the power house and connect with the switchboard, which is seen in Fig. 2. This switchboard is located at one end of the station on an elevated platform, and consists of a central board, which carries the ammeters, voltmeters, wattmeters, etc., for the alternators, and two lateral boards, as well as a working table for the small hand-wheels which control the switches and rheostat for the field circuit of the alternators. At the present time there are seven main switches installed, and of these two are automatic. The direct current for the fields of the alternators is controlled from this switchboard on the upper platform.

A masonry partition, divided into two parts, is provided for each alternator. The lower part connection with the switchboard, and up to the lightning arresters, from which they leave the building on a double row of poles leading to Venice. Fig. 3 shows very clearly the line construction in crossing the numerous lagoons.

The sub-station which has been designed for Venice has already been completed. Fig. 5 shows the high-pressure bus bars in the sub-station, while Fig. 6 shows the switch gear. The switches and

FIG. 4. AUTOMATIC SWITCHES AND INSTRUMENT TRANSFORMERS IN MALNISIO STATION.

transformers used are similar to those in the Malnisio power house. The entire electrical installation has been carried out by the well-known Swiss engineers, Brown, Boveri & Co. of Baden, who also installed the 40,000-volt transmission line between Gromo and Nembro.

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It is reported that W. B. S. Whaley of Boston, representing eastern capital, has purchased the Sedalia Water and Light Company, Sedalia Water, Light and Fuel Company, and the Sedalia street railway, all of Sedalia, Mo.

commensurate with safety. Next, "economy." While this is placed last, it is of great importance. Economy in the number of trains run, but not to the detriment of the service or to dispatch and safety.

Interurban roads are yet in their infancy and have not the old and experienced men that steam roads have; therefore Mr. Spellman thought it should devolve upon the chief dispatcher to conduct examinations of all applicants so far as such examinations pertain to the book of rules, time card and the running of trains. When, on account of troubles on the line, wires down and trains late, a train crew is undecided just what its rights are, or what to do under certain circumstances, Mr. Spellman's company makes a memorandum of each question or case and brings it before the men in the service and embodies it in the examination of all new men.

Mr. Spellman said that until some better means of communication for the transmission of train orders was offered than the present telephone system he strongly favors making all trains on the time card of the same class. If you have superior and inferior, when an inferior train gets late and there is trouble on the telephone line, nothing but superior trains will move, and thus in a short time you demoralize your schedule. If all trains are of one class they can all go to their scheduled meeting point, and you can thus take care of your local business. An important train can be given an advantage of one of minor importance by special order. Mr. Spellman explained at some length the system used on his line.

Walter L. Pearson, chief train dispatcher for the Indianapolis and Eastern Traction Company, read a paper which consisted of a description of his company's system of train dispatching by the use of portable telephones with drops provided every half mile. He explains rules that govern the operating of trains and said their record sheet enabled them to tell where the trains were at all times. By this system regular, limited and extra trains always keep the dispatcher informed of their movement in case the schedule is interrupted. In case the telephone line is out of service, eastbound trains have right of way over westbound trains five minutes after schedule passing time. A book of instruction covering all points and including rules is furnished each of the employes of this road.

After adjournment the members of the association were the guests of the Indianapolis and Martinsville Rapid Transit Company and were taken to Martinsville in the "Scenic Route" special. At Mooresville the power house was visited and at Martinsville the members were shown the Calebriate Springs and the Sanitariums. The train was under the escort of Paul H. White, general superintendent of the Scenic line. The association will hold no more meetings until October 12th. The meetings have been a success from the start and the members are free to acknowledge that great and lasting benefits have been derived from the discussions of important subjects and the exchanging of ideas and experiences.

## Rare Metals for Illuminant Purposes.

By Gilbert E. Walsh.

The problem of improving methods of illumination through the employment of certain rare metals and ores is one that has been steadily simplified in recent years, and the solution of the question appears to be largely a matter of substituting better and more satisfactory mineral elements or earths for the older ones used. Constant experiments conducted in laboratories indicate that investigations along this line are progressing rapidly and that the future economy and value of such illuminants as the arc and incandescent lamp, Nernst lamp, Welsbach mantle and the mercury-vapor lamp depend to a large extent upon the rare earths and minerals employed in their manufacture.

Selenium, for instance, is recognized as an important factor in the development of the electric lamp, for as a means for measuring the luminosity of rays it proves of great value. Selenium responds principally to the luminous rays and not to the heat rays or the chemical rays, consequently its use in photometric studies, and experiments is rapidly increasing. Its history is too recent for any safe prediction about its extensive use, but it undoubtedly finds a broad field open for it in laboratory practice, if not in the commercial field.

The inefficiency of the electric lamp has long attracted experimenters into the field of practical tests with new materials for improving it. The use of carbon filaments so generally has been due to their efficiency in withstanding a high temperature for a considerable length of time. But repeated efforts have been made to discover other substances which will produce better effects than carbon filaments. The rare earths and minerals which have occupied the attention of experimenters in recent years have given results that make them of more value than carbon. These earths are fusible, but they vaporize very slowly or not at all, while carbon vaporizes at the temperature at which it operates in the incandescent lamp, but is practially infusible.

The rare-earth oxides are the basis of most of the modern improvements in both electric and gas lighting. Their use was first made with gas lamps. As mantles for gas lamps they proved their efficiency years ago, and their employment has steadily increased in this field. The manufacture of the Welsbach gas mantles of thoria and ceria has assumed an importance in the mining and manufacturing world of far-reaching effect. When the electrician experimented with the rare-

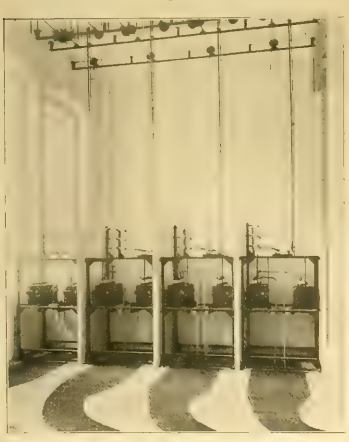


FIG. 6. SWITCH GEAR IN VENICE SUB-STATION.

earth oxides for improving his illuminants it was not supposed that they would conduct electricity. But as glass and porcelain insulators become conductors of electricity at very high temperatures, so most of the rare-earth oxides prove efficient in this respect when heated.

In the manufacture of the Nernst lamps zirconium oxide and yttria are employed in the proportion of 85 per cent. of the former and 15 per cent. of the latter. This mixture was the result of years of close experiment with magnesia, thoria, ceria and other substances. The combination of zirconium and yttria into a substance which conducts electricity at certain temperatures, and which vapor-

FIG. 5. HIGH-TENSION BUS BARS IN VENICE SUB-STATION.

chemically treated to remove all traces of iron and other impurities from it. Absolutely pure zirconium is not obtained by this process, but it is sufficiently pure for all commercial purposes. The mining industry for the ore has grown extensively in recent years, and with the development of the gas mantles and Nernst lamps the demand for the ore is rapidly increasing.

Yttria, which is combined with zirconium to produce the glower of the Nernst lamp, is obtained from gadolinite, fergusonite, rowlandite and other rare minerals. Nearly all of the yttria earths were obtained until a few years ago from Norway and Sweden, where they were found mixed with gadolinite. The discovery of a rich deposit of these earths in Llano County, Texas, immediately attracted the attention of manufacturers. The domestic ores were found to be superior to the foreign, the atomic weights of the former ranging from 100 to 115, and the latter as low as from 90 to 92. The yttria earths having the greatest atomic weights prove the most valuable for illuminant purposes.

The deposits of yttria earths in Texas are supposed to be of volcanic origin and the district in which they are found is comparatively small. Extensive examination of the neighboring regions have so far resulted in no discovery of new deposits. Reports have indicated that the ores may be found in portions of the West, but so far no exact area has yet been marked where deposits can be located. The Texas deposits are radioactive, and their presence in the quartz is indicated by slight radiating discolorations. In Texas the earths are found in varying proportions in crystalline form associated with the other minerals.

Rowlandite contains the highest percentage of the yttria earths, ranging from 47 to 62 per cent., but this mineral is not very abundant in Texas. Next to this, gadolinite is the richest in yttria earths, yielding on the average from 42 to 45 per cent., and then comes fergusonite, with an average proportion of 32 to 46 per cent. Yttrialite, however, is the most valuable of the minerals associated with yttria earths, for besides containing from 40 to 47 per cent. of the latter, its atomic weight is 115, the very highest on record. For this reason yttrialite is most sought after for making suitable glowers for the trade. Allanite contains a small percentage of yttria earths, but more ceria, didymia, iron,

is first removed by grinding the ore, dissolving it

chemical nature. When the yttria is finally purified sufficiently for all practical purposes it is in

chanically suitable for mixing with the zirconia

pressure through a die. The pieces thus formed are finally roasted to an intense white heat in a platinum box, after which it is ready to have the terminals attached to the ends for the Nernst lamp.

The Nernst glowers operate at about 2,300 degrees Centigrade. The intense heat of the Nernst lamp attacks the oxides rapidly at first, and causes 10 or 20 per cent. depreciation within the first hour, but after that there is an improvement, and the loss is very slow. Under normal conditions, the life of a glower made of zirconium and yttria is about 800 hours.

In Europe the rare earths have been experimented with in connection with electric arcs more than in this country. Some of the rare-earth oxides have been used for electrodes entirely. Considerable advances have consequently been made in the introduction of these earths and also such elements as boron and tantalum. These latter have been introduced in the electrodes with varying degrees of success. In the recent development of the tantalum lamp we have an illustration of the possible value of the little-known metals and earths. In this lamp the filament is composed of a fine thread of tantalum metal. Until this type of lamp was developed tantalum metal was not known to contain any of the properties which would make it of value for electric illuminants.

In the manufacture of modern illuminant apparatuses, platinum, porcelain, carbon, and many rare minerals are proving to be more than ordinary factors. The manufacture of a high-grade porcelain to withstand the very high temperature of the Nernst lamp, and not conduct electricity, has developed into an industry of great value. The most successful porcelain made for this purpose is composed of kaolin, alumina and silica in varying proportions. Such porcelain is highly refractory and porous, and even at a very high temperature it proves an excellent non-conductor.

A good many of the rare earths and minerals are not commercially attractive today because of their relative unimportance in the industrial world. Some of them appear to possess qualities which render them of value, but the cost of refining them nullifies their virtues. On the other hand, many of the earth oxides are strong in certain desirable qualities, but weak in others. By combining them with other oxides, however, results are frequently obtained which make the combination of unusual importance. In fact, a mixture of two or more oxides has generally given better results than one. As an illustration of this, magnesia and thoria will stand very high temperatures, and neither fuse nor vaporize, but they are such poor conductors of electricity that they appear to be of little value in modern illuminants. The red-iron oxide is a good conductor of electricity at all temperatures, but it breaks down under moderately high temperatures. Most of the rare earths are highly refractory and not readily vaporized, but many of them are poor conductors of electricity, and consequently, when used alone as filaments, they prove troublesome.

Nearly all of the rare-earth oxides possess some of the desirable properties for illuminating purposes, but their value from the miner's point of view cannot be great until they have come into commercial use, either alone or in combination with other substances. The field of experiment is thus broad and attractive, and scientists and engineers may find new uses for many of the earth oxides that today are worthless.

---

A new space-telegraph station is in course of completion at Portpatrick, on the southwest coast of Scotland, and is expected to be ready for operation soon. The poles, supplied by the Grangermouth and Greenock Dockyard Company, are now being erected. The lower mast measures 90 feet, the topmast 75 feet and the entire height of the pole will be 150 feet above ground level.

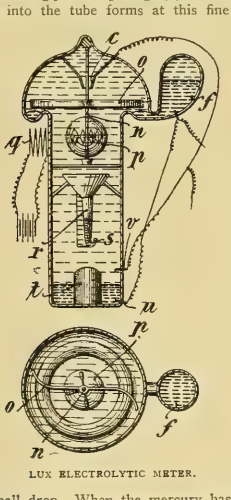
## Lux Electrolytic Meter.

Electric meters of the electrolytic type were among the early forms of measuring instruments used, but for many reasons they did not gain ground and have been largely superseded by other types. One electrolytic meter devised employed mercury as an anode, the cathode being composed of a metallic body, such as a platinum funnel, located above the anode. From the cathode the mercury precipitated from the solution surrounding the cathode dropped into a chamber or tube provided with a scale to weigh the amount precipitated. One objection to this form of meter was the formation of crystals upon the anode which were prejudicial to the operation of the meter.

To prevent the formation of the crystals, Mr. Fredrich Lux of Heidelberg has patented a meter in which the electrolyte is constantly kept in motion, thus keeping its constituent of dissolved salts constant at various points in the depth. The accompanying illustration shows one form of the meter, though several other modifications have been suggested.

In the constructional form illustrated, there is arranged upon a readily displaceable spindle (n) a vane-wheel (o) for agitating the solution, and as a driving member a glass sphere (p), provided with an internal radiometer vane-wheel. Outside the apparatus is arranged a heating wire (q), owing to the heat of which, movement of the radiometer, and consequently of the agitating wheel, is produced.

In order to permit of obtaining a convenient and exact measurement by means of this apparatus, there is arranged below the cathode a funnel tube (r), which is laterally bent below and terminates in an exceedingly fine opening (s). The mercury dropping into the tube forms at this fine opening




LUX ELECTROLYTIC METER.

(s) a small drop. When the mercury has reached a predetermined height in the tube (r), its pressure exceeds the superficial tension of the drop of mercury, and the tube is emptied. Its contents may be read upon a scale on the tube. The emptying of the tube into the lower chamber fills this latter to the extent of a division of the scale tube (t). This scale tube indicates units, while the scale upon the tube (r) indicates decimals. When all the mercury of the anode has been exhausted oxygen would be formed upon the fused-in platinum wire. In order to prevent this, the two platinum wires (u) and (v) are fused into the lower portion of the instrument in connection with the anode and the cathode.

## Steam and Electric Joint Traffic.

It is said that there was quite a warm discussion at a recent meeting of the Central Passenger Association over the fact that certain steam railroads are exchanging business with interurban electric lines. The Wheeling and Lake Erie, now a part of the Wabash system, tickets passengers through to Sandusky and Lakeside, Ohio, from Pittsburg and uses the Lake Shore Electric from Cleveland. The latter sells tickets from its stations through to Pittsburg, using the Wheeling and Lake Erie. It is said the arrangement will stand good for the season, if not longer, and that the road is willing to make the same arrangement with other interurban lines if there are prospects of an increased business by it.

## Programme and Arrangements for the Institute Convention.

The programme for the 22d annual convention of the American Institute of Electrical Engineers, to be held in Asheville, N. C., from the 19th to the 23d of this month, has been completed and contains valuable papers, as well as ample provision for the entertainment of the delegates. The programme is as follows:

MONDAY, JUNE 19TH.

Morning.—Address of welcome, by Hon. A. S. Barnard, mayor of Asheville; address, by President John W. Lieb, Jr.; "High-potential Oscillations of High Power in Large Power-distribution Systems," by Charles P. Steinmetz, General Electric Company, Schenectady, N. Y.; "The Constant-current Mercury-arc Rectifier," by Charles P. Steinmetz; "An Experimental Study on Commercial Transmission Lines of the Rise of Potential Due to Static Disturbances, such as Switches, Grounding, etc.," by Percy H. Thomas, Cooper Hewitt Electric Company, New York.

Afternoon.—Drive through Mr. George W. Vanderbilt's estate at Biltmore.

Evening.—"Data Relating to Electric Conductors and Cables," by Henry W. Fisher, Standard Underground Cable Company, Pittsburg, Pa; "Methods of High-pressure Measurement," by S. M. Kintner, Westinghouse Electric and Manufacturing Company, Pittsburg, Pa.; "Some Comments on Remarks Made by Col. R. E. B. Crompton Before the International Electrical Congress at St. Louis," by John W. Howell, General Electric Company, Harrison, N. J.

TUESDAY, JUNE 20TH (RAILROAD DAY).

Morning.—"Three-phase Traction," by F. N. Waterman, mechanical and electrical engineer, New York; "Heavy Electric Freight Traction," by C. de Muralt, electrical engineer, New York; "Choice of Motors in Steam and Electric Practice," by William McClellan, University of Pennsylvania, Philadelphia, Pa.; "Electrical Features of Block Signaling," by L. H. Thullen, Union Switch and Signal Company, Pittsburg, Pa.; "Weight Distribution on Electric Locomotives as Affected by Motor Suspension and Draw-bar Pull," by S. T. Dodd, General Electric Company, Schenectady, N. Y.

Afternoon.—Visit to the Weaver Power Company's high-tension transmission plant.

Evening.—Ball in the main ballroom at the Battery Park Hotel, as arranged by the local committee.

WEDNESDAY, JUNE 21ST (ELECTRICAL DESIGN DAY).

Morning.—"Limits of Injurious Sparking in Direct-current Commutation," by Thorburn Reid, consulting engineer, New York; "A Study in the Design of Induction Motors," by C. A. Adams, Harvard University, Cambridge, Mass.; "Limitations in Direct-current Machine Design," by Sebastian Senstius, Bullock Electric Manufacturing Company, Cincinnati, Ohio; "Motor-generators and Synchronous Converters," by W. L. Waters, National Electric Company, Milwaukee, Wis.; "A New Instrument for Measuring Alternating Currents," by E. F. Northrup, consulting engineer, Philadelphia, Pa.; "Eddy Currents in Large Slot-wound Conductors," by A. B. Field, Bullock Electric Manufacturing Company, Cincinnati, Ohio.

Afternoon.—Trolley excursion through Asheville and vicinity. Tea at the Swannanoa Golf Club.

Evening.—Banquet at the Battery Park Hotel, as arranged by the local committee.

THURSDAY, JUNE 22D (NEW DEVELOPMENT DAY).

Morning.—"Waterpower of the Southeastern Appalachian Region," by F. A. C. Perrine, consulting engineer, New York; "The Development of the Ontario Power Company," by P. N. Nunn, electrical engineer, Niagara Falls, N. Y.; "A New Carbon Filament," by John W. Howell, General Electric Company, Harrison, N. J.; "A New Induction Generator," by William Stanley, electrical engineer and inventor, Great Barrington, Mass.; "Note on a Simple Device for Finding the Slip of an Induction Motor," by Charles A. Perkins, University of Tennessee, Knoxville, Tenn.; "The Preservation of the Southern Streams—a Forest Problem," by Charles E. Waddell, electrical engineer, Biltmore, N. C.

Afternoon.—Organ recital at All Souls' Church, Biltmore.

Evening.—Smoker at Albemarle Club.

FRIDAY, JUNE 23D.

Programme to be arranged by the local committee.

Transportation arrangements have been made with care. Tickets will be issued at all the principal stations and ticket offices of the Trunk Line Passenger Association, the Central Passenger Association, the Southeastern Passenger Association, and the New England Passenger Association, to members and guests, on the certificate plan, which allows the holders of such certificates to purchase tickets from Asheville to original starting point at reduced rates.

Tickets at full fare for the going journey may be obtained three days (exclusive of Sunday) prior to the meeting, and also during the first three days of the meeting.

Members who wish to start from Chicago, St. Louis, etc., may apply for additional information to Mr. John H. Finney, member of local committee, National Bank of Commerce Building, St. Louis, Mo.

## Alternator Induction Constants and Energy Losses.

It is important in connection with the use of alternating-current apparatus in lighting, power and railway plants that the characteristics of alternating-current apparatus installed be carefully studied. It will, therefore, be of interest to note the arrangement and details of construction of some recently designed German measuring apparatus for determining the energy losses of alternating-current machines as well as for ascertaining the induction constants. The accompanying illustrations show special apparatus for this purpose made by Siemens & Halske of Berlin for ascertaining the

FIG. 1. ALTERNATOR INDUCTION CONSTANTS AND ENERGY LOSSES.—HUMMING TRANSFORMER.

constants controlling the behavior of high-frequency alternating currents.

The measurements are best undertaken by utilizing the alternating current itself, as the mutual induction, capacity and energy losses by eddy currents, as well as hysteresis and self-induction, are dependent on the frequency of the alternating current. Of the accompanying illustrations Fig. 1 is a humming transformer, while Fig. 2 shows the details of its construction and connections. A telephone membrane of circular form has fixed to its center a bag microphone surrounded by a magnetized steel tube, indicated at (R) and placed a small distance in front of the telephone membrane (M). A wire coil is carried by the steel tube, whose winding is connected in series with the secondary

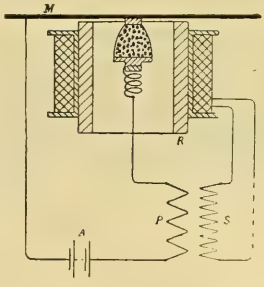



FIG. 2. CONNECTIONS OF HUMMING TRANSFORMER.

coil of a small induction coil indicated at (S). The microphone is connected to the induction coil primary (P), and to two storage-battery cells, forming a single circuit. When the membrane or disk (M) vibrates toward the steel tube the microphone contact resistance is lowered and the increasing current induces in the secondary winding an induction current reinforcing the magnetism of the steel tube and accelerating the movement of the membrane or disk. When the membrane moves backward the phenomena is noted in

an inverse manner, the telephone diaphragm or membrane thus being made to perform permanent vibrations in a similar manner to the Scott hammer. By ascertaining the number of period which effect the distances of the nodes of stationary sound waves generated in a glass tube by a telephone excited by the humming current, the frequency of the humming current is indicated.

A bridge arrangement is utilized to measure self-inductance down to 0001 henry, while another bridge (Fig. 3) is employed for ascertaining the self-inductance from 0.001 henry down to 10⁻⁶ henry, both of these instruments being based on the Wheatstone bridge connections, as shown in Fig. 4. A manganine measuring wire with sliding contact is represented by (ab), the branches (BC) comprising a henry self-inductance standard (L), the resistance being (R). The branch (AC) includes the self-inductance (L'x) which is to be measured. The resistance is (R'x), (Rx) being the ohmic resistance in case an alternating current is flowing. In the (AC) branch, (w) represents a resistance box.

A source of alternating current is connected to the points (A) and (B), thus being a sine current, and a telephone is utilized in the other diagonal branch as indicated. When the sound in the telephone disappears by the proper choosing of the two portions of the measuring wire the following relations will allow the immediate determining of the self-inductance:

$$\frac{W + R'x}{R} = \frac{a}{b}, \qquad \frac{-L'x}{L} = \frac{a}{b}$$

When the alternating-current adjustment has been performed as mentioned above, and a direct current is switched into the bridge, the telephone being replaced by a galvanoscope, the presence of a current will be indicated in the bridge by the latter instrument, and this current may be made to disappear by the proper shifting of the plugs in the resistance. That portion of the resistance box (w) which is inserted in the circuit finally indicates the alternating-current resistance loss R'x — Rx. The current output in watts as lost in the apparatus per second by eddy currents, radiation, and hysteresis is shown by multiplying the above by the square of the current intensity.

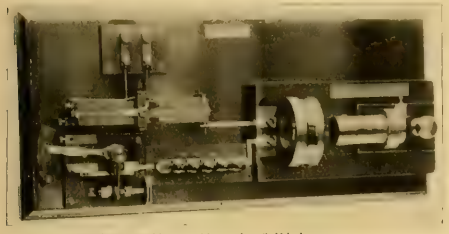


Fig. 3. Bridge for Measuring Self-inductance.

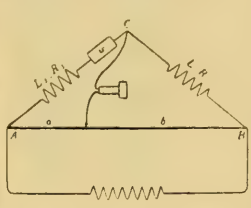



Fig. 4. Connections of Bridge for Measuring Self-inductance.

ALTERNATOR INDUCTION CONSTANTS AND ENERGY LOSSES.

Two special instruments are used as an alternating-current source, in order to give as pure a sine current as possible, and thus a sharp minimum in the telephone. Current oscillations are employed for this purpose by replacing the primary-current interruption as usual in induction coils. A high-frequency machine is utilized for this purpose, generating current up to 10,000 periods per second, together with a humming transformer generating alternating current of 300 to 650 periods. A type of self-induction standard is utilized in which the dependency of the resistance and self-induction on the frequency of the alternating current as due to the use of self-induction standards with massive wire is avoided by replacing them by a standard cable of insulated wire, one-tenth millimeter in thickness, while the terminals are placed as far as possible from the magnetic field of the coil, and are formed from resistance material.

It is asserted that these standards are very largely independent of the frequency as observed from the higher values of the high frequency and self-induction. The high-frequency machine includes an iron disk similar to a toothed wheel two centimeters in thickness and 20 centimeters in diameter. It consists of several hundred thin metal disks, each carefully varnished, and thus well insulated, securely held together by a hard rubber. A horseshoe electromagnet has its poles a small distance in front of the teeth of the disk. The poles of this electromagnet are sharpened like wedges, so that the magnetic circuit is closed by the iron disk [illegible] the poles of the electromagnet.

The electromagnet [illegible] thinnest sheet iron, [illegible] passing through the middle winding, and the iron disk is rotated very rapidly by a shunt motor. As the iron teeth are continually approaching and receding from the poles of the electromagnet, alternating currents are generated in the secondary coils by the strong magnetic oscillations. There is another electric motor closed by an adjustable resistance, which serves to keep the load of the starting motor at constant figures, so as to have the speed vary as little as possible. This new German measuring apparatus for determining induction constants and energy losses of alternating-current machines is interesting and unique in construction. P.

## University of Illinois Test Car.

There is probably no technical school in the country that has such natural advantages for electric railway work as the University of Illinois. Its track of the Illinois Traction System passes through its campus, about 1,500 feet being within the campus limits. This system is now completed from Danville to Champaign, and next year will probably be completed to East St. Louis, making a continuous trackage of nearly 200 miles. The Hon. W. B. McKinley, president of the Illinois Traction System, and one of the trustees of the university, has given the university the free use of the tracks of the system for experimental purposes.

Believing that such excellent natural advantages should be used for experimental work in electric railroading, and that a suitable test car is the first necessity in the way of equipment, the electrical engineering department is now having an interurban test car built by the Jewett Car Company of Newark, Ohio. This car is 34 feet four inches over the corner posts and 45 feet over all, vestibuled at each end, and has a double trolley, so that it can be run in either direction; and will weigh, with equipment, about 50,000 pounds. The interior is divided into a main compartment and an instrument room. The trucks are the Standard Steel Car Company's M. C. B. type, with six-feet six-inch wheel base, and 33-inch rolled steel wheels. The electrical equipment consists of four 50-horsepower Westinghouse motors, with Westinghouse unit switch system of control. The car is also equipped with Christensen independent air brakes, and electric headlights. The instrument room will be equipped with a complete set of graphic recording instruments, made by the General Electric Company and Elliott Bros. of London.

A car house containing a testing pit will be constructed at the university, where temperature tests of motor equipments can be made. All actual running experiments will be made on the tracks of the Illinois Traction System, which is built with 70-pound steel rails, gravel ballast and steel bridges.

This test car will be used to give students experimental work in connection with their course in electric railways, and also for thesis and research work. It is expected that in this latter respect it will be particularly useful to the electric railway interests of the country, as it will be available for any special investigations that may be desired. The car and equipment will be delivered in June, and will be ready for use at the opening of the next college year, in September.

## Commonwealth Electric and Chicago Edison Meetings.

At the annual stockholders' meetings of the Chicago Edison Company and the Commonwealth Electric Company on June 12th, the reports of board of directors showed that at the close of the year ended March 31st, the Edison company had a connected business equivalent to 1,475,699 16-candlepower lamps and the Commonwealth company had an equivalent of 727,975 16-candlepower lamps. The figures for the last preceding year were 1,307,631 and 604,194, respectively. The Edison company operates four generating stations and 18 sub-stations. The Commonwealth company has three generating and six sub-stations; a new sub-station re-

[illegible] ments have already [illegible]

## Contemplated Combining of Important Traction Lines.

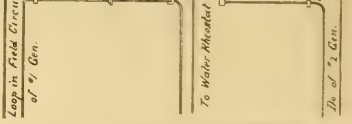
[illegible] tion lines out of Indianapolis, except the Indianapolis and Martinsville line, which recently passed to the control of Stone & Webster of Boston. The plans of the holding company are said to contemplate a trunk line from Cincinnati to Toledo, connecting the Ohio River and Lake Erie with important branch lines eastward and westward, including the lines that center in Indianapolis.

The Philadelphia syndicate has been gradually acquiring traction property until it has become probably the most formidable and powerful traction factor in the central West. John M. Lontz, secretary of the Richmond Street and Interurban Company, says it may be announced authoritatively that there will be a consolidation of the Indiana traction lines, and he thinks that the network of interurban roads between Indianapolis, Cincinnati and Columbus will soon be under one control aand through service established.

It is said that either the Toledo and Indiana or the Toledo and Western electric railway will be used in the plan to connect Cleveland and Chicago, which George F. McCullough is working out. The completion of the lines proposed will also unite Indiana towns with Southern Michigan and form a system of the roads of the three states through friendly connections. Mr. McCulloch is now giving his attention to the western gap, which when filled in will run to Hammond, Ind., where it will connect with Chicago.

## Paralleling Generators With Same Source of Exciting Current.

In throwing one or more generators in parallel with another generator having the same source of exciting current, a very objectionable disturbance is made in the exciter speed and voltage, and in the voltage of the first generator, in spite of the best switchboard attendance. Besides, in the case of the second generator or generators, it is objectionable to have so large a percentage of the full load switched on suddenly. To overcome this difficulty a method is described in the "Wrinkles" department of the National Electric Light Association by Mr. G. Hartman of St. Gabriel, Quebec, which is illustrated herewith.




APPARATUS FOR PARALLELING GENERATORS.

A water rheostat is connected to a double-throw switch as shown in the diagram. This is done in such a manner that it may be inserted in the field circuit of either of the two generators or be short-circuited. There is thus obtained a very gradual rise in voltage from zero to normal, and a gradual decrease from normal to zero in starting up, or closing down, a second generator, line and set of transformers. The objectionable disturbance is thus eliminated in the first generator, and there is a minimum strain on the second outfit.

A unique device was recently patented by George R. Somes of Laconia, N. H., which consists of a policeman's billy fitted with a small incandescent lamp in the opposite end from the handle to act as a searchlight. A detachable translucent cover is fitted over the end containing the lamp. A battery is contained in the hollow interior of the billy and is provided with the necessary connection to the lamp. A push button in the handle makes the circuit to the lamp.

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## DATES AHEAD.

American Institute of Electrical Engineers (annual convention), Battery Park Hotel, Asheville, N. C., June 19th to 23d.

National-Interstate Telephone Association (first convention of consolidated telephone associations), Auditorium Hotel, Chicago, June 20th and 21st.

Canadian Electrical Association (annual convention), Montreal, June 21st, 22d and 23d.

National Electrical Contractors' Association (fifth annual convention), Mechanics Hall, Boston, Mass., July 19th, 20th and 21st; electrical exhibition, July 15th to 22d.

Ohio Electric Light Association (annual convention), Hotel Victory, Put-in-Bay, August 16th to 18th.

Inter-national Association of Municipal Electricians (annual convention), Erie, Pa., August 23d, 24th and 25th.

International Association of Municipal Electricians (annual convention), Erie, Pa., August 29th, 30th and 31st.

Old Time Telegraphers' and Historical Association (annual meeting), New York city, August 29th to September 1st.

American Street Railway Association (annual convention), Bellevue-Stratford Hotel, Philadelphia, September 25th to 29th.

ALTHOUGH high-tension transmission plants in Europe are not planned on as extensive a scale as they are in this country, still there are many plants of large size, especially in the Alps region, where waterpower is abundant. A notable example is the system supplying Malnisio and Venice, which is described in the Western Electrician this week in an article by Mr. C. Smith. This system embodies a large power plant containing four 2,600-horsepower turbo-alternators, the hydraulic turbines deriving their water supply from the Cellina River. Current is transmitted from Malnisio to Venice at 36,000 volts. The head of water available at the power plant is 58.64 meters, and the minimum power available is 15,600 horsepower. Although but four turbines are installed at present, space is available for two or more; and when these are put in place the plant will be one of the foremost in Italy in point of size.

WORK upon the waterpower-development scheme of the British Columbia Electric Railway Company near Vancouver, B. C., is now nearing completion. Near that city there is a small lake covering about 300 acres. A power plant is nearly completed at the foot of the mountains, the fall of water being 390 feet in 1,600 feet. Still another lake, 35 feet higher, has also been tapped, to furnish plenty of power at all seasons of the year. To bring the water from the mountain lakes necessitated tunneling through solid rock for nearly 2½ miles. Work was begun over two years ago from each end, and was completed a few days ago. The tunnel is regarded as one of the largest and most successful engineering enterprises yet undertaken in the province. Its cost was $320,000, total length 2½ miles, size nine by nine feet, and area of normal cross-section 73 square feet. Waterpower sufficient for the needs of the community for years to come will be turned into electrical energy.

MUCH interest at the Denver-Colorado Springs convention of the National Electric Light Association centered in the paper of Dr. Louis Bell upon the "Tantalum Lamp." This paper, together with the discussion, is given elsewhere in this issue. The consensus of opinion among the central-station men at the convention was that, although the new illuminant undoubtedly possesses many qualities to recommend it for practical purposes, the stage has not as yet been reached in its development which will allow of its extended adoption. The question of whether to sell current on the lamp-hour or kilowatt-hour basis is one which has long been in the minds of central-station men, and, as pointed out by Mr. J. F. Gilchrist of Chicago, an extended use of the tantalum lamp would have a considerable bearing on this question. The low current consumption of the tantalum lamp—about two watts per candlepower—must necessarily reduce the income derived from the sale of current when the lamp is run upon a kilowatt-hour basis. While it is unwise, of course, for a central-station company to attack anything which is distinctly an advance, it will be wise, on the other hand, to make sure that the use of the lamp will be a decided advantage to the customer, and that sufficient business can be built up to warrant its adoption. Mr. Dudley Farrand, however, did not believe that the use of the new lamp would cut into the station receipts, for when the efficiency of a lamp is increased the capacity of the station is increased in a corresponding ratio, and while the higher efficiency may increase the distributing expense, the net result will be in favor of the high-efficiency lamp.

The price of the tantalum lamp, though not as yet fixed in this country, abroad is about $1. On this basis, with current at 10 cents a kilowatt-hour, taking the new lamp at a 600-hour rating, the cost of its 12,000 candle hours, including the lamp, amounts to $3.40. An equal number of candle hours with a lamp requiring 3.25 watts per candle, and excluding the lamp, would be $3.90, i. e., the consumer could afford to pay $1 for the new lamp rather than take the old one free. Going on down the scale of prices, we find that at five cents a kilowatt-hour, the consumer could only afford to pay 75 cents as against getting the carbon lamp free.

MUNICIPAL ownership of public utilities, such as street railways, telephones, gas works, etc., is impracticable in the United States. Such is the conclusion reached by James Dalrymple of the Glasgow municipal tramways, who, at the invitation of Mayor Dunne of Chicago, has been making a study of the conditions in that city. "To put street railroads, telephone companies and kindred concerns under municipal ownership," he is quoted as saying, "would create a political machine in every large city that would be simply impregnable." To the American citizen, proud in his ability for self-government, this seems rather a harsh statement. But true it is, that political conditions in this country do not adapt themselves to municipal ownership as well as they do in Scotland. Mr. Dalrymple said that what he had seen—and he had studied the situation carefully—made him realize private ownership, under proper conditions, is far better for the citizens of American cities. To him the best plan for cities here to adopt seems to be for the cities to sell their franchises upon the best possible terms, and to protect themselves by drawing up short leases. With a short lease the city will always be in a position to exercise a corrective influence upon corporations if public rights are absolutely disregarded.

In regard to fares, Mr. Dalrymple said that he believed that whenever a traction company is in proper financial condition, it should give three-cent fares. Once the original cost of the system is provided for, three-cent fares will return sufficient revenue to make the stock of a company attractive. In this opinion, however, the expert from Glasgow was, perhaps, somewhat biased by the results which have been obtained in his own city, where no transfer system is in vogue, and where the population is congested within a short distance of the center of the corporation. It is doubtful, that, in a city like Chicago, covering a wide area, the three-cent fare could be made to pay where the necessarily long hauls from the outskirts are taken into consideration.

ELEVEN HUNDRED people attended the convention of the National Electric Light Association in Denver and Colorado Springs. Eleven hundred people returned to their homes unbounded in their praise of the hospitality of the citizens of these two cities who united so loyally to extend to the visitors every courtesy and every token of good will which could be conceived in months of planning. Unrivaled natural attractions, electrical plants of unusual interest, entertainment features from golf to broncho busting—these things, and many more, all went to make the trip to these two hustling and representative cities of the West one long to be remembered.

But sight-seeing and entertainments did not hinder the association from carrying out a business programme that was full of things beneficial to its members, and to the central-station industry in general. Three days were given up to business affairs and the reading and discussion of papers, as reported in the Western Electrician last week and in this issue. Perhaps the question which was most upon the minds of the delegates was that of local advertising, and there was a pronounced feeling among the central-station men, that, as a rule, they are not giving this department of their business the attention which it deserves. Electric signs and electric decorations are not only a benefit to the consumer, but advertise the central station as well. For this reason, and also from the fact that electric sign lighting aids materially in smoothing out the load curve of a station, this class of custom should be encouraged in every possible way. Many of the larger central stations are doing this by a persistent advertising campaign—notably the Denver Gas and Electric Company, which has made Denver, as visitors are aware, a veritable "City of Light"—but still there is much that may be done in this line, especially among the smaller companies.

In all respects the convention was noteworthy, instructive and pleasing. There was a large attendance of ladies, and the supply men were out in full force. Special mention is due the various railroad companies which co-operated to make the journey to Denver so pleasant and which ran special trains to Colorado Springs and other points of interest.

# NATIONAL ELECTRIC LIGHT ASSOCIATION.

## Denver-Colorado Springs Convention of June 6-11, 1905.

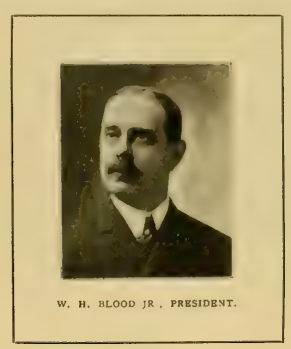
What Denver and Colorado Springs showed the National Electric Light Association at its twenty-eighth convention, held in those cities on June 6th to 11th, was unrivaled natural attractions and some electrical plants of unusual interest. In the case of the former city, too, the visitors saw and were much pleased with the exceptional skill displayed by the Denver Gas and Electric Company in marketing its product. The "City of Light" truly deserves its name. Electrical signs and electric-light decorations of an advertising nature—such as cornice lighting, outline lighting and dome effects—are profusely employed and give a noticeably bright, cheerful effect to the city at night. In the daytime, of course, the incomparable Colorado sunshine is all that is needed. This liberal use of light seems to be a deliberate, well-recognized municipal policy, and was brought about at the instance of the central-station company, which convinced the mayor and city authorities, apparently, that to have Denver become a city of light was the part of wisdom, both for its own well-being and its reputation abroad. This shows the broad, logical, enterprising character of the company's policy of promotion—a policy which is carried out, with many advertising details and methods, in a most admirable manner. A Denver business man said in the hearing of a representative of the Western Electrician that Doherty, Frueauff, Barker and Hammond formed a quartette that it was hard to beat, and in sober truth it is apparent that the administrative and new-business methods of the Denver company constitute an example that may well be studied by other central-station companies.

The convention itself was a good one—one of the very best which the association has held. The attendance was about 1,100—very satisfactory, when the location of Denver and Colorado Springs with reference to the geographical distribution of the membership is considered. Many reports and papers of much value were presented and discussed, as may be judged by the reports in the Western Electrician of last week and this week. The attendance at the various sessions was excellent, the programme being arranged so that the entertainment features, numerous and delightful as they were, did not conflict with business. President Davis kept the business steadily moving, and Secretary Farrand looked after the duties of his office with attention. Especially valuable features of the business sessions were Mr. Hancock's paper on power-house personnel, the report of the committee on steam turbines, Dow and Stewart on "Protection from Lightning and Other Static Disturbances," with ensuing discussion, the discussion of central-station advertising methods, the report of Mr. Williams on municipal ownership and the Question Box by Mr. Niesz.

At both Denver and Colorado Springs the entertainment was profuse and pleasing. Only a mere enumeration of the events may be attempted. Monday evening, June 5th, the day of the arrival in Denver of the special trains from the East, there was a reception, with dancing, at the Brown Palace Hotel. The next day the ladies were taken for a tally-ho ride and luncheon at the Country Club. In the evening there was a summer-theater party for both ladies and gentlemen at the beautiful Eletch Gardens. On Wednesday afternoon there was a broncho-busting contest at Denver Athletic Park. This was attended by both ladies and gentlemen and was a new and exciting spectacle to most of the visitors. The cowboys rode the wild, unbroken horses with great skill. One, however, mounted on a horse that tried to climb the rim of the "saucer track," was thrown and was borne from the field with a broken leg. In the evening the ladies were given a theater party at the Broadway Theater, and after the evening session the men were taken to an "athletic smoker" at Colisseum Hall, where [illegible] tion had been arranged. [illegible] the ladies were taken to [illegible] hall, which in the evening was [illegible] by the George W. Cecil Drum Corps.

On Friday nearly all the [illegible] to Colorado Springs, from which [illegible] were sent to power plants and [illegible] trip, "too numerous to mention," the party was split into numerous smaller detachments. Here, as in Denver, the local people were most hospitable and indefatigable in looking after the comfort of their guests.

There was a large attendance of ladies, and the supply men were out in full force, many of them with exhibits. The number of central-station men present from points west of the Mississippi was, of course, larger than at any previous convention. In all respects the Denver-Colorado Springs convention was noteworthy, instructive and pleasing.



W. H. BLOOD JR., PRESIDENT.

### New Officers of the Association.

On Thursday President Davis appointed as the nominating committee L. A. Ferguson, Paul Doty, Paul Spender, N. F. Brady and Samuel Scovil. This committee later made its report as follows: President, W. H. Blood, Jr., of Seattle, Wash.; first vice-president, Arthur Williams of New York; second vice-president, Dudley Farrand of Newark, N. J.; executive committee, Charles L. Edgar of Bostone, John Martin of San Francisco and Frank W. Frueauff of Denver, who were unanimously elected.

Arthur Williams, First Vice-President

Dudley Farrand, Second Vice-President.

C. L. Edgar, Member of Executive Committee

F. W. Frueauff Member of Executive Committee

NEW OFFICERS OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.

Although, according to the by-laws, the secretary-treasurer is to be elected by the executive committee, this practice has not been strictly followed, and, in view of this fact, the nominating committee, as a mark of respect, suggested Mr. W. C. L. Eglin of Philadelphia as a nominee for the office, and Mr. Eglin was unanimously elected.

In presenting Mr. Blood, President Davis said: "Let me say a few words for myself. I am the representative of a small company, and I was unexpectedly elected to the presidency of this association, as Mr. Blood has been on this occasion. The importance of the position somewhat staggered me. I became very conservative, and at times possibly rattled, in the discharge of my duties. I believe that few of our members appreciate the great influence of the association and the fact that we are making history, whether we act or whether we do not. I have been trained as a lawyer, and drifted into this business, and what struck me forcibly, as stated in my address, is the great danger to the industry of unwise legislation. The great value of our association no longer lies in the fact of meeting once a year to discuss the papers. It lies in the fact of the policy of the past being followed in the future, and improved upon."

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Organization Address of President.

President E. H. Davis called the first session to order on Tuesday morning and introduced Hon. Robert W. Speer, mayor of Denver. Mayor Speer gave the members a hearty greeting and in a pleasing way welcomed them to his city. In his address he said: "When we learned that your convention was to be held here we were pleased, because we believed that you could do us good, and that by meeting and becoming acquainted with the warm-hearted western people your views and opinions of the great West would be enlarged. We have a city which is new. It lacks many of the ornaments that are pleasing to the eye; yet we are laying a foundation, and we are going to build Denver so that it will be known all over this country for beauty and business combined. There is no city in the West or in any part of the United States where the people are more loyal and enthusiastic than in Denver."

He then went on to recite the wonderful resources of the state of Colorado and the advantages which it possesses in the way of a healthful climate.

Concluding his address the mayor remarked: "In Colorado we all boast; we cannot help it. It is in the air. If any of you gentlemen are looking for a location, if you want to start in and personally help in developing and profiting by the wonderful resources of this new empire: if you have money to invest and want to place it somewhere where it will be safe and be sure to get returns; if your health is failing or you feel you are breaking down under the strain and cares of business, turn toward Denver and Colorado."

President Davis thanked the speaker for his remarks and then called upon Secretary Dudley A. Farrand of Newark, N. J., who read a number of letters from the following-named gentlemen who were unable to attend the convention: Charles L. Edgar, Boston; P. G. Gossler, New York; Prof. Henry T. Bovey, Montreal; Prof. Edward L. Nichols, Ithaca, N. Y.; Elihu Thomson, West Lynn, Mass.; S. A. Duncan, Atlanta, Ga.; C. F. Brush, Cleveland, Ohio; E. A. Armstrong, Camden; James C. Cahoon, New York, and George Forbes, London, England.

The president then read his address, which was published in full in the Western Electrician last week.

The report of the committee on progress was next read by Chairman T. C. Martin of New York. He said that it occurred to the committee that it would be interesting and valuable to have at the convention an exhibit of the advertising methods and materials used by some of the companies in this country; also an exhibit of some of the "follow-up" methods by means of which the impression created by advertising is driven home and new patrons secured. It was therefore determined to associate with the report of the committee on ad-

vertising an exhibit of advertising material and methods, of which some very handsome contributions had been secured.

The report considered some of the leading central-station developments during the last year and mentioned particularly such instances as Detroit, where Mr. Alex Dow is carrying out an extremely interesting and ingenous development.

One of the interesting developments which have taken place in the last year is that of the tantalum lamp. A valuable paper upon this subject was contributed by Dr. Louis Bell and was read by Mr. Martin in the absence of the author. This paper, with the discussion which ensued, is printed elsewhere in this issue.

Two other papers were presented at the morning session. One was entitled "The Paramount Importance of the Selection of Standard in Preference to Special Machinery," and was contributed by David Hall of Cincinnati. This paper was given in the Western Electrician last week.

In discussing Mr. Hall's paper E. F. McCabe of Lewiston, Pa., said: "A short time ago I had occasion to write a specification for a 300-kilowatt, alternating-current generator, 25-degree rise. Among the four bidders there was only one who had the generator at the required speed and size, and one of these wanted us to accept the machine at a given atmospheric temperature of 25° C. We received bids from three or four manufacturers, each one bidding on a different machine. Within a week or two I had occasion to ask for bids of a half dozen manufacturers for a 300-kilowatt induction motor, with a speed of 450 revolutions. There was not one manufacturer who could produce the machine within 10 weeks, because they all said it was special. What we want is to have machines that are not special, except in minor respects."

H. T. Hartman of Philadelphia thought that the trouble in that respect is largely due to the fact that the engine builder has his speeds for special outputs, and the purchaser if he wants a special style of engine, must specify the speed that the engine builder calls for. If the electrical manufacturers were to get together and standardize their speeds and at the same time consult the users of them, between the two a standard which would be satisfactory under almost all conditions could be arrived at.

"Insulation Testing—Apparatus and Methods," by C. E. Skinner of Pittsburg, Pa., was the next paper, which was read by the author.

Tuesday afternoon four papers and one report were read, the first upon "Automatic Synchronizing of Generators and Rotaries," by Paul MacGahan of Pittsburg. This paper was not discussed and was followed by a paper upon "Notes on Rotary Converters and Motor Generators for Lighting and Power Systems," by Louis E. Bogen of Cincinnati. This paper was discussed by Clarence Renshaw of Pittsburg, Alex Dow of Detroit, and H. J. Gille of St. Paul.

"The Organization of the Working Forces in Large Power Houses," by W. P. Hancock, was next considered.

In discussing this paper W. B. Jackson of Madison, Wis., said: "It seems to me that not only is there a value which fully pays for keeping a plant in a clean condition, but also the morale of the employes will be much better, and they will be much cleaner on account of the plant being clean in every detail. In my opinion the keeping of the plant will be paid for from this standpoint for the reason that wherever one goes into a dirty plant one sees slovenly employes. When one enters a beautiful, clean plant, one sees bright, attractive employes who seem to be pleased with their work."

Answering a question by A. H. Kruesi of Schenectady, Mr. Hancock said that he did not hire any beginners for firemen. He hires a fireman for $16 a week, and if he is not worth that he is not wanted. In the case of the operators they are taken in as low as $10 a week and are moved up as fast as possible.

The report of the committee on the investigation of the steam turbine was then taken up. The most important points brought out in connection with this report, together with the names of the committee members, were given in the Western Electrician last week. Following this a paper by A. H. Kruesi upon "Operating Features of Vertical Curtis Steam Turbines" was read by the author.

LADIES' TALLY-HO PARTY LEAVING OVERLAND COUNTRY CLUB.

### Motor Papers Discussed.

Two papers were taken up on Wednesday morning, one by Clarence Renshaw of Pittsburg, upon "Series Alternating-current Motors for Industrial Work," and the other by G. Percy Cole of St. Louis upon "A New Type of Single-phase Alternating-current Motor for Elevator Work. These two papers, being upon similar subjects, were discussed together.

Mr. Renshaw inquired of Mr. Cole if the motor he described might be used for other purposes than elevator work, to which the latter replied that it was their intention to develop the motor to be used for cranes and hoists.

A statement in Mr. Cole's paper was to the effect that in many of the largest cities power companies are changing over whole sections from direct to alternating supply. W. C. L. Eglin desired further information as to this, to which Mr. Cole replied: "I cannot name the exact cities at present, but know that is the case in a good many places. In the city of St. Louis, for instance, there is a section in which you cannot obtain anything but alternating current, and I believe this is true in many other cities. I have been informed to that effect, but cannot at present give the names of each city where that change has taken place."

### High-tension Transmission and Protection from Static Disturbances.

Following the motor papers two others were read—one upon "Long-distance High-tension Transmission in California," by John A. Britton. The author was not at the convention, so his paper was read by title. It was given in abstract in the Western Electrician last week.

The report on "Present Methods of Protection from Lightning and Other Static Disturbances," by Alex Dow and Robert S. Stewart of Detroit, was next read by Mr. Dow.

By way of introduction Mr. Dow said: "In making this report there has been no attempt to go into detailed theory nor to go through the history of protective devices. It is, to the best of our belief, a statement of what may be considered the standard practice today. We were unable to obtain in sufficient time to put into print the data regarding the European practice which we would like to have incorporated, particularly with reference to the use of the water-jet arrester, which we find is exceedingly common in the Swiss, Italian and southern French transmission systems. The water-jet arrester is obviously merely a leg of high resistance and of no inductance and it consumes energy continuously. It appeared to us—although we did not include the statement in our printed report—that a water jet might be used to good purpose on many high-tension transmission lines as special protection during thunder storms in much the same way as in certain railway plants the tank arrester is switched on during thunder storms. The effect is excellent, and in conjunction with choke coils it seems to be the most thoroughly reliable method of protection. You will observe, of course, that its use involves a loss of energy of from three to 10 kilowatts, depending on the voltage.

"In the matter of the use of an overhead ground wire strung on the transmission line, we will say that certain information reached us after this report was prepared; and while it does not add to the general statements here set forth, it is well to say that our recommendation of two outside pins for cross-arms—a tentative recommendation—I think will be now withdrawn in favor of the use of a single ground wire. We believe that in practice a single wire will do the work as well as two wires, and we also believe they are reliable."

"We believe that an iron ground wire, carefully regulated to allow the difference in contraction and expansion between the iron and copper wires, will in many cases be invaluable and in all cases justify its erection where the line is of any length and the voltage high."

Regarding the horn arrester, Mr. Dow said that they had not been able to get definite data. The use of the iron tail-piece is dispensed with entirely

GROUP OF LADIES OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION AT THE OVERLAND COUNTRY CLUB.

in many European plants and it was found there is no codification of practice at all. The arrester seems to be rather a survival than an immediate adaptation of the best means for the end in view. He said further: "We would recommend that the association appoint a reporter—a committee is a somewhat unmanageable thing—which shall next year and thereafter for a year or two report on this subject."

In discussing protective apparatus, R. F. Hayward of Salt Lake City said: "Most of the members probably know that in Utah we have a number of miles of transmission lines running from 28,000 to 40,000 volts. There are altogether about 300 miles of 40,000 and 200 miles of 28,000 volts running in parallel, but there are no thunder storms occurring within a range of 140 miles north and south that seem to miss us. I believe we catch a little of everything. I do not think during last summer that any one storm passed through our lines without striking something, either directly or inductively, giving us a secondary shock. We put in all the lightning apparatus we can, not so much to protect our machinery and lines as to protect our consciences. We do not believe that it protects our apparatus, but we do like to say to the board of directors that we have taken every precaution that is known. We have about come to the conclusion—and this conclusion is based on what we have run up against, and upon the advice of the best authorities in the East, from Mr. Steinmetz down, and from our friends in the Westinghouse company, who have done some very good work in the investigation of this line, especially Mr. Thomas—that we must spread our lightning protection all over the line in the form of lightning conductors. Lightning likes to follow a line which is as non-inductive as possible, and you cannot get a heavy discharge involving a large amount of current which will keep itself together in one part, because the large amount of current in itself entails heavy self-inductance. It will split up if it possibly can. We find when a storm passes over us that it will generally strike the lines and splinter a number of poles, shattering all the insulators on one pole and puncturing a number of insulators on other poles."

"We believe that we should put the ground wire on the line. We believe after all that is going to be the only protection. Mr. Honnold, our operating engineer, has devised a scheme which seems to be successful. When a thunder storm comes along, if we have not a ground wire on the line, we ground one of the two circuits at each end of the line. In this way we have had several storms pass over without doing damage. This plan will not prevent the lightning from striking the pole line, and if it strikes it you cannot tell what will happen."

Following the papers above referred to, the last paper to be read Wednesday morning was by E. R. Roberts of Pittsburg upon "The Nernst Lamp—Its Present Performance and Commercial Status." This paper was discussed by W. J. Hazard of Golden, Colo.; Arthur Williams of New York; W. E. Russell of Massillon, Ohio; A. C. Dunham of Hartford, Conn., and Mr. Roberts.

### Amendments to By-laws.

At Wednesday evening's session, President Davis announced a proposed amendment to the by-laws presented by Malcolm Scovil, by which the retiring president was to be made a member of the executive committee for one year after the expiration of his term. This was referred to a committee composed of Henry L. Doherty, H. T. Hartman and George W. Brine, having charge of amendments.

Later, on Thursday, this committee presented to the convention two amendments to the by-laws as follows:

"To amend Section 3, Article IV, to read as follows: 'The vice-presidents of this association shall be members of the executive committee, and the retiring president, shall, by reason thereof, be a member of the executive committee for the period of one year after the expiration of his term.'

Amend [illegible] matter [illegible] an executive [illegible] of the [illegible] nominating committee [illegible] ted representative [illegible] A, in the following [illegible]

"Any representative [illegible] pany, class A shall have the [illegible] nominations, and when any such nominations are seconded by any other such accredited representative, that nominee shall be [illegible] Nomination in this manner [illegible] resolution shall be adopted to close the lists. After the lists are closed, a ballot shall then be taken. The accredited representative present of any class A member company shall have the right of voting for five of those placed in nomination in the manner previously described. The five nominees receiving the highest number of votes shall constitute the nominating committee.

"This nominating committee shall, at a subsequent executive session, bring in the names of those recommended by them for the several offices to be filled.

"The submission of names by the nominating committee shall not, however, debar any accredited representative of a class A, member company from making nominations for any or all of the several offices to be filled, which nominations, if seconded, shall be submitted for election at the same time and in the same manner as those of the nominating committee. Whenever there are more nominees than vacancies to be filled, then, in such cases, the election shall be decided by ballot. When there is no contest for any office, the secretary may be instructed by a viva voce vote to cast the ballot for those recommended by the nominating committee."

These amendments were unanimously adopted.

A paper was read Wednesday evening by E. P. Dillon of Colorado Springs upon "Some Investigations of Inductive Losses," also one upon the "Choice of an Insulated Cable" by Wallace S. Clark of Schenectady, N. Y. An abstract of the latter paper appears elsewhere in this issue.

P. D. Wagoner of Schenectady next read his paper upon "Mercury Arc Rectifiers." Mr. Wagoner then gave a demonstration of one of the rectifiers.

RECEPTION AT BROWN PALACE HOTEL IN DENVER FOR THE NATIONAL ELECTRIC LIGHT ASSOCIATION DELEGATES

[illegible] will put the arc out. On a 10-ampere tube the [illegible]

[illegible]

### Advertising Methods.

Three papers upon the general subject of advertising were read at the Wednesday evening session and were discussed at once. [illegible] "Advertising Methods" by Percy [illegible] of Newark, N. J.; "Sign and Decorative Lighting" by [illegible] Vredenburgh of Boston, read by C. W. Lee of Newark, N. J., and "Free Signs and Flat Rates" by C. W. Lee. The last two papers were summarized in the Western Electrician last week.

This general subject brought forth a long and valuable discussion on Wednesday and Thursday, the most important parts of which follow.

John Craig Hammond of the Denver Gas and Electric Company said:

"The Denver Gas and Electric Company has been one of the pioneers in the advertising of gas and electrical appliances. We have an exhibit back in the rear of the hall which tells its own story to a certain extent. It does not wholly tell its own story, however, for there are a number of things in the exhibit, which, to a man who does not know the local conditions, would be considered out of place. There is not a piece of literature which has not had a theory or idea back of it. By the way, theory is sometimes a bad thing in advertising, which is a matter of dollars and cents, as the men who pay the bills well understand. For instance, in our advertising campaign there was a street car card issued which related to Mormonism. When that card was put out, the subject of Mormonism was before the public in the daily press, and it was an opportune card. Advertising must be of a pertinent nature. I do not mean to say that a piece of advertising matter issued in Denver will not hold good in some other city, but at the same time local conditions govern to a great extent; there is no doubt about that. I heard a man criticize a card; he said he could not read it; for instance, that transfer card. You from other cities perhaps would not appreciate that card fully. Here in Denver, where we ride on the cars, a person in a street car will recognize the card at once. It is a facsimile, on a large scale, of the Denver City Tramway Company's transfer slip. The passengers on the car notice it. They see the flash line. We have a line of red at the top which arouses their curiosity. They read it. People have been found who have said that they

DENVER GAS AND ELECTRIC COMPANY'S OFFICE AT NIGHT.

stood on their heads to read it. It is a good advertisement, in my opinion.

"The subject of advertising is one which necessarily involves considerable generalization, but I believe that the advertising field is one of even greater importance to the plant than the generating of more power. If you have a plant that will give satisfactory service and take care of the business in a general way, then I believe you should turn it into a commercial proposition. There is only one way in which to do that, in my opinion, and that is by advertising, which has become a science. Advertising is really in its infancy. There is not a man in the United States today who understands it thoroughly. We all have our ideas, our own schemes, our own methods, and some men may have a brilliant scheme and some may not; but advertising of all kinds brings in a certain result.

"The great point today, and what we are coming to in the advertising field is self-supporting advertising. That is a thing that I believe will come, and I am not a theorist, as I want to impress upon you; but if you could turn an electric-light plant into a commercial proposition and educate the people that they must use more electric current or more gas, you are making that property more valuable and increasing its earning power, and that is what you want to do. It is simply with you all a proposition to sell more current. How are you going to do it? There are different methods. I have my own ideas. Here in Denver we carry them out. We are boastful to this one point, that we do not copy any other company. We originate and create. There has not been a piece of advertising matter sent out by the local company which has been copied from other companies. That is not necessarily a strong point in favor of it, but we have shown results. The motto of Denver some time ago was 'Forward.' Today it is 'City of Light.' Mayor Speer, who is in this room, is in favor of 'The City of Light.' The proposition was laid before him, he was told the idea, and the suggestion; a germ was created; and it developed, until today the people of the city are in favor of 'The City of Light.' I believe it is possible to educate the public that while it is dark now, it is light. The human mind is peculiar. You must know how to do it. That is good advertising.

There is one great principle in advertising. You must have something that is legitimate. You must have a solid proposition. You cannot "bunco" the public, you cannot fool them; you cannot get them to part with their money on the old theory of saying that John Smith was kicked in the head by a mule, had four teeth knocked out, took Dr. Chamberlain's cough syrup, and was cured. That won't go today. You must have something legitimate which appeals to the public."

John F. Gilchrist of Chicago said: "Even in a small community there is no doubt that advertising, although you cannot trace the direct results at all times, will do good. The company which I represent started in, possibly five or six years ago, to do a little advertising. That has been increased each succeeding year. We are issuing a bulletin, with the results of which we are entirely satisfied, and we feel that we are warranted in spending for advertising probably one-third of the entire amount which we spend for getting business. We have conducted during the last year an advertising campaign which was arranged for us by the Bates Advertising Company of New York, and have watched the results of it very carefully. They prepared for us a lot of material which was very unique and good in many ways. We have kept a closely tabulated record of all the returns which we could trace directly to it, and the amount is very considerable."

"Some stations will pride themselves on having in a year obtained 50,000 lamps. Why not double their energies and get that 50,000 lamps in six months? Supposing we do spend money, after all it comes out of the other fellow. I am thoroughly in favor of spending a very considerable amount for advertising. The question of how much should be spent, as based on your gross sales, is the problem. I should estimate it to run somewhere from two to 2½ per cent. That would include the entire costs of getting the business and the advertising; two-thirds on the soliciting force and one-third on advertising.

Percy Ingalls, Newark, N. J.: It is probably very difficult to determine just what advertising and soliciting will do for a company. Very few companies advertise one year and then give it up the next. We had an experience in one of our towns last year where, through the fact that our plant was loaded up to the muzzle and we we could not take any more business, we had to give up advertising for a while. We were under the impression that discharging most of our solicitors and giving up our advertising would not have a marked effect, and that several months would elapse before we noticed any difference in the business which came in, but, as a matter of fact, almost the very day that the men were laid off and the advertising stopped, the new business slowed up. It was only a week or two before we saw a very marked difference, and we practically did no new business until we were in shape to take on more business and begin soliciting and advertising.

R. W. Rollins of Hartford, Conn., asked Mr. Gilchrist if the bulletin issued by the Chicago Edison Company leads to any beneficial results.

Mr. Gilchrist answered that he knew that their bulletin is thoroughly appreciated. As an illustration, he said that one of their engineers, who is a very able man, but sometimes does not get on to what is going on around the office until two months after it has happened, went out to figure with a man on the question of taking current. He made certain statements to the man, and the man came back at him and said: "I have seen all that, I read it in your bulletin nearly two months ago," and this man went on to tell the engineer what else he saw in the bulletin.

Mr. Lee remarked, in regard to new business methods, it had come to his attention this spring in a territory recently acquired and in which his company's business methods and soliciting had been put in effect, that in a month's time they were able to do more business and create more new business than was done during the entire last year by the company that had the plant before they had bought it. This was in New Jersey.

E. F. McCabe of Lewistown, Pa., asked Mr. Lee what percentage of the gross income of the company he expends for advertising in a city of 10,000.

Mr. Lee said it would be rather hard to make that estimate, because their plan of campaign is rather large. They are able to buy better designs and pay more money for them, having a large campaign, covering a number of different towns, than in a town of 10,000 inhabitants. But probably one-half of one per cent. would cover it very nicely for advertising proper. That is, one-half of one per cent. on the gross earnings.

Arthur Williams of New York said: "We must not lose sight of the fact that all of our advertising is purely supplemental to personal canvassing. Both should go hand in hand. Newspapers, street cars, bulletins and billboards, follow-up letters, postal cards—all of these things should be at all times so constructed and issued as to follow up most effectively the working of your canvassing department. Advertising is a branch of the canvassing department, and in my opinion one without the other is quite incomplete. I think also that it is very important to carefully classify advertising according to the business and the men who are working in different branches of your business."

L. E. Watson, Kearney, Neb.: I am a representative of one of the small lighting plants, and, like the gentleman from New Jersey, who said he had used advertising methods until he was able to load up the plant clear to the muzzle, I want to get at the best means of advertising small plants. My advertising methods have been small, but rather unique, in the way I went at them. I was up against very stiff competition with the gas plant and had taken charge of a rather run-down electric-light plant. I made personal solicitation of a majority of the business people of the town, and directed personal letters to them. Another scheme was on particular days, such as holidays, particularly on New Years day, to send a letter to each one of our customers and prospective customers, the letter properly dated and addressed to Mrs. John Smith, we will say, having the appearance of a wedding invitation or something of the kind, gotten up as neatly as possible, setting forth some little thing in connection with our business which we had put forth.

One thing which I think brought more business than anything else was the decoration of my office with ferns and other plants. As you all know, it is an impossible thing to raise plants indoors where they burn gas of the average quality of the gas produced in the small cities. The average household wife and the average woman is a great lover of such things, and I was able, by cutting out all gas from the office, to have a beautiful display of ferns and plants. That attracted a great deal of attention, and in a very short time I had very beneficial results from that.

R. E. Allen, Walla Walla, Wash., said that, with his company, the question of getting new business has been one of paramount importance, inasmuch as it has just completed a plant which has a capacity three times the demand of the community. Last year, when the plant was bought by the present company, the electric part of it was heavily overloaded, and the only avenue for business was through the gas department. He made a campaign through the newspapers, for two reasons—one was that he wanted the friendship of the newspapers in the community, and the other was that he thought he could better reach in that way the people who would be particularly interested. He started out and took a full page in each paper each week, and after two months' advertising the gross output had increased 40 per cent. over the same month of the year before. This year's output, since January 1st, in the gas department, has not been less than 55 per cent. more than a year ago during any month of the same period.

He particularly directed his attention to the matter of small-motor business. There are no manufacturing industries there, and consequently he could get no large power business, but, through suggestion, he has secured all of the power business in the town, with the exception of four plants —two breweries, one planing mill, which had to use steam to dispose of its refuse, and a laundry.

F. W. Wilcox, Harrison, N. J.: To my mind the question of rates and the question of advertising are the most important things that concern practical electric-light success. I think the question divides itself into two parts; first, the conviction on the part of central-station companies as to the value of advertising, and, second, the undertaking of the work. I think it shows considerable progress in the matter when we find that the companies are convinced today that advertising pays. There was a time when few companies agreed that it was profitable to advertise. That is past. As to undertaking the work, I think if a vote were taken at this meeting it would be surprising to find how few companies do systematic advertising, and how few companies do any advertising at all. A few companies do it in a systematic manner, some companies do it irregularly, but a large number of companies do nothing at all. The reason in the latter case is that they have no means of undertaking the work. The members come to the meetings, and become enthusiastic about advertising, and they go home, and for various reasons the subject goes without attention, and the matter is dropped.

Following the discussion upon advertising methods, James I. Ayer of Boston read his report upon the "Progress of Electric Heating." This was discussed by E. F. McCabe of Lewistown, Pa., Earl W. Paul of Ontario, Cal., A. L. Selig of Los Angeles, P. H. Korst of Janesville, Wis., Julian B. Downey of Rawlins, Wyo., A. C. Dunham of Hartford, Conn., Arthur Williams of New York, H. W. Hillman of Schenectady, J. F. Gilchrist of Chicago, W. H. Gardiner, Jr., and C. R. Maunsell of Topeka, Kan.

The first subject to be taken up Thursday afternoon was the "Wrinkles" department, edited by H. C. Abell of New York. President Davis thanked Mr. Abell for the efficient manner in which his duties had been performed.

Following this came the report of the committee on "District Heating," which was well discussed. "Purchased Electric Power in Factories," by E. W. Lloyd of Chicago was the next paper considered, and it was read by Mr. Gilchrist, in the absence of Mr. Lloyd, who was unable to attend the convention, owing to ill health.

L. A. Ferguson of Chicago, chairman of the committee on the president's address, then presented the report of the committee, emphasizing the fact that the association should not be passive while laws placing the industry under the regulation of commissions are passed by the several states without making proper suggestions whereby such laws would be made reasonable and uniform in their provisions. Nor should it permit, without protest, the passage of any laws admittedly unduly restrictive and burdensome. The object should be to have the general laws of the several states, relating to the industry, conform to some standard, fair both to the public and to the industry.

The other members of this committee were F. W. Frueauff, George R. Stetson, Samuel Scovil and S. Carnes.

A resolution was then adopted to the effect that the executive officers be authorized to spend, during the fiscal year 1905-6, not to exceed $500 in procuring such electrical tests as in their judgment are advisable, from a competent testing laboratory, and report them as promptly as possible to each member.

Another resolution was also passed expressing the appreciation of the delegates for the work of the several committees of arrangements, in connection with the annual convention; their thanks to Mayor Speer, who so felicitously welcomed them to Denver; to Mr. Henry Wray, the secretary of the Colorado Springs Chamber of Commerce, for his efforts to make their stay in his town one long to be remembered; to all general, special and ladies' committees for their work; to the railroad companies for their excellent arrangements, and to the local press of Denver and Colorado Springs for their excellent reports of the proceedings of the convention.

Arthur Williams presented the report of the committee on deceased members. He referred in suitable terms to the demise of Baron Rothschild and George L. Bowen, honorary members, and Charles H. Peters, E. A. Leslie and George W. Davenport, active members.

### Executive Session.

At the executive session held on Thursday afternoon the following business was transacted: Report of the committee on "Relations with Kindred Organizations," by James I. Ayer of Boston (chairman); report of preliminary draft of committee on "Rates and Costs," by Charles L. Edgar of Boston (chairman); report of the committee on "Municipal Ownership," by Arthur Williams of New York (chairman); report of the committee on "Standard Rules for Electrical Construction and Operation," by Charles L. Edgar (chairman).

## Convention Notes.

George A. Grey of Chas. Shawmut['s] Denver office was one of the host.

The Standard Paint Company of New York was, as usual, represented at the convention.

The Temple electric air drill at Denver was on exhibition in Denver during the convention.

The John A. Roebling's Sons Company of Trenton, N. J., was well represented at the convention.

J. O. Maloney of the Maloney Electric Company, "the transformer man," came on from St. Louis.

Superintendent Lamphier of the Sangamo Electric Company made a host of friends for Sangamo meters.

B. K. Sweeney, sales manager of the Denver office of the New York Insulated Wire Company, was present.

Baker & Co. of Newark, N. J., were represented by several men at the convention, including Mr. C. O. Baker, president of the company.

James M. Perry, manager of the H. W. Johns-Manville Company of New York, with a party of ladies, was in attendance at the convention.

A. A. Serva of the Fres-Ko Chemical Company, Ft. Wayne, Ind., distributed souvenirs in the form of soldering-paste boxes, filled with candy, which made quite a hit.

Vice-president W. L. Arnold of The Arnold Company of Chicago, accompanied by his wife, was numbered among the distinguished guests.

Mr. and Mrs. W. W. Low and Messrs. Packard and Grier left Denver late Thursday afternoon and traveled to Colorado Springs in an automobile.

Secretary and Manager Charles R. Bishop of the American District Steam Company of Lockport, N. Y., dropped in from the East and was most welcome.

The Rio Grande railroad ran a big special train from Denver to Colorado Springs Friday afternoon, and its efforts were much appreciated by the delegates.

General Manager Jos. E. Montague of the Buffalo and Niagara Falls Electric Light and Power Company, as usual, proved himself a "winner" with the ladies.

Thomas G. Grier of the American Circular Loom Company, Chelsea, Mass., looked out for the interests of his company with almost more than his usual activity.

S. E. Doane of the Bryan-Marsh Company registered from Cleveland. Mrs. Doane was one of the ladies of the convention whose acquaintance was eagerly sought.

The Association of Incandescent Lamp Manufacturers of the United States did itself credit by placing its interests, as usual, in the hands of J. Robert Crouse, Jr.

E. R. Roberts of the Nernst Lamp Company, Pittsburg, was one of the most welcome at the convention. Mr. Roberts is much liked by electrical commercial men.

District Manager W. J. Parrish of the Denver office of the Burroughs Adding Machine Company gave a most interesting and practical exhibit, which illustrated the merits of his counting machines for electric-light station service.

Second Vice-president Louis A. Ferguson of the Chicago Edison Company came in the Chicago special to Denver, accompanied by Mrs. Ferguson. Mr. Ferguson was among the prominent delegates who fell victim to the caricatures of the Denver daily papers.

Superintendent J. C. McQuiston of the Westinghouse Companies' publishing department, is to be especially congratulated on his artistic and thoroughly scientific presentment of the Westinghouse display in the company's parlor at the Brown Palace.

C. A. Tupper, accompanied by Mrs. Tupper, was persevering in his efforts in the promotion of the interests of Manager Arthur Warren of the Allis-Chalmers and Bullock companies' publicity department. Mr. Tupper's parlor was one of the handsomest on the convention floor.

Thursday morning President George A. McKinlock of the Central Electric Company, Chicago, joined Mr. George D. Manson's party, and these two gentlemen, in company with Miss Manson, constituted a noble front on behalf of the Okonite and Central Electric interests.

Again it is a pleasure to make record of the indefatigable and successful efforts of Assistant Secretary Billings and her co-worker, Miss Douglas—two ladies who were in constant attendance at headquarters. There were no greater favorites among the delegates than these two.

Walter Cary is now general manager of the Sawyer-Man Electric Company of New York. [illegible] Sawyer-Man Company [illegible]

The American District Steam Company [illegible] agent H. C. Eddy of Chicago. Mr. [illegible] traveling representative [illegible] of the American District Steam Company; his home is the United States and his [illegible].

Manager A. L. [illegible] of the Western Electric Company [illegible] Chicago with the Burlington party. Mr. [illegible] is an ever-welcome guest at conventions, as is Mr. Rockafellow, New York [illegible] manager of the company, who likewise was on hand at Denver.

Max Harris, general sales manager of the Nernst Lamp Company, Pittsburg, was on hand. Nernst lamp sales have come rapidly to the front under Mr. Harris' skillful handling of the company's district offices and stores. Mr. Harris has received many deserved compliments on his splendid success.

Mr. and Mrs. Francis E. Donohoe of the American Electrical Works of Chicago were among the most welcome at Denver and Colorado Springs. Mr. and Mrs. Donohoe are enthusiastic golfers and Mrs. Donohoe particularly distinguished herself on the links of Chicago as "one of the finest in the West."

The India Rubber and Guttapercha Insulating Company was represented by Manager of Sales James B. Olson. Mr. Olson has represented Mr. Habirshaw for years, and this time, as usual, he "took in" the National Electric Light Convention. Mr. Olson came on with the New York delegation over the Pennsylvania.

Assistant General Manager George R. Carr of the Dearborn Drug and Chemical Works, Chicago, was "foxy." The Dearborn perfumes were found in the hands of practically every lady at the convention; this was Mr. Carr's subtle scheme of getting in his fine work with "the husbands" and "the brothers." It worked.

Secretary Johns of the Cleveland Electric Illuminating Company; C. H. Stannard, contract agent of the Denver Gas and Electric Company, and representative Ross B. Mateer, also of the latter company, distinguished themselves as "Apache Indians" during the attack on the ladies' gathering at the Country Club luncheon.

J. P. Maloy of Springfield, Ohio, made this announcement: "I am drumming for the Weinland tube cleaners of the Lagonda Manufacturing Company." Incidentally it may be stated that Mr. Maloy announces that his company has recently taken an order for 1,000 of the Weinland tube cleaners from the Babcock boiler company.

W. W. Merrill, manager of the Chicago Fuse Wire and Manufacturing Company, whenever seen at a convention is sure to say something worth listening to about the enclosed fuse manufactured by his company. Not long ago the Chicago Fuse Wire and Manufacturing Company removed to more satisfactory quarters on Randolph Street.

President Henry L. Doherty has been "it" many times before, but this time when Denver under his guidance had such a fine convention he literally eclipsed himself. Heretofore President Doherty, besides being a man of extraordinary executive ability, has often been referred to as a "prince," this time, though, he earned the title of "king of conventions."

Master of Transportation George F. Porter carried off the laurels for electrical special trains. His duplicate of the famous Pennsylvania Limited when running west to Denver, followed by the splendid train of the Burlington Route as arranged by F. E. Bell of the Burlington, with its prize diner from the St. Louis Exposition, broke all records, so to speak.

General Manager John Speer of the Speer Carbon Company of St. Marys, Pa., was one of the most welcome guests of the convention. Mr. Speer's party consisted of Mrs. Speer and Mrs. Miller, the latter lady from Westport, Pa., near St. Mary's. The Speer party availed themselves of all the opportunities presented during the entire six days' stay in the West.

Frank C. Farrar of the advertising department of the Denver Gas and Electric Company, good-humored, quick-witted and obliging, placed many of the visitors under obligation by his courteous attention to their wants. He was always "Johnny on the spot," pleased at the opportunity of extending his assistance. He is of the stuff of which the Denver "boosters" are made.

The Federal Sign Company of Chicago, through the efforts of Manager Gilchrist, displayed an immense amount of energy by its advertising of Federal signs. The signs "N. E. L. A.," which appeared on the back of the two specials and were electrically illuminated as the trains started and passed through the country from Chicago, were made up of Federal sign letters. The Federal [illegible]

[illegible]

[illegible]

[illegible]

[illegible] interests.

Among the [illegible] mentioned Mr. J. H. [illegible] and Mrs. Hoyt Post. Mr. L[illegible] of the Detroit office of the General Electric Company, while Mrs. H[illegible] of Mr. and Mrs. Hoyt Post of the Peninsular Electric Company of Detroit, accompanied them. Rumor has it that Mr. Livsey is now an enthusiastic automobilist.

A gentleman that distinguished himself as an entertainer among the "gentlemen of Denver" was N. Miner, expert [illegible] the Denver Gas and Electric Company. It is not necessary to state that Mr. Miner proved himself "a prince of entertainers." [illegible] work in Denver as an illuminating engineer has already made for him a record that is highly appreciated by his company.

The Stanley Instrument Company's exhibit was in charge of F. J. Alderson. There was exhibited in the company's parlor at the Brown Palace the company's latest type of meter, known as the "rotated jewel meter." This instrument, however, must be seen in all its details to be appreciated. The representatives of the company attending in addition to Mr. Alderson were S. O. Ochs of Boston and F. C. R. Spence of Denver.

The Electric Storage Battery Company of Philadelphia was represented very effectively by G. H. Atkin, manager of its Chicago office. Owing to the heavy nature of Mr. Atkin's product, no effort was made at an exhibit. Mr. Atkin was accompanied by the St. Louis agent, Theodore B. Entz, and these gentlemen were in constant attendance throughout the whole period of the convention at both Denevr and Colorado Springs.

Homer E. Niesz, assistant to Second Vice-president Ferguson of the Chicago Edison Company, accompanied by Mrs. Niesz, was [illegible] welcome guests on the Chicago special to Denver. Mr. Niesz is one of the best-liked representatives of the central-station interests, but this time Mrs. Niesz' popularity, especially at the reception and dance Tuesday night and at Colorado Springs, reduced him decidedly to the second place.

Two hard-working electrical experts on the Burlington special from Chicago deserve special mention. A. J. Saxe and Fred McGary were in charge of the train lighting of the two specials that passed over the C., B. and Q. railway. All that is necessary to say is that the service given indicated that the Burlington company knew its business in putting two such experienced engineers in charge; there was not the slightest hitch in the lighting.

Frank H. Gale, advertising manager of the General Electric Company, was on hand. Since Mr. Gale's assumption of the duties of his new position with the General Electric Company he has won for himself many new friends among newspaper men through his courtesy and fair treatment of the "boys who have to hustle." The General Electric Company this time made no exhibit, but entertained royally in parlors at the Brown Palace Hotel.

Sales Manager A. C. Savidge of the Switchboard Equipment Company of Pittsburg presented a line of beautiful switchboard instruments. One of these devices excited particular interest. It was a 35-ampere, 250-volt [illegible] a circuit breaker on one side of the line and a switch with fuse on the other side, giving true inverse time-element protection. Mr. Savidge also presented a number of bulletins showing a full line of his specialties.

Among the great variety of social entertainments the golfers were especially interested in the golf tournament at Colorado Springs on Friday, June 9th. President [illegible] offered [illegible]

handsome silver cups—one for ladies and one for gentlemen. The grounds were those of the Town and Gown Golf Club, and the course was over 18 holes. The prize for the ladies went to Mrs. Percy Ingalls of Arlington, N. J., and that for the gentlemen to Mr. Louis A. Ferguson of Chicago.

W. W. Low, president of the Electric Appliance Company, came on from Chicago on the Burlington special, accompanied by his wife. Mr. and Mrs. Low were leaders in the gay set, attending every social function. Their evident enjoyment was ever an inspiration to the friends that accompanied them. The Electric Appliance Company has recently built a new store and warehouse in Chicago that is one of the largest of its kind in the world.

Western Manager Haughton of the Chicago office of the Bryan-Marsh Company came out to the convention, accompanied by his wife, in the private car belonging to a prominent official of the Chicago Northwestern railway. Mrs. Haughton was one of the belles of the opening reception ball and at the other functions. The Bryan-Marsh Company made no exhibit, but Manager Haughton was untiring in keeping the Bryan-Marsh lamps before the electric-light men.

Too much praise cannot be given Eastern Passenger Agent Harry E. Heller of the Philadelphia office of the Burlington road for his interest and aid to Master of Transportation Porter in the handling of the splendid duplicate of the "Pennsylvania Limited," which was afterward pulled ahead of the Chicago Burlington special train from Chicago to Denver. Mr. Heller is a typical Burlington man, and, like his associates, Messrs. Bell, Puhl and Whitehead, "knows the business" from A to Z.

The Duncan Electric Manufacturing Company, under the skillful management of its representative, William H. Sinks, made a very interesting exhibit of the Duncan direct-current wattmeters. The up-to-date feature of these meters is the ease with which the different working parts of the meter can be inspected while in operation. This makes an ideal meter for the central-station man. Mr. Sinks reports that the Duncan factory at Lafayette, Ind., is being constantly increased in size to meet the enormous demand for this instrument.

The "Reflectric" sign was so prominent to the right of the elevator on the floor of the convention hall at Denver that many of the delegates were exceedingly complimentary to the enterprise of the Western Display Company of St. Paul. The peculiarity of this sign, as claimed by the company, is that owing to the fact that the lights themselves are screened from the eye and the sign seen only by its reflected light, it may be read at a greater distance and makes a more handsome appearance both night and day "than any other electric sign in the world."

The Wagner Electric Manufacturing Company was thoroughly well represented by Chicago Manager George B. Foster and Assistant Sales Manager V. W. Bergenthal and S. Percy Cole, the latter gentleman from St. Louis. An exhibit was made of single-phase motors, constant-speed, variable-speed and reversible motors for elevators, cranes, hoists, etc. Polyphase motors were also shown of the squirrel-cage and external-resistance types. In addition to all of these Wagner transformers were presented, also a number of alternating-current and direct-current Wagner instruments.

W. S. Crosby, one of the hosts who was untiring in his efforts to entertain the electrical visitors to Colorado Springs, joined the Rio Grande special from Denver to the Springs en route. Mr. Crosby was on hand daily, looking to the pleasure of the visitors, and took many parties to South Cheyenne Canyon, which is one of the greatest scenic attractions at the Springs. South Cheyenne Canyon is within easy driving distance of the Antlers, and its magnificent scenery was appreciated by every visitor. Mr. Crosby made many friends among the electrical fraternity who will not forget his hospitality.

The Simplex Electric Heating Company of Cambridgeport, Mass., came to the front in the persons of James I. Ayer and C. W. Richards. Without attempting to enumerate the room full of heating specials placed on exhibition by this company, it is safe to say that there was not an electrical heating device known to electrical people that was not there for inspection. The Simplex Heating Company has secured for itself a line of patronage on its heating apparatus second to none in the United States, having been engaged in the electric heating business long before it began its present rapid progress.

Nowadays no electrical convention, whether electric-light or telephonic in its nature, is ever complete without the presence of the general manager of the American Conduit Company of Chicago, A. L. Waterbury. Mr. Waterbury was kept busy meeting his host of friends from the middle West. The American Conduit Company's electrolysis-proof bituminized fiber conduit is meeting with much favor with the electric-lighting people of the United States since the dangers due to electrolysis have been found to be important. Mr. Waterbury reports a fine business during the last six months for his company.

Messrs. Puhl and Whitehead of the Burlington staff, who were in charge of the Chicago special, did honor to their chief, F. E. Bell, Chicago city passenger agent of the Burlington Route. Mr. Bell could not have made a better selection in the placing of these two courteous gentlemen on board the Chicago special to Denver as his personal representatives. Burlington men keep their promises, and Messrs. Bell, Puhl and Whitehead, to say nothing of Mr. Ream, Mr. Eustis' right-hand man at headquarters in Chicago, proved themselves individually and collectively shining examples of the truth of the above statement.

Third Vice-president and Western Manager Martin Insull of the Stanley-G. I. Electric Manufacturing Company's Chicago office arrived Wednesday and was accompanied by St. Louis Sales Engineer Thomas F. Clohesey. Mr. Insull made no attempt at an exhibit. It has now been only a few months since Mr. Insull came on from the East to assume command of the Stanley-G. I. company and already the increased business of the combined companies stands as evidence of the effectiveness of the plans laid by Mr. Insull for extending the already large business which the companies had acquired under their individual names.

Under the management of General Sales Manager J. W. Gillette the National Battery Company of Buffalo made a hit by its fine storage-battery exhibit at Denver. As an illustration of the nature of the company's product three large type X National batteries complete were shown on the floor. There were presented also for inspection a number of National Unit accumulator plates of different sizes and capacities. The National Battery Company earned the distinction of being the only exhibitor of storage batteries at the Denver convention. The car Lumen of the Burlington Chicago special was lighted by the National Battery Company.

Chicago Manager Julian Roe of the Crocker-Wheeler Company was one of the first men to be seen at the Brown Palace on the arrival of the Chicago delegation. Mr. Roe has made an enviable reputation for himself in the West as an enterprising and thoroughly reliable and very aggressive electric-light and power sales manager. As one of his friends put it, Roe "delivers all the goods." Mr. Roe in conjunction with the Denver office of the Crocker-Wheeler Company sent out an invitation to visitors to make themselves at home at the offices of the Crocker-Wheeler Company on Seventeenth Street, Denver, and was persistent in his efforts to entertain the company's friends.

The National Carbon Company of Cleveland was out in full force. Manager of Sales N. C. Cotabish, accompanied by Mrs. Cotabish, came on from Cleveland and made the trip with the Chicago train to Denver. Accompanying Mr. and Mrs. Cotabish was Assistant Sales Manager J. F. Kerlin. At the convention the above-mentioned party was joined by the following-named representatives of the company: Secretary J. S. Crider, F. H. Murray, F. J. Kysela, A. E. Carrier, F. C. Park, and last but not least, C. W. Wilkins the "Chesterfieldian master of carbonaceous products." Particular friends of the National company were presented with a handsome souvenir, an electric flash pocket lamp.

About 600 of those attending the convention—including nearly all from the East—went on to Colorado Springs, where Mr. George B. Tripp and his associates of the Colorado Springs Electric Company and many of the citizens of that enterprising city united to entertain them. The various sight-seeing tours were carefully planned and successfully carried out, and the visitors could not find words strong enough to express their admiration for what they saw at Pike's Peak, Manitou, the Garden of the Gods, Glen Eyrie, the Broadmoor Casino and the various canyons; also during the wonderful ride to Cripple Creek and at other places. The train to Cripple Creek on June 10th was run in three sections. It and the other sight-seeing tours were tendered with the compliments of the generous and warm-hearted people of Colorado Springs.

The General Electric Company made no special exhibit, but, as usual, had its "army" on hand, as follows: General Irving Hale, manager, Denver office; G. A. Woolley, supply manager, Denver office; H. C. Glaze, sales department, Denver office; C. B. Mahaffey, engineer, Denver office; J. V. Swanson, construction department, Denver office; Robert Tait, auditor, Denver office; E. E. Gilbert, lighting department, Schenectady; A. D. Babson, supply manager, New York; M. D. Grosh, Salt Lake City; O. E. Turner, Dallas, Texas; J. Scribner, lighting department, Chicago; W. F. Smith, Minneapolis; J. H. Livsey, Detroit; P. D. Wagoner, Schenectady; H. W. Hillman, Schenectady; F. G. Vaughn, Schenectady; H. J. Buddy, Philadelphia; F. H. Gale, advertising department, Schenectady; F. W. Wilcox, incandescent lamp department, Harrison, N. J.; C. B. Burleigh, Boston; H. C. Houck, Cincinnati. Manager Jesse Scribner of the electric-lighting department of the Chicago branch of the General Electric Company, as usual, personally represented General Manager B. E. Sunny of the western office. Mr. Scribner brought with him quite a party that filled a goodly portion of the car of the Chicago special.

President B. F. Vreeland of the Western Lumber and Pole Company, assisted by Mrs. Vreeland, was one of the Denver hosts to the visiting delegates. The Western Lumber and Pole Company has yards in Idaho, Montana, Michigan and Wisconsin. Mr. Vreeland reports at the present time a most satisfactory business. He states that the present season sees the company literally loaded with orders and daily shipping to nearly every state in the Union. Some exceedingly large orders have come in recently which put him in a decidedly pleasant frame of mind with which to attend the convention. He reports a fine demand for poles from the Southwest and even from Mexico. The company distributed a very handsome celluloid-covered notebook.

John Craig Hammond was one of the busiest men at the convention. He is a clever advertising expert and at the head of the Hammond Advertising Company, which handles the advertising of the Denver Gas and Electric Company and other central-station companies. A few years ago Mr. Hammond was a young newspaper reporter in Chicago, but later he removed to Denver, where he has made a great success. He is president of the Press Club, a member of the Chamber of Commerce, chairman of the executive committee of the Ad Club, and interested in several business enterprises in Denver and New York. Mr. Hammond is a bright fellow, with a resourceful mind, an aptitude for hard work and the quality of attracting all men to him as friends. Mrs. Hammond—a charming woman—is a fit helpmate and graciously assisted the visiting ladies in enjoying the sights of Denver.

When I. A. Bennett appears at a convention Osburn flexible conduit "do move." Mr. Bennett was literally an advertising emporium. Stick pins, buttons, pencils, red, white and blue silk ribbons and a number of other ingenious advertising "eye catchers" emanated from Bennett and told the story not only of the many merits of Osburn flexible conduit but did most excellent work for the Marion Insulated Wire and Rubber Company, the Reynolds Electric Company, the Uehling-Decker Company and the Benjamin Electric Manufacturing Company. Incidentally it may be said that President Benjamin of the Benjamin Electric Manufacturing Company was on hand and co-operated with Mr. Bennett on behalf of Benjamin arc burst clusters. Mr. Bennett's magazine for distribution to local central stations excited interest on the part of visiting delegates. One of the most welcome visitors at the Bennet exhibit was Bennet, Jr.

Among the electrical men at the Denver convention who distinguished themselves for originality and aggressiveness in presenting the interests of their companies was General Sales Agent Charles G. Burton of the National Electric Company of Milwaukee. Mr. Burton operated in conjunction with the Hendrie & Bolthoff Company, Denver, in presenting the National Electric Company's display. Mr. Burton was given every license by President John I. Beggs of the National Electric Company to put his company well to the fore. Among other things Mr. Burton exhibited large photographs showing the immense alternating and direct-current machines now being turned out by the National Electric Company. He also presented to friends of the company the National watch fob. No better evidence of Mr. Burton's work can be given than to state that the Denver Times picked out his exhibit and advertising methods for special mention in one of its convention issues.

Sales Manager John W. Brooks of Pass & Seymour, porcelain manufacturers of Solvay, N. Y., arrived in Chicago Friday of last week, and in company with his western manager, Julian Jackson, was at the train "speeding the parting" of their host of friends, who left Chicago for Denver on the two electric-light specials. Mr. Brooks came west alone on the Chicago special and was in constant attendance throughout the Denver gathering. Pressure of business in the East, however, necessitated his leaving without availing himself of the social features that were so hospitably offered by Colorado Springs. It is believed that the increase in the Pass & Seymour factory is largely due to the broad-gauge policy so energetically and aggressively pursued by Sales Manager Brooks. Mr. Brooks was appointed to his position several years ago by General Manager Salsbury. He was chosen by Mr. Salsbury for his present position through his record-breaking work as local sales manager at the Chicago office.

One of the most welcome visitors at the Denver convention was President C. Edward Browne of the American Electrical Supply Company of Chicago. Mr. Browne took the occasion to become a member of the National Electric Light Associa-

tion and proved himself a thoroughly "good fellow." Mr. Browne was accompanied by Mrs. Browne, and judging from the number of friends made by "the Brownes," it is safe to say the American Electrical Supply Company will never be represented at any other electrical convention unless Mrs. Browne has a place on it [illegible]. Mr. Browne thoroughly advertised his company by the distribution of grip tags, but his smile and "glad hand" put the tag in the shade, so to speak. The American Electrical Supply Company has recently forged rapidly to the front through the energetic efforts of Messrs. Browne and Phillips. At the present time it has some of the most substantial agencies in the United States. Within a few weeks the American company has added to its already long list the agency for Fostoria lamps.

The Fort Wayne Electric Works of Fort Wayne, Ind., presented one of the novelties of the convention. The Wood prepayment wattmeters excited much interest on the part of central-station men confronted with the problems which confront every central-station man and have such a tremendous bearing upon his dividends. As explained by Factory Manager J. J. Wood, who was in attendance, the Wood prepayment wattmeter applies particularly as a preventive to consumers whose credit has been found to be bad; consumers who are chronic faultfinders; consumers who are not able financially to make the required deposit; consumers employing electric signs for advertising purposes; consumers operating automobile charging stations, etc. A pamphlet entitled "Notes on Prepayment Wattmeters" will be sent upon application. The Fort Wayne company was out in force. Sales Manager and Treasurer F. S. Hunting was in command, seconded by Assistant Sales Manager A. A. Serva, Factory Manager J. J. Wood, Chicago Manager Walter S. Goll and A. A. Searls, manager of the Grand Rapids (Mich.) office.

The Phelps Company of Detroit, Mich., was on hand, as usual, with a very attractive exhibit of Hylo turn-down lamps and self-flashing sign specialties. Three styles of Hylo lamps were shown, namely, the original Hylo, which is still very popular; the pull-string, especially designed for short ladies and high fixtures, and the long-distance, or lazy man's lamp, which has a switch at the end of a cord of any desired length. Two years ago, at the National Electric Light convention in Chicago, the Phelps Company exhibited its first self-flashing Hylos, having an automatic device within the base, which alternately lights the large and the baby filament, producing a novel flashing effect. Since then it has brought out the self-flashing socket plug or "Skeedoodle" which lights a common lamp and puts it out, lightning-bug fashion. The company also makes a very attractive Wynk sign frame for merchants' daily announcements. This is equipped with two-candlepower lamps and has a flasher attached, which puts the lamps out and lights them in unison. They are made in three styles. A recent novelty is a large turnip-shaped lamp, decorated with any name or legend. This is done by a new process and is very beautiful and durable. Each lamp has a "Skeedoodle" of its own, and flashes out and on continually. The display was made up of these various lamps and devices, and a variety of signs and transparencies, illustrating their use. Hanging on the walls the visitor saw the official certificates of highest award from the Louisiana Purchase Exposition for turn-down lamps, self-flashing sign lamps and self-flashing socket plugs. The Hylo cigarette was a very unique souvenir. It was generally conceded, however, that the quality of the talk was much better than the smoke. The company was represented by President W. E. Phelps, Secretary J. Wiley Phelps and S. J. Dutch, Denver representative.

The Allis-Chalmers Company made preparations to be well represented at the convention. A number of prominent officers and heads of departments for whom reservations had been made at the Brown Palace and Savoy hotels found themselves unable to attend, but 11 delegates from the company were present during the entire session. The list is as follows: O. A. Stranahan, manager power department, Milwaukee; M. C. Miller, executive department, Milwaukee; C. A. Tupper, publicity department, Milwaukee; J. R. Jeffrey, assistant secretary, Bullock Electric Manufacturing Company, Cincinnati, Ohio; David Hall, assistant chief electrical engineer, Cincinnati; Louis E. Bogen, engineer, electrical department, Cincinnati; George H. Berg, district manager, Boston; George B. Foster, district manager, Chicago; R. B. McConney, district manager, Denver; H. L. Woolfenden, electrical department, district office, Denver; R. J. Glendenning, assistant district manager, Salt Lake, Utah. A large reception room in the immediate vicinity of the convention hall was elaborately furnished and carpeted with costly Navajo rugs. The walls were hung with framed photographs representing Bullock electrical apparatus and leading installations, and bulletins elaborating on these themes covered two large tables. The new Allis-Chalmers binders, which are so arranged as to permit the bulletins inserted to lie perfectly flat when opened [illegible] attention, and many of [illegible] the binder furnished [illegible] dress [illegible] hotel to take guests to the [illegible] Gas and Electric Company, where [illegible] Chalmers and Bullock apparatus [illegible] said to be the largest [illegible] between the Missouri River and the Pacific Coast. Altogether the Allis-Chalmers Company [illegible] on to feel gratified with the [illegible] produced as one of the leading [illegible] in the electrical field, and it will doubtless receive its full benefit from the convention. [illegible] lavishly distributed, with straps for converting them into watch fobs, were much sought by the delegates, and will serve to hold in memory the impression made by the Allis-Chalmers Company.

Of particular interest to central-station men at the convention was the work that is going on in Denver to educate the consumer and the possible consumer of electric current. Probably no city in the country has more to teach of method and persistency in the work of marketing the commodity which central-station men have to sell. It followed that on Wednesday evening, when Mr. Ingalls' paper, "Advertising Methods," was read, the exhibits made in the convention hall of "business-getting" literature put out by several large lighting companies attracted deserved attention. Of these, one of the most striking, both in point of originality and apparent effectiveness, was that of the advertising department of the Denver Gas and Electric Company. This department of the local lighting company's business is in charge of the Hammond Advertising Company, of which John Craig Hammond is the moving spirit, which originates special and striking advertising literature. One feature of the Denver company's exhibit was a series of handsome posters distributed as premiums to purchasers of gas and electric-heating and cooking devices. Another showed clever newspaper cartoons, the point being to show the advantages of gas and electric current as compared with coal, wood and oil for domestic purposes. Still another comprised a number of street-car advertisements. Each appeared to be a portion of the first page of a daily paper whose headlines and cartoons were made to apply in a happy manner to the instruction of users of light and heat. There were, besides, various circulars and advertising novelties; menu cards of meals to be prepared with gas ranges and electric ovens; photographs of electric signs exemplifying the motto, "Talk with Light"—in short, the whole formed a display of undoubted value for the benefit of the vendors of light, heat and power, who wish to learn how, by the use of publicity, to increase the market for their output. There were other exhibits, also of much interest, made by the New York Edison Company, Boston Edison Company, United Electric Light Company of Baltimore, Washington Electric and Railway Company, Washington, D. C., Philadelphia Electric Company, Detroit Edison Company and the Public Service Corporation of New Jersey. These were collected and arranged by T. C. Martin of New York.

The exhibit of the Westinghouse Companies, which adjoined the convention hall in the hotel, was unusually attractive on account of the handsome decorations, which were typical of the West. The Westinghouse companies made an excellent exhibit of apparatus. The display consisted of a full line of incandescent and arc lamps, lightning arresters, meters, transformers, circuit breakers, small motors, etc. The headquarters were in a room near by. Here refreshments were served to the friends of the companies and a complete line of the literature descriptive of the apparatus distributed. The interior of the Brown Palace Hotel, being open from the roof to the lobby and surrounded by circuitous balconies, made it possible to suspend from the center of the ceiling a "stringer" display sign spelling from top to bottom the name of the company. This sign was 100 feet long and extended to within 20 feet of the ground floor. The Nernst company had on exhibition a full line of its lamps at the Hotel Savoy. E. R. Roberts of its Pittsburg office was in charge. The Westinghouse delegation consisted of the following-named persons from the Westinghouse Electric and Manufacturing Company: C. S. Cook, manager of the railway and lighting department; C. B. Humphrey, manager of detail and supply department; G. B. Griffin, of the same department; H. P. Davis, assistant chief engineer; W. C. Webster assistant to the second vice-president; Mr. Whipple, general lamp agent; P. N. Jones, manager of Pittsburg district office; L. M. Cargo, manager of Denver district office; C. E. Skinner, Paul McGahan, K. C. Randal and Clarence Renshaw, engineers; Mr. Chase of the New York sales office; W. R. Pinckard of the Chicago district office; Mr. McPherson of the Baltimore office; H. S. Sands, E. C. Means and B. S. Manuel of the Denver district office; from the Saw-R. D. Marthens, manager Denver office; from the Nernst Lamp Company, Max Harris, sales manager; S. Solomon, Pittsburg manager; E. R. Roberts of the Pittsburg office. The Westinghouse [illegible]

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## The Tantalum Incandescent Lamp.[1]

By [illegible]

[illegible] 80 per cent. of their initial candlepower, and were both burning [illegible] went on burning.

These two lamps ran 800 hours of their life at a mean horizontal candlepower of [illegible] 2.05 watts per candle, thus giving 16,000 candle-hours of useful life at this extremely high efficiency. On a rating of two watts per candle, average, the lamps were good for 600 hours, giving over 12,000 candle-hours. On a rating of 1,000 hours, they gave nearly 19,000 candle-hours at a mean energy consumption of [illegible] mean horizontal candle. The circuit on which the run was made was on the average [illegible] the rated 110 volts, although the pressure varied somewhat irregularly, perhaps a couple of volts on each side of this figure.

The light of the tantalum lamp is, as might be expected from its high efficiency, rather whiter than that of an ordinary incandescent, being as white as the Nernst lamp or the acetylene flame. Its distribution of light is, in the present form of filament, rather less uniform than that of the common incandescent, being relatively more powerful in a horizontal zone and less powerful for points near the axis. The ratio of mean spherical to mean horizontal candlepower, as found in Professor Kennelly's investigation of the frosted lamps, proved to be 0.73, and the writer's figure from the clear lamps was substantially the same. The distribution, however, could very easily be improved, so that the spherical reduction factor would not differ materially from the usual figures, and the light at the top could be correspondingly increased.

Since the tantalum filament has a low initial resistance (between 55 and 60 ohms), it jumps into incandescence with startling rapidity as compared with a carbon filament, but, because of its positive temperature coefficient, it seems to be decidedly less sensitive to changes of voltage in its working condition. This is a useful property in certain respects. The fact, however, that the initial resistance of the tantalum lamp is so low and its thermal inertia so small, owing to its small mass and low specific heat, means rather violent heating up, which is probably the cause of some doubts which have been expressed as to the endurance of these lamps upon alternating circuits. It is not difficult to imagine pretty severe strains upon the filament, if it had time to cool down much between impulses. If such cooling could take place, for instance, on an ordinary alternating circuit, the results might be serious.

Some stroboscopic tests were therefore made at the last moment to determine whether, at say 25, there was a specially violent fluctuation of light from the tantalum lamp; in other words, to find out whether on a 25 current the filament had time to cool down materially. The result showed that the light fluctuation at this frequency was somewhat but not much more pronounced than in a carbon filament. The tantalum lamp behaved in fact about like a 10-candlepower carbon-filament lamp. Even a 75-candlepower carbon-filament lamp, however, shows perceptible variation under this test. At 60, the fluctuation, while still perceptible, was trivial, both in the tantalum and carbon lamps. It hardly seems probable that at 60 the life of the tantalum would be enough impaired to cause serious trouble, but the writer now has some lamps on alternating-current tests, and proposes to pursue the inquiry.

The tantalum filament seems to stretch and sag at first as if undergoing annealing, and losing the set produced by drawing. Then it shows local bright spots, which grow lumpy, as if the material tended to flow a little from the heat, and with the increasing lumpiness the filament draws up tight. At this stage it is rather fragile, and would probably break easily from vibration or shock. It seems likely that the final break comes just where

1. Paper read before the Denver-Colorado Springs Convention of the National Electric Light Association on June 6, 1905.

one of the lumps has reduced the cross-section of the wire beside it. The break in the lamp during test, already referred to, showed considerable attenuation of the loose end.

The lamps as tested showed the following characteristics:

| Lamp. | Watts | Candle-power. | Watts Per Candle power. |
|---|---|---|---|
| Clear globes | 41.58 | 21.42 | 1.94 |
| | 36.61 | 20.09 | 1.84 |
| | 41.58 | 24.93 | 1.66 |
| | 41.58 | 21.55 | 1.93 |
| | 41.91 | 21.81 | 1.92 |
| | 41.91 | 22.59 | 1.85 |
| Frosted globes | 40.36 | 19.79 | 2.03 |
| | 40.04 | 18.54 | 2.15 |
| | 40.04 | 18.74 | 2.13 |
| | 40.48 | 19.27 | 2.09 |

The mean result from the clear globes was 22.2 candlepower at 1.85 watts per candlepower, that from the frosted globes 19.08 candlepower at 2.1 watts per candlepower.

It is interesting to note that the clear lamp gives just about one candlepower per inch of incandescent filament, which implies an intrinsic brilliancy of somewhere about 500 candlepower per square inch of filament—a figure much higher than in the ordinary incandescent lamp.

As illuminants, the lamps are certainly excellent, but their introduction raises some most interesting questions for the central-station operator.

Putting aside all the petty questions that will be raised about the new lamps for commercial reasons, the broad fact remains that we are here dealing with a bona-fide two-watt lamp, having a life fairly comparable with the carbon-filament lamps now customarily in use. Moreover, it is a competitor of these, socket by socket, and not as a substitute with particular requirements, as in the case of the Nernst lamp or the very small arcs. There is some doubt as to the life of the tantalum lamp when exposed to unusual vibration, which may perhaps bar it in some special locations, but for the everyday work of the central station there is good reason to believe it generally applicable.

Its price can hardly be said to be fixed in this country, but abroad, in Berlin, it is about $1, which will give at least a fair line on its commercial results. On this basis and with current at 10 cents per kilowatt-hour, one finds, taking the new lamp on its 600-hour rating, that the cost of its 12,000 candle-hours, including the lamp, amounts to $3.40. The same number of candle-hours from a lamp giving a mean efficiency of 3.25 watts per candle would cost $3.90, exclusive of lamps, i. e., the consumer could afford to pay $1 for the new lamp better than to take the old ones free. With current as low as five cents per kilowatt-hour, the user of tantalum lamps could only afford to pay 75 cents per lamp, as against getting carbon lamps free. That means that a sliding scale of discounts for lamps according to quantity could be made to catch the consumer at all prices ordinarily charged for current by central stations. Does this mean that the carbon lamp will shortly be down and out? Probably not, for there is no spur like competition to start up improvements, and there are some signs that carbon lamps may be improved enough in efficiency to make things interesting, at least with current at the prices charged to very large consumers. This, however, remains to be seen, and the thing which the central-station man has to meet is the immediate probability of consumers putting upon their circuits lamps taking less than two-thirds the energy per candlepower of the best lamps now in use, and thereby cutting down their meter bills enormously.

Now, broadly, what shall be the attitude of the central-station man toward this income-scalping innovation? There are some managers who may be inclined to put up a fight to discourage the user, either by raising pettifogging objections, or by trying to discriminate against two-watt lamps by readjusting discounts in various ingenious ways. The writer is very strongly of the opinion that such a policy is wrong and will certainly lead to ultimate disaster in the form of municipal restrictions or regulation of rates by law. In the long run, opposition to improvements does not pay. If, on the other hand, the central-station man hangs quietly on and gives the consumer the "glad hand," the change will work to his ultimate benefit. In the first place, the tantalum lamps now made are of 22 candlepower, instead of 16, and the filament will hardly bear much reduction in cross-section. The tendency, therefore, will be to use these slightly more powerful lamps, taking, say 42 watts, instead of a trifle over 40 watts in the 16-candlepower carbon lamps. The actual loss in energy sold is likely, therefore, to be for the present quite a little less than the difference of efficiency would indicate.

Besides this, the attraction of cheaper light will certainly bring into line new consumers, so that the net result will probably be an actual increase in sales of current, quite a little of it being along the smaller consumers who pay the higher rates. Such a change means, upon the whole, more lights connected per unit of capacity in transformers or feeders, and hence a slightly better utilization of material, and improved load. In the case of stations with underground service the change to two-watt lamps ought to bring with it increased earnings per unit of cable capacity. The fact is that improvements in the efficiency of utilization of electric energy helps the business, and it is both fruitless and inadvisable to oppose them for any short-sighted notion of small temporary savings.

I have here said nothing regarding the inevitable competition between present lamps and the newcomer. In the first place, the merits of the final issue remain to be determined, and, in the second place, competition in lamps is on the whole a good thing for the user of them, however it turns out. So far as the central station is concerned, it is a case of "dog eat dog."

The really important thing is that from now on the station manager will have to deal directly with the two-watt-lamp proposition, for there is no disguising the fact that it is here, and in a form which is quite unexpected. The appearance of tantalum lamps in quantity may be a little delayed in this country, but delay will improve them, as in the case of every new product, and will serve to assure a better understanding of their truly remarkable properties and of their possible limitations. The unexpected has certainly happened, for most engineers had long ago abandoned the idea of a lamp with a metallic filament. Only the discovery of a metal virtually new, and possessed of most sensational qualities, could have brought about the present striking result.

### Discussion.

Arthur Williams, New York: I think, Mr. President, the life of the tantalum lamp has been too limited to enable us to have had any commercial experience with it. We have had a number on test, and these tests and reports of other tests promise, I think, a very marked improvement in the economy of incandescent lamps in the future. I am of the opinion that it makes very little difference to the consumer whether he buys part of his light in current and part in lamps, or all in current, and that with this lamp, owing to the present high price, $1 in Germany, and perhaps $1.50 or $2 here, at present it will not be a serious competitor with the incandescent lamp as we now know it. As an illuminant it is certainly very interesting, and promises well for the future; but as there probably have not been more than 100 of these lamps in this country, and they have not been here long enough to be subjected to any kind of commercial tests, I do not think it would be practicable to discuss the lamp in any commercial sense. I do not think, because of the high price at which the lamp is obtainable, that it will be immediately a competitor with the ordinary incandescent lamp, because a high lamp cost will make up, in the economy of the lamp, compared with the standard we now have.

John F. Gilchrist, Chicago: The bringing out of this lamp raises a question which has been in the minds of some of the central-station men for some little time, and that is a question of selling electricity for illuminating purposes, particularly incandescent lighting, on the lamp-hour basis instead of on the kilowatt-hour basis. It can be readily seen that, should it seem wise to push this lamp hard, the first thing that the central-station man is liable to consider if he is selling current on the kilowatt-hour basis, is that it is going to cut down his income and consequently, while he may agree with Mr. Martin that it is unwise to attack anything which has merit, he may want to hold it back until he can build up his business to meet it and not impair his income too much. In the legislative action which semes to have taken the form of a wave throughout the country, the talk seems to be entirely along the lines of the kilowatt-hour, and it has occurred to me whether it is not a wise proposition for this association and the electric-light men to try to guide that legislation along the basis of charging on a flat-hour basis, so that any new lamp of this type can be put out by the central-station men with an advantage to themselves, which they can give to their customers in such degree as they see fit.

A. C. Dunham, Hartford, Conn.: I have experimented with the tantalum lamps, and I find that the tests given in this paper are practically correct. They burn a long time after the filament breaks, and it has occurred to me that the history of the osmium lamp is a curious history. They could not find osmium enough so as to make a large quantity of the lamps, and they adopted this system—putting the lamps on central stations and charging 20 cents a month rent. They pay the central station for the power consumed for the osmium lamp at the same rate as for the carbon lamp. They return the lamp and make it over into a new lamp, and the osmium lamp goes on indefinitely. There is small wasteage. I think we must find some way to get over the sudden drop, if it is sudden, on the tantalum lamp.

Dudley Farrand, Newark, N. J.: We have had two of the tantalum lamps. The first showed an efficiency of 1.99, which is better than that mentioned by Dr. Bell. That lamp, however, lasted only some 20-odd hours, a little over a day. The second lamp is still burning, and showed an efficiency of 1.68. I do not know how long that will burn. The commercial efficiency is a matter which will have to be determined. The theoretical efficiency amounts to very little. Mr. Gilchrist touched on the question of cutting down the revenue of the central station by using a high-efficiency lamp. My own opinion on that subject is that it is not going to work against the company's interest a bit. Every time you double your efficiency in the lamp you double the plant's capacity, and while the higher efficiency may tend to increase the distribution expense, the net result will all be in favor of the high-efficiency lamp. I am heartily in favor of it, and only wish we could get them in sufficient quantity to supply our business today. It will not upset all your commercial calculations. Your business will increase upon the general announcement of this lamp coming into use faster than you can get the lamps to put them into use.

W. H. Gardner, Jr., Boston: As I remember the figures, the introduction of the tantalum lamp will show a loss of current consumption, owing to the size of the lamp, of only about 20 per cent. The gain in individual candlepower per lamp, I think, will be advantageous, because the 16-candlepower lamp was introduced at a time when other illuminants, for instance gas, were of a lower candlepower than at present, and before the extended introduction of incandescent gas lighting. Therefore, the unit of illumination of the tantalum lamp shows up approximately on the same basis as its competitors. Today we have 25-candlepower gas in a great many places, and we also have the incandescent gas lighting, which is very much more brilliant. Consequently, if one lights a 16-candlepower lamp, it is very usual that one has to light two of them, in order to get the same illuminating effect. Therefore, I should say that we should welcome this increase in the size of the lamp, even if accompanied with a slight decrease in current output. That is only about 20 per cent. I will add, in this connection, that the gas industry had a very much larger decrease to face. They had formerly, with their gas at 25 candlepower, consumed five feet to the burner per hour, but when the incandescent lamp came in the consumption went down to three feet, and the candlepower went up to 50. That was very much greater difference, a greater drop, and some gas managers were not very quick to recognize the point, but I think it is now very generally accepted that it is to the advantage of the gas manager to use the incandescent gas mantle over the open flame, in spite of the shrinkage in consumption of 40 or 50 per cent. I think we should welcome the tantalum lamp.

## Municipal Ownership.[1]

By Arthur Williams.

The craze for municipal ownership will undoubtedly continue for a time, and even gain some headway. It threatens to replace the populistic movement of some years ago, and the later free-silver theories of one of our great national parties. The advocates of municipal ownership promise to accomplish, through that medium, what was formerly promised through the others—and here, for the time being at least, there may be more assurance of immediate success in carrying their ideas into the different political platforms. And there may be greater chance of ultimate success because of the greater complexity of the subject and the kind of misinformation that is now being broadly circulated over the entire country. It is natural that municipalities, after making large investment in these enterprises, should seek to justify what they have done. The least that can be said is that they will be reluctant to bring to light errors in their acts and conclusions. A tendency to suppress the bad, and give emphasis to the good—if good may be anywhere found—is to be expected. And this, as much as anything else is to be watched for in meeting these questions, with which in the near future some of the member companies may be confronted.

Æsop's fable of the fox and his lost tail here finds excellent application. The wily old fellow wished company in his misery, and, we recall, urged all the other foxes to cut off their tails. He gave as many favorable reasons as any proud possessor of a municipal plant can offer a sister municipality in urging her to do likewise. But the assembled foxes remembered that the loss of a tail is easily accomplished; that the troublesome thing is to get it back again. Municipal, like private, funds may be spent at any time—they take flight easily—with less ease one again gets possession of them.

Mr. William Richmond Smith, in his excellent work, "Municipal Trading in Great Britain," states that in the year 1875, through the exertions of Joseph Chamberlain, then mayor, the city of Birmingham, England, secured permission from Parliament to take over the gas-making plants of the private companies. The undertaking proved, for the time being, a great success, both financially and otherwise. Mr. Chamberlain as mayor gave the undertaking his personal attention. He did all in his power to make it the success which it became.

1. From the introduction to a report on the subject prepared by Mr. Williams for the National Electric Light Association and presented at Denver on June 8, 1905. The complete report makes a volume of 188 pages and is very full and valuable—a most useful book, for which central-station companies have to thank the author. Mr. Williams is general inspector for the New York Edison Company.

About the same time other municipalities of England began to engage in enterprises of this kind; the principal statistics upon the subject all date from 1875, and it is not beyond reason that the movement in Birmingham was father to the movement elsewhere. The results secured in that city, doubtless, were referred to as affording abundant reason why similar movements should be undertaken by other English municipalities. Here may be found an explanation for the present, and general, unsatisfactory condition of municipal trading in that country. The virtue lay in the man, Joseph Chamberlain, not the cause, which was questionable, to say the least. The world knows how many, or how few, Joseph Chamberlains there are and they are not managing municipal trading ventures.

The newspapers have heralded that Charles T. Yerkes, formerly of Chicago, has taken Mr. Young from the municipal tramways of Glasgow to manage his great railway undertakings in London. Mr. Yerkes [who is quoted from the Daily News (London) in full in the report] should be heard on this point: "Young, whom I took from the management of the Glasgow street railways, was handicapped in his work there, although he did his best to minimize political interference. Moreover, politicians of Glasgow, while ignorant, are honest. Politicians generally in Europe are comparatively honest, whereas the politicians of Chicago are the worst in the civilized world."

Suggestion is frequently offered that if the municipalities can operate their waterworks successfully, with equal success they can also operate gas and electric-light works and street railways. There is a marked distinction between water and the other systems. Water is easily pumped and distributed. For operation, it does not require a high order of technical engineering or financial competency. Of administrative and executive skill no more is required than in the care of the station houses of our police departments, and far less than in the conduct of our public schools. It should be remembered also that water is an absolute necessity to the health, to the life, of the community, and that it must be provided freely in unlimited quantities, whether any particular member of the community can or cannot pay for it. If he cannot pay for it, the general good of all demands that it shall be provided to him, even without cost.

Of education the same is true—it is a public necessity. The general welfare demands that every boy and girl shall receive at least a rudimentary education, and that, under certain conditions, they shall also receive a higher education at public expense. If unable to provide it for themselves the charge properly belongs to the state, for the benefit in better citizenship and lessened crime—to mention two of many advantages—goes to the state as well as to the individual. Thus one might reason indefinitely regarding our purely public utilities and conveniences, such as the police, the highways, the fire department, waterways and sewers.

The lighting of the highways, it must be added, is also necessary to public convenience and safety, and is a public function. From the adequate illumination of the streets all receive like benefit, and it is necessarily a general charge upon the community. Whether the service should be obtained from the private companies or from a municipal plant is purely a question of relative cost—there is no sentimental reason why a municipality should not make its own light, and there is no sentimental reason why it should do so.

But here the function of the municipality should stop. Beyond this point it must not go. It should not encroach upon the service to individuals any more than it should undertake to furnish individuals with bread and meat, with clothing, or newspapers; no more than it should conduct hotels, restaurants, theaters or the opera. Entering this field it invades the exclusive domain of private enterprise, which makes for the prosperity, and, in fact, the very existence of the community as a whole. There is, perhaps, no question that any one, or all, of the industries of a municipality could be conducted, after some fashion, by a municipal administration; nor is there any reason why, with deficits made up from general taxation, the municipality cannot compete with any kind of private enterprise.

Street illumination, whether from the central station or a municipal plant, should be a question of relative price and cost. When threatened with municipal competition, it should be made clear that prices are no more than the cost of corresponding service if derived from a municipal plant, adding an admittedly fair profit. Where incorrect figures and misleading opinions are publicly circulated, they should be corrected with equal publicity. In a matter of this kind nothing equals counteracting publicity. This is an age of reason, of eventual control through public opinion, and the lighting companies have the same weapons at their disposal for defense that their opponents have for offense. The present prominence of municipal socialism as a political question is the result of publicity largely on one side, and there should be united effort on our part to meet it and restore normal conditions. This can be accomplished with united, concerted effort; all of which is well worth while, for the question may be extended into the different political parties, and possibly [illegible] and municipal politics.

Here the National Electric Light Association [illegible] find a wide field of [illegible] been done already [illegible] larger means at command [illegible] results may be secured in the future [illegible] last year the president of the [illegible] very active in these matters [illegible] been engaged to represent one of the large companies before the local authorities [illegible] legislature, accountants have been [illegible] examine carefully into the [illegible] one of the larger cities [illegible] the association has been [illegible] desired.

It might not be beyond the means of the association to establish and maintain a well-organized press bureau, supplementing the [illegible] work of Mr. Billings, without special reference to whom this report would be still more incomplete, and certainly it should have at all times, for the assistance of the member companies, competent legal talent, which could be called upon in the event of need. These contests will come frequently, oftentimes without warning, and they call for the best experience that can be had. The cause of one is the cause of all, and it is a gratifying sign that this fact is universally recognized by our membership.

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## The Choice of an Insulated Cable.[1]

By Wallace S. Clark.

There are two distinct conditions of service. One where the amount of current is not subject to any probable increase, such as instrument, generator and transformer leads; the second comprising all lines outside of the station that may be subjected to increasing loads due to the growth of business.

For the first class, ampere capacity or mechanical strength in the case of small apparatus is the determining factor. The current-carrying capacities given in the National Electric Code for rubber insulation are a fairly safe guide and the current densities given should not be exceeded.

For the second class of conductors, the cost of power at the switchboard, the load factor of the line, the limits of loss in transmission for satisfactory regulation of potential and operation of consuming device, the heating of the cable in short lines, the probable increase in load with time and the interest charge on the cable investment are the principal factors in settling the size of conductor to be used. The Thomson law, so-called—that the most economical arrangement is where the cost of the power wasted and the interest charge on the cable investment is a minimum—is the basis of many formulæ elaborated in different books.

Having determined the size of conductor required on theoretical grounds, consideration should be given one or two very practical points. First, do not use for underground construction cables so small as to be mechanically weak. I have in mind a station with a 6,600-volt distribution where the cables run from three-conductor No. 0000 to three-conductor No. 6 in size, the No. 6 constituting the smallest part of the installation and giving more trouble than the entire remainder of the system.

Second, if you use a duct system, keep in mind the fact that the cost of duct per foot is independent of the size of the cable in the duct, and select the size of conductors so that the cables will utilize a reasonable proportion of the duct area. Two No. 8 arc-light cables, single-conductor, in a three-inch duct, costing from 20 cents to 40 cents per duct-foot, is evidently uneconomical. The standard three-inch duct will take cables of the following sizes, insulated for different voltages: Any voltage under 1,500, single-conductor cables up to 2,000,000 circular mils; concentric two-conductor cables up to 1,000,000 circular mils; three-conductor cables up to 500,000 circular mils. For 3,000 volts, single conductors up to 1,500,000 circular mils; concentric up to 750,000 circular mils; three-conductor up to 400,000 circular mils.

For 6,600-volt lines, which are practically all three-phase, the limit is found at three-conductor, 250,000-centimeter cable; on 12,000-volt lines the limit is found at three-conductor No. 0000 cable; on 24,000-volt lines at about 100,000-centimeter cable. It is assumed, of course, that the three-conductor cables are run on delta-connected circuits and have the same wall of insulation between conductors and ground as between the conductors themselves. If the three-phase circuit is run Y-connected with neutral grounded, then the outer jacket of the three-phase cable can be made considerably less in thickness and larger cables be installed in the standard three-inch duct.

The accompanying curves show the variation in cost per 1,000 circular mils of copper contained in the cable for different sizes of cables and different working electromotive forces. It will be noted that the lack of economy in the use of small conductors is most marked in the 15,000-volt class, where changing the size from No. 8 to No. 6 wire in- [illegible]

[illegible] tration of pressure tending to break [illegible] inner layers [illegible] the entire insulating wall. In short, it is easier to make a [illegible] working pressure than to insulate a No. 14 wire for the same purpose.

The next point [illegible] or multiple-conductor [illegible] station wiring single conductors in separate ducts, or runways, might [illegible] modern practice. Maximum [illegible] and simplicity of arrangement [illegible] this question pretty definitely. For outside lines the service will largely decide. Direct-current railway feeders are normally single-conductor.

For low-tension mains on the three-wire system, either three single-conductor cables or one three-conductor cable can be used. The three-conductor cable is slightly cheaper in first cost but not nearly as convenient for making taps [illegible] retically, with alternating currents [illegible] advantage in the use of the [illegible]

CURVE SHOWING VARIATION IN COST PER 1000 CIRCULAR MILS.

For low-tension feeders, which usually exceed 250,000 circular mils in size, the concentric type of cable should be used for maximum duct economy. Smaller than 250,000-circular-mil cables may be run as a flat twin conductor, and this type of conductor is always advisable for alternating-current feeders with manhole transformers.

The common practice in arc circuits is to use single-conductor cable. Where a number of circuits are in parallel for any distance an excellent plan is to combine them into a multiple-conductor cable. This saves in first cost, in cost of installation and in cost of ducts.

Single-phase two-wire lines not exceeding No. 0000 size should be run as twin conductors unless numerous taps are made, in which case the greater convenience in making joints may justify the use of the single-conductor cable. The concentric type of cable for single-phase work is losing favor in England and on the continent and has never been in favor in this country.

I believe the majority of engineers who have had experience in central-station construction now consider that cables without metallic sheaths are better than leaded or other metal-sheath cables for this class of work. The lead sheaths are generally grounded and must be grounded in a high-tension system to prevent the accumulation of static charge. These grounded lead sheaths offer the arc from any conductor to earth in their neighborhood a ready inducement to spread and cause trouble on adjoining cables. The lead sheath on circuits exceeding 5,000 volts and on all voltages if the cable is paper or fibrous insulation must terminate in an end bell or pothead to prevent the breakdown of the cable at the terminus of the lead sheath. This end bell in addition serves as a seal to prevent the absorption of moisture in the case of paper or similar cable.

Cables for tensions not exceeding 750 volts that can be run in dry non-metallic ducts without pockets where water may collect, or on suitable incom-

1. Abstract of a paper read before the Denver-Colorado Springs convention of the National Electric Light Association. June 7, 1905.

bustible insulators—porcelain, glass, slate shelves, concrete, etc.—require insulation only to prevent shocks to operatives and short circuits due to mechanical causes, such as a workman dropping a wrench or bar across two bare conductors. An excellent type of cable for this work is one insulated with varnished cambric tapes and asbestos (asbestos being on the outside), finished with a flameproof braid. Such a cable can be operated continously at the boiling point of water without injury.

For pressures of 1,000 volts and upward we must use rubber cables of good quality, or some satisfactory substitute. Such cables, unless protected by individual fireproof runways, should be protected on the outside by an asbestos jacket. This jacket will prevent fire following along the cable or bunch of cables; it also acts as a protection to a considerable extent from the destructive action of an arc from an adjoining conductor.

If rubber insulation is used it should be of good quality, and such cables cannot be cheaply made, owing to the present extremely high price of the better grades of crude material. Rubber cables should not be operated at temperatures exceeding 125 degrees Fahrenheit if reasonable long life is expected of the insulation. Lower operating temperatures are most desirable, as they will do much to prolong the life of the insulating wall. Higher temperatures cause very rapid deterioration of the insulation.

Passing to conductors outside of the stations, these may be roughly divided into transmission lines, practically always operated at potentials of 4,000 volts or more, and running to sub-stations. The second class of cables comprises the distributing systems, with feeders seldom exceeding 3,000 volts and mains to which customers are directly connected operating at 500 volts or less. Circuits outside of the station using insulated cables are practically all underground. There are a few cases where high-tension leaded cables are run on pole lines supported by a steel cable similar to telephone practice, but this may be regarded as a temporary expedient.

Underground construction in this country consists almost entirely of lead-jacketed cables in conduits, the most permanent type of duct being thoroughly vitrified tile. For installations where electrolysis can be guarded against, or is not to be feared, paper-insulated lead cables give thoroughly satisfactory service when carefully installed. Where severe electrolysis is counted on or where the ducts are filled with water for considerable lengths of time, varnished cambric or rubber leaded cables should be used to insure against interruptions of service.

Where sub-aqueous lines are called for, various constructions are possible. With narrow, shallow streams or canals the line of conduits may be dropped with deep manholes, and the ducts carried underneath the bed of the stream. This usually necessitates draining the ducts toward one manhole and providing a small pump to keep the manhole clear of water seeping in. Wide shallow streams can have a trench dredged or dug across them and cables with band-steel armor laid in the trench, which will usually be rapidly filled with silt. For deeper streams or wider streams armored submarine cable is required. A method used with success in some cases is to lay a cast-iron water main with specially bolted ball and socket joints along the bottom of the river and to draw an unarmored leaded cable through it. Tunnels can, of course, be used, but except for a very heavy line, containing a number of cables, this construction is extremely expensive, and it is cheaper to install one or more spare cables which can be switched into service in case of accident to one of the operating cables. It is perhaps well to mention here that where a submarine cable or underground cable is inserted in a pole line of any length adequate lightning protection should exist at each end of the cable.

There is one type of cable largely used in England, and almost universally in Continental Europe, of which we do not avail ourselves as much as we should for underground work. This is the so-called band iron armored cable. Leaded cable is wrapped with tarred jute, and over this with two overlapping steel tapes, each from one-thirty-second to one-sixteenth inch thick. The outer tape covers the butt joint in the inner tape and is protected against corrosion on the outside by an additional jacket of compounded jute. Such cables buried directly in the earth have been giving first-class service in some cases for 20 years. They are in use for pressures from 250 up to 15,000 volts, and lines of even higher potentials have been installed, but for too short a time to be cited.

Before it is shipped from the maker's factory every cable should be tested with an electromotive force higher than the maximum working pressure. If possible, a similar test should be made after the cable is installed and jointed. As to the relation which these test pressures should bear to the working pressure, the duration of the tests, etc., there exists considerable diversity of opinion. For a good many years the writer has advocated 2½ times the working pressure for 30 minutes to an hour as a factory test and twice the working pressure for the same length of time after the cable is installed. Cables tested under these requirements have given no indication in practice that the margin of safety was not ample. Some engineers, desiring a higher factor of safety on important and large installations, specify a factory test of three times the working pressure and a test installed of 2½ times. Any requirement more severe than this represents a questionable investment on the part of the purchaser. It is especially undesirable to make very high potential tests for very short periods of time, since the cable may be decidedly weakened by such treatment, although it does withstand the high-potential test for the brief period specified. In short, the words "breakdown test" should not appear in cable specifications, in the writer's opinion. Boilers are tested to see if they are safe for a given working pressure, but such test is not usually referred to as a bursting test. Cable tests should be considered on the same basis. They are not to show the ultimate strength of the cable, but to show that the cable is safe and satisfactory cable for the purpose for which it is intended.

It should, of course, be understood that the above refers to cables for 2,000-volt circuits or over, since in lower voltages the necessary mechanical requirements frequently call for a wall of insulation sufficient for a 3,000-volt test or even a 5,000-volt test on cables which are to operate at 250 volts. A variation in tests called for by some engineers, which is a very good one, in my opinion, is to test the cable for one hour at 2½ times the working pressure, and at the end of that period to raise the pressure to three times the working pressure for one minute.

Paper cables are not generally tested at more than 2,300 volts for each one thirty-second inch of wall; rubber cables at 2,500 volts for each one thirty-second inch of wall; varnished-cambric cables we are enabled to test with 2,800 volts for each one thirty-second inch of wall. These figures apply, of course, to the ordinary commercial cables as made today. They can be exceeded on specially made cables of all types. The size of the cable has a considerable bearing on the pressure test, and the figures above represent the practice on cables running from No. 6 and larger, for working pressures from 2,000 to 20,000 volts.

## The Organization of Working Forces in Large Power Houses.[1]

By W. P. Hancock.

The chief engineer of the steam system is, of course, totally responsible to the head of department, or his representative, for the good and economical operation of that system; and in order to be able to assume that responsibility in a manner favorable to the company's interest, and with success for himself, he must have among his various accomplishments a few which I will mention, and which I claim are extremely important.

We will assume that he came to us with the necessary license, that he has had a good and varied experience with steam engines and auxiliaries and is a first-class mechanic. Perhaps we know him by reason of his having been employed on a nearby system for some time, and, if this be the case, we have had the opportunity to see what kind of an organizer he is, what his judgment is in the hiring of men, whether he has the ability to maintain discipline among his men, and takes an interest in knowing whether or not it is maintained, and whether he plans the work of his system and passes his orders to his first assistant, to be passed by him down the line, in such a way as to avoid the bad complications caused by conflicting orders given by himself and his first assistant to a watch engineer, perhaps to others of his organization. We can see whether he has favorites among his men by reason of earlier acquaintance with them; if he has and it is apparent, we know there is trouble ahead. We can see what his inclination is when the load is going at the beginning of the summer and the pay-roll will stand a reduction, not in the rate of wages but in number of men employed. We can see whether or not he has the "hustle and push" to put the system on its feet and keep it there, without having to be reminded that it is for that purpose that he is drawing his salary; also if he takes a keen interest in matters to such a degree that if he doesn't hear from certain items in his system he will go after such items and not take it for granted that they are all right or he would have heard from them.

If arguments arise between any of the men and their superiors, does he act absolutely on his best judgment, or does he allow it to be warped because the man who is in trouble with his watch engineer is an old man—not in years, but on the system—and he thinks that man cannot do wrong?

I claim that if the head of a steam division has not the ability to take care of these matters on these lines, the organization will be far from satisfactory from the standpoint of good service and economy. Almost any chief engineer can continue to hire and discharge men at short intervals and claim that as his only alternative; but if he does, it is a loss to his employers.

The engine room is in the immediate charge of the first assistant engineer, who directs all of the work from orders given him by the chief engineer. As he, of course, cannot be on watch more than the regular hours, unless in case of emergency, the orders are transmitted by him to the watch engineers, and in absence of the chief engineer these men have, in their consecutive order, absolute control over every piece of steam apparatus and the appurtenances thereto, from the ends of the crank shafts to the outer end of the circulating water intake, including all labor incident to steam operation.

The first assistant and his watch engineers are busy men. I say "busy," because, if they are not, they are in the wrong place, for on these men we place secondarily the responsibility of the steam apparatus and its operation.

Of the watch engineers we must require as nearly as possible the duties of the first assistant, with the addition that the orders of the latter, as to work to be done during the hours he is absent, are to be strictly obeyed, and the results must show favorably when he again appears on watch.

The oilers come next in line in the engine-room, and on these men we rely to keep the engines in operation after once started, and to know absolutely that the large number of oil feeders and grease cups found to-day on reciprocating engines are in proper operation. An oiler must give immediate notice to the watch engineer of any irregularity in the operation of his machine; must see that he is using enough oil, and not more than enough, and when his machine goes off the line must wipe it up and clean it ready for the next run. These men are important in their positions, whether the title implies it or not, for power stations, unlike steamboats, can not afford to shut down to cool hot bearings, nor can we afford to let the customers drift, as the commander might let the ship drift at sea if emergency occurred and weather and sea room were favorable. I consider an oiler important when the question of hiring men comes up in the fall. I lose no opportunity to take the name and address of all men who have had experience in that line, and find such a list very useful when the fall load begins to appear.

We can now take up the operation of the boiler-room, that portion of the system which can be so handled as to assist greatly in paying dividends, and can also be handled in such a manner as to be largely the means of passing one, especially if the coal supply is uncertain as to quantity and quality, for in this latter case we must necessarily save at every other point in order partially to make good such deficiency. Therefore let us at once have the fire-room in charge of a competent man whose immediate superior is the engineer on watch. We need a man for this place who carries a first-class engineer's license; one who has had experience in the engine-room and thus understands practically how the load rises and falls; one who will keep in touch with the watch engineer and realize that it is absolutely necessary that he does keep in touch with that man and know as far ahead of time as is possible what his future needs will be.

Next come the water tenders, who are in charge of the fire-room watches when the foreman is off watch and who, in such periods, are immediately responsible to the watch engineers, and have a quota of firemen under their charge, as well as all other men of the fire-room force. The water tender may be apparently perfectly competent to occupy his position by reason of his coming to you with a proper license and a long list of recommendations from former employers, but the question will arise as to whether he will fill his proposed position.

The firemen are those of the force whom we must select with care, for the type we need must have had experience, and must have judgment and be reliable. That is to say, we can not afford to have a man with us who is afflicted with pay-day sickness. We want him eight hours a day, seven days a week, and I am glad to say we have a large number of this kind who like their positions well enough to work steadily for the periods mentioned above. We want men who will obey the instructions given them by their superiors, and those who are free from connection with any organization that would interfere with men that are getting satisfactory wages and treatment and are contented. We want men who, when occasion requires, will hand-fire 2,000 pounds of coal an hour, and do so for several hours, if necessary. We want men who will burn coal, and not simply dispose of it; men who will use judgment in both firing and cleaning fires, and if the plant is using stokers of the type we use on our system, it is of the greatest importance that he should watch the coal as it comes to him and regulate the depth of the feed and the speed of the grate in accordance with both the quality of the fuel and the demand for steam as his best judgment dictates, and act promptly on instructions given.

Firemen are a class of men who must of necessity do very hard work, and they are also a class of men upon whom the power stations are to a large degree dependent for their continuous operation. Both of these facts should be taken into careful consideration, especially as to the treatment of these men, and as to the wages paid them—two items which should be uniform throughout the fire-room; I mean by this, that all first-class licensed firemen should receive the same wages; not because a man comes to you with a license, nor because he claims he is first-class, but I mean that he should go on the pay-roll at your stated rate for first-class men in his line, and it is for the water tender, or other higher authority, to determine

1. Abstract of a paper read before the Denver-Colorado Springs convention of the National Electric Light Association on June 6, 1905. Mr. Hancock is connected with the Edison Illuminating Company of Boston.

in the first few days whether or not the man can substantiate his claim.

We can now take up the other half of the system, so to speak, or the electrical portion. This part of the organization is divided into [illegible] parts. We depend on this portion of the labor system to [illegible] important items of operation, the most important of which are:

First—A uniform pressure at the feeder terminals throughout the entire system.

Second—The proper and economical loading of machinery under the charge of the division, and,

Third—We hold this division responsible for the welfare of all electrical machinery, which must be, so far as possible, always ready for operation.

I may say that all repairs, except minor ones, in the division are done by outside persons. With the modern stations of today operating lighting and stationary motors and other low tension apparatus, at the same time delivering alternating current to substations, there is involved a vast amount of apparatus, due to the fact that we must have as much flexibility as possible. We must also have several ways of attaining the same object, as to the delivery of current, in order to safeguard our customers against interruption of service and, incidentally, preserve our reputation for being a reliable concern to deal with. It follows then that we need in a chief operator a man who is absolutely reliable, preferably one who has come up from the ranks and has long since become acquainted with the practical side of operation; one who realizes and instills into the minds of his assistants and men that one of their most important duties is so to manipulate the load with reference to machines to be operated that all units will be loaded to just as near the most economical operating point as it is possible to have them under the existing conditions. He must at all times be in close touch with the chief engineer and, so far as possible, give the steam division advance notice of his probable demand for steam units, thereby giving everybody a chance to be ready, and giving the customer the opportunity to verify our claim that we are at all times ready to supply current. Above all other things, he must have and use good judgment in the selection of his men and the treatment of them, and must conduct his division in a manner that will not only produce satisfactory service, but will be conducive to contentment among his men, and will secure for himself their confidence and respect, which, once secured and properly held, will be a large factor in maintaining what is as nearly as possible ideal operation.

The assistant to the chief operator must be a man who can assist his superior, and to that end he must be thoroughly familiar with all of the electrical apparatus in the division. He must be able to occupy the position of the chief operator when necessary; in fact, he must be a first-class understudy, and must realize the fact, too, or he will lose to some degree the sense of his responsibility. He should circulate among the sub-stations and correct and report any irregularity noticed in machines or operators; in fact, he should keep his superior constantly in touch with such details as do not come immediately under the notice of the chief operator, and in cases of emergency should come at once to the station and be ready to assist if needed.

The heads of watches should be, and necessarily are, men who have come up the line and who understand all the electrical combinations that can be made with machines, switches and lines throughout the system; if they are not, they should not occupy that position, nor should they in any case until we know by actual experience that they have the ability described above.

To these men we accord the highest wages paid in the division, with the exception of those of the chief operator and his assistant, and we make them uniform in all power stations of the system. By this method of making men fit the position before they occupy it, we secure the ability we desire, and after it has been proven beyond doubt by a previous practical experience. It is, in my opinion, a serious mistake to class men alike for the sole reason that they have worked practically side by side on the system for a period of time. I say, pay the man in accordance with what he can deliver to you in brains or manual labor equivalent.

Of the organization to operate storage batteries, I will say I believe that the cheapest man to have at the head is one who is both technical and practical in that line of work, and that he should be possessed of the same qualifications as are necessary in other heads of divisions with reference to handling men. But there is this to add, that it is seldom that men will work in the general line of storage-battery repairs for any considerable length of time, in that such work is not of the sort that attracts the average man, and they do not stay long enough to actually show of what value they might be after a reasonable period of service.

I have refrained from speaking of the head of the generating system and the assistant to that person, for the reason that it seemed to me proper to look over what there was in the nature of organization and operation that the head and his assistant were called upon to look after. I now say that the head of the department has responsibilities.

The very important one is the organization of his department. If that be correct, or as nearly so as conditions will permit, the operating responsibility, broadly speaking, will not seem as serious to the head of the department [illegible] total of these will represent his total generating cost. He should not, however, [illegible] small details, [illegible] has an assistant and several heads of [illegible] occupy positions and are paid [illegible] for the purpose of looking out for that portion of the [illegible] and if they don't do it and relieve him in that direction, then either the organization or the discipline or both are not correct, and it is absolutely useless for him to expect to proceed on a successful basis until his own error, whether caused by neglect or otherwise, is corrected, and his people understand in a thorough manner that the head of the department is there to direct its operation.

The head of the department should also keep in touch with the intentions of his heads of divisions relative to their hiring of men, and not only confer with them in a general way on such matters, but lay down a rule that men connected in any way with matters detrimental to the interests of the corporation should not be hired in any event.

I have found by some years of experience that to pay one line of work a standard wage, whether it be lower or higher than the so-called "union" scale, is productive of more contentment and better sentiment toward the employer than anything else I know of.

It does not seem necessary to say that the head of the department should not absent himself from the system or from his office for any length of time without giving notice where he can be found in case of emergency, and the assistant and heads of divisions should be required to observe the same rule.

The head of the department has at times to go farther than his office to get at the reason of the rise in some account which seems abnormal. He must, after exhausting other methods, simply get in and dig it out.

It sometimes happens that difficulty occurs between some of the men and their superior, in which the man from the ranks feels that he has been misused; that his superior has been too hard on him because his advantage of position has given him the privilege. In such cases, after the man has taken his trouble to the chief of his division and even then feels that he has a grievance, I believe it to be good policy to allow him to see the head of the department as a last resort; for the head to call in all parties concerned at one time and hear the several stories, one at a time, and decide the matter. Of course, if the superior has used his position properly there can be but one result; if he has not, and you have to decide the man is not to blame, then be sure you have that man understand beyond a doubt that he cannot and must not mistake a just decision for a license to disobey in the future, but that he is bound to work for and obey the same superior, just as much as he was previous to the time when the difficulty occurred.

And now about the assistant to the head of the department. We will assign to that individual the duty of placing with the heads of the several divisions the orders given by the head of the department. We will ask him to see that the electrical instruments, steam gauges, and all other indicating apparatus, are kept at proper standard; to know whether the engines have been indicated; to keep in touch with the load, and the time of demand for the same, at its highest point and its lowest point as well, and thereby be enabled to suggest the advisability of changing the load from one station to another with a view to obtaining the best economy possible with the fuel and water consumed and the expenditure for labor; to check the amounts of fuel consumed; to check and comment on the grade of fuel and kick on the quality if necessary.

The assistant to the head of the department must necessarily be a man of technical ability and be able to take up the items heretofore set forth on that basis; for among the many small items which when taken as a whole tend to lower the economy of operation there are usually many that require analysis, and such analysis calls for the services of a man who is well versed in technicalities and who can get down to the bottom facts of such matters easily and quickly and open the way to apply the proper remedy.

In the foregoing matter I have endeavored to place before the association an outline of the generating department organization of the Boston Edison Company; and, finally, I wish to say that whatever success we have attained in this direction has been due to efforts to secure a close and constant co-operation throughout the department; to the maintaining of a discipline which has been necessary and warrantable, but which has been established and maintained with justice and tempered by kindness.

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The Pioneer Telephone Company will install a plant at Durant, I. T., with complete metallic circuit. The general office of the company is at Oklahoma City.

## Monroe, Mich., May Quit Lighting Business.

[illegible] received several [illegible]

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## BOOK TABLE.

[illegible]

[illegible] Price, [illegible]

[illegible] These books are the first [illegible] which is being [illegible] and called by him "Repertorien der Elektrotechnik" (Repertory of Electricity). In the constantly increasing amount of electrical literature there has been felt the need [illegible] time complete work which would deal with the various subjects in a clear, concise and practical way. The series, when completed, will serve the engineer as a handy reference, inasmuch as all technical and mathematical discussions have been omitted and only the fundamental formulas and principles recorded. In addition, there are contained in each of the books now published a bibliography of articles pertaining to the title subject.

THE LETTER OF PETRUS PEREGRINUS ON THE MAGNET, A. D. 1269. Translated by Brother Arnold, M. Sc., and Brother Potamian, D. Sc. New York: McGraw Publishing Company. 1905. Pp. (6½ by 8½ inches), 41, with four illustrations. Price, $1.50.

Classic antiquity has handed down little of magnetic lore, but scraps have come to us, here and there, from the ages past which have been translated from the old works, as has been the letter of Petrus Peregrinous. Pierre de Maricourt, commonly called Petrus Peregrinous, lived in the thirteenth century and was a cultured man, of a speculative turn of mind, who was not only interested in the lodestone, but experimented with and studied it more than had hitherto been done. In the course of his work he made a little motor, operated by a lodestone, and straightway became fascinated with the problem of perpetual motion, and thoroughly believed he had fastened onto that elusive thing. Therefore, in a letter of 3,500 words, he explained to his great friend, Sigerus de Foucancourt, the mechanism of his new motor, this letter on the magnet or lodestone being the first great landmark in the domain of magnetic philosophy.

CYCLOPEDIA OF APPLIED ELECTRICITY. (In five volumes.) Prepared by a corps of experts, electrical engineers and designers. Chicago: American School of Correspondence, at Armour Institute of Technology. 1905. Pp. (6½ by 9½ inches), 2,500, with 2,000 illustrations. Price, $18.

This cyclopedia is a comprehensive work on electricity and its practical applications. It is not addressed to the technically educated specialist, but to students and practical workers in the electrical field, and for this reason higher mathematics have been avoided and the subject matter explained in the simplest language possible, in connection with a large number of diagrams prepared especially for the text. The books have been designed for textbooks, and each volume is supplemented with a list of review questions. The cyclopedia is also valuable for reference, having a subject index for this purpose. The index feature [illegible] which covers all departments of electricity, will save much time in searching through scattered textbooks.

Among the large corps of special writers and collaborators in the preparation of the work may be mentioned Prof. F. B. Crocker of Columbia University, Prof. William Esty of Lehigh University, Prof. D. C. Jackson, collaborating with Prof. George C. Shaad of the University of Wisconsin, Prof. Louis Derr of the Massachusetts Institute of Technology, and numerous other well-known authorities. Volume I. commences with the elements of electricity and magnetism, and deals with current measurements, wiring and the telegraph. Volume II. includes the subjects of dynamo-electric machinery and storage batteries. Volume III. is devoted to electric lighting, electric railways, the operation of dynamo-electric machinery and the general principles of power-station design. Volume IV. is devoted to alternating currents and automatic current [illegible] Volume V. is given entirely to the various phases of telephony.

## National-Interstate Telephone Convention.

Arrangements for the convention of the National Interstate Telephone Association at the Auditorium Hotel in Chicago on June 20th, 21st and 22d are being perfected, and the indications are for an exceptionally large gathering of Independent telephone men. The committee in charge, composed of James B. Hoge and Theodore Gary, states that, besides a large attendance of accredited delegates, a number of men prominent in the financial and promoting end of the business will be present. Tuesday and Wednesday will be given over to the business of the association, and Thursday to sightseeing and social amenities, with an elaborate banquet in the evening.

The program includes a number of papers by men who are recognized as capable of giving the members something of value. A feature of the program will be the reports of five committees which have been considering subjects of vital importance to all operating companies. These committees, composed of 12 men each, will meet on June 19th and complete their reports to be presented to the convention on the following days. The subjects which these reports will treat and the chairmen of the committees are as follows: "Standard Forms of Accounting," H. E. Bradley, Eastern Traffic Association, Philadelphia, Pa.; "Standard Operating Rules and Regulations," A. L. Tetu, Louisville, Ky.; "Standardization of Equipment," Sidney H. Brown, Pittsburg and Allegheny Telephone Company, Pittsburg, Pa.; "Best Methods of Advertising," Thomas Loftin, Indianapolis Telephone Company, Indianapolis, Ind.; "Arrangements Necessary Between Operators and Manufacturers to Protect Independent Companies," Thomas Bromley, Muncie, Ind.

The program for the convention is as follows:

Tuesday, 10 a. m.—Address of welcome, Edward F. Dunne, mayor of Chicago; response, S. P. Sheerin, New Long-Distance Telephone Company, Indianapolis, Ind.; address, "The National-Interstate Telephone Association," James B. Hoge, Cleveland, Ohio; address, "Ways and Means to Make Our Association a Success," Theodore Gary, Macon, Mo.; "Shall the Independent Companies Have an Insurance Company of Their Own?" James S. Brailey, Jr., Toledo Home Telephone Company, Toledo, Ohio; appointment of committees; "Combined Telephony and Telegraphy," Samuel G. McMeen, Chicago.

Tuesday, 2 p. m.—Roll call of states; "Standard Toll Signs," W. F. Laubach, Akron, Ohio; "Value of Telephone Securities," A. B. Greenshields, Philadelphia, Pa.

Wednesday, 10 a. m.—Report of Committees: Standard Operating Rules and Regulations; Standard Forms of Accounting; Standardization of Equipment; Best Methods of Advertising; What Arrangement is Necessary Between the Operators and Manufacturers to Protect Independent Companies? Discussion of Reports and Action by the Convention.

Wednesday, 2 p. m.—Reports of other committees; election of officers; transaction of any miscellaneous business; presentation of new business; adjournment.

From 15 to 30 minutes will be devoted to the discussion of each of the papers and reports. In this way it is hoped to bring out valuable information, especially as it is already known that more than 15 states will have delegates present, thus representing the conditions in all parts of the country.

The manufacturers and supply men will make a large display at the hotel. Already the entire sixth floor and part of the fifth and parlor floors have been engaged for exhibition purposes.

The social and entertainment programme will surpass that of any previous convention. The commitee, headed by P. C. Burns of the American Electric Telephone Company, Chicago, is making its final arrangements while this is being written and nothing will be left undone for the pleasure and comfort of those who attend. The whole proceedings will be concluded with a banquet on Thursday night.

## Telephone News from the Northwest.

The Winona Telephone Company of Winona, Minn., will make extensions to its system in that city.

The Missouri Valley Telephone Company of Mandan, N. D., seeks a franchise in Wilton, N. D., for a local exchange.

The Browerville and Motley (Minn.) Rural Telephone Company has been organized.

The Northwestern Telephone Exchange Company will soon start work rebuilding the exchange at Owatonna, Minn. New exchange offices will be equipped with a large new central-energy switchboard.

The Dakota Central Telephone Company has issued mortgage bonds to raise $500,000 for the extension and improvement of its system through the state.

The Donnybrook (N. D.) Telephone Company has been formed to install a local system.

Work has been started on the telephone system at Granville, N. D., by the Union Telephone and Light Company.

The Northwestern Telephone Exchange Company of Minneapolis is preparing to build a north branch exchange to handle the business of North Minneapolis. This will be the third branch exchange in addition to the main exchange in Minneapolis.

E. M. Sheffield is talking of organizing a rural telephone company at Belmond, Iowa.

W. H. Monroe and others are forming a company to establish a local telephone exchange at Earlham, Iowa.

The Litchville (N. D.) Rural Telephone Company has been incorporated by J. M. Olson and others with $12,000 capital. R.

## Indiana Telephone Items.

A district meeting of the chief operators of the Central Union telephone exchanges of the first district of Indiana was held at the Barnett Hotel in the city of Logansport on June 7th for the purpose of conferring with E. J. Roche of South Bend, service inspector for the district, and incidentally to make arrangements for the annual outing of the operators. Among those present were the Misses E. Lewis of Kokomo, E. Smith of Peru, S. Robinson of Lafayette, C. Laysetter of Wabash and Harriet Heaton of Logansport. Fowler and Frankfort were not represented. The afternoon session was taken up with a discussion of how best to improve the various toll lines. At the close of the discussion the committee decided to hold the next annual outing at Lake Maxinkuckee at a time to be agreed upon by the committee.

The new switchboard for the Independent Telephone Company at Princeton, Ind., is now being installed in the company's new quarters on the second floor of the Ingle Block. The new board has a capacity of 600 single-line telephones with provisions for extension from time to time so as to accommodate 2,000 lines or more. This company is also installing a new outfit of batteries and generators. The officials estimate that at least three weeks will be required to complete the installation of the new equipment.

Patrick Carter, lineman for the Peru Telephone Company, was killed recently by a live wire from a trolley line coming in contact with telephone wires he was repairing after a storm.

Word comes from Washington that M. P. Boone, superintendent of the Home Telephone Company of Peru, has been granted a patent on a common lock-out telephone system.

At a recent meeting of the representatives of Independent telephone companies, held at Fort Wayne, the plan of invasion was left in the hands of a committee consisting of W. L. Moelling of Fort Wayne, Thomas Promley of Muncie, H. P. Sayles of Indianapolis and M. R. Park of Portland. Judge Taylor has rendered a decision to the effect that the contracts affecting the toll-line service which the Independent companies had with the United Telephone Company are good and enforceable. The plan of securing franchises and establishing exchanges in the territory recently acquired by the Bell company through the United company was thoroughly discussed and the committee adjourned to hold another meeting in the near future.

The Home Telephone Company is putting in an exchange in the village of Osceola. Over 100 subscribers will be accommodated to begin with and a toll line is already being constructed from Mishawaka. The placing of an exchange in this village will add quite a territory to the Home company. S.

## Ohio Telephone Notes.

A new voting trust controlling 70 per cent. of the stock of the Toledo Home Telephone Company has been organized to continue until 1910. It is announced that this action was taken to prevent the stock from being picked up by rival interests. A dividend of one per cent. for the quarter was declared, and it is announced that dividends will hereafter be paid on the stock regularly.

The Northern Ohio Telephone Company was organized at Toledo a few days ago by the election of officers, with Willard F. Robison as president. The company was formed to take over the exchanges at Maumee, Perrysburg and Whitehouse. It is probable that other exchanges will be acquired from time to time. It will operate in harmony with the local company at Toledo.

The Central Union Telephone Company has sub-licensed all the exchanges recently taken over in Jackson County, by which about 1,800 subscribers were acquired. Bell instruments have been put in and the wires connected up with the Bell long-distance wires. Jackson, Wellston, Coalton, Oak Hill and Hamden are affected. The exchanges in these places have been consolidated with the Bell exchanges.

The new common-battery multiple switchboard of the Central Union Telephone Company at Massillon was put into operation a few days ago..

Plans are being discussed for the dissolution of the Federal Telephone Company of Cleveland, which is the holding company for 22 Independent companies in Northern Ohio, and has an interest in long-distance lines. The largest creditors are also the largest stockholders in the company. The plan is to exchange the stock in the Federal for that of subsidiary companies or sell the assets to the stockholders at a figure that would pay the debts of the larger concern. It is thought that the business of the smaller companies may be transacted now without a holding company, since a large part of its interests were disposed of in the settlement of the Everett-Moore trouble. The plans, it is thought, will work out to the satisfaction of all concerned if put into execution.

The Bell Telephone Company is arranging to put in a conduit system at Youngstown, it is said, while the streets are torn up in paving.

J. B. Hoge has purchased a controlling interest in the Chagrin Falls Telephone Company at Chagrin Falls. He secured the stock of the late William D. Brewster, who was president of the company, and another block or two that gave him the control. The Bell interests have been after the exchange. C.

## Michigan Telephone Matters.

The Co-operative Telephone Company of Detroit, by a recent decision of the Supreme Court, loses its fight to collect on stock contracts. A large number of people subscribed for stock of this company on a mutual plan at the rate of $50 per share. The stock subscription carried with it a three years' telephone contract. The telephone company won in the Circuit Court, but the decision was reversed in the Supreme Court. The contracts were not signed by the telephone company, and for that reason the court decides that neither party can be held. The Co-operative company is the only Independent company in Detroit, and, while its city business is very light, the long-distance service from other Independent lines throughout the state is considerable.

The Michigan Telephone Company has informed its patrons in River Rouge and Ecorse that a raise of rates will be effected this month. These towns will also have to pay long-distance rates for Detroit and Wyandotte calls. The lines of Delray, River Rouge and Ecorse will be centered at River Rouge and an exchange located there. Retaliation is talked of and an opportunity for an Independent line is opened, it is said.

The Michigan State Telephone Company will install a new exchange at Wyandotte on July 1st. Over 40,000 feet of new wire will be strung. A new exchange will also be installed at Trenton. Both of these towns were worked from the Detroit exchange. W.

## GENERAL TELEPHONE NEWS.

The Rocky Mountain Bell Telephone Company proposes the early construction of a new telephone building at Pocatello, Ida.

The system of the Twin Falls Telephone Company at Twin Falls, Ida., has been purchased by the Rocky Mountain Bell Telephone Company.

Oscar O. Ayres has sold the plant of the Olathe Citizens' Telephone Company at Olathe, Kan., to F. R. Ogg and M. G. Miller, local business men.

The Interurban Telephone Company of West Palm Beach, Fla., has been incorporated with a capital of $25,000 by H. B. Yarborough and associates.

The Southern Montana Telephone Company, capitalized at $5,000, has been organized at Dillon, Mont., and will string wires throughout the Big Hole region.

E. M. O'Brien has resigned his position as resident manager of the Iowa Telephone Company at Des Moines, Iowa. His successor will be E. E. Thompson of Boone. E. E. Tierney takes the latter's place at Boone.

## MANUFACTURERS AND DEALERS.

San Francisco is to have an automatic telephone exchange, the apparatus to be installed by the Automatic Electric Company of Chicago. Articles of incorporation have been filed by the Home Telephone Company and work upon the system has been begun.

R. W. Kemp, F. M. Kemp, W. K. Kise, Will Warren and M. B. Pile have incorporated as the Mutual Telephone Engineering and Supply Company, with a capital of $5,000. The new company is located at Wellington, Kan., and proposes to do telephone construction work in the Southwest and will also carry on hand all kinds of supplies.

The Stromberg-Carlson Telephone Manufacturing Company of Rochester, N. Y., reports having closed contracts for switchboards for the following places: Mt. Branch, Tenn.; Berwick, Pa.; Fulton, Kan.; Fenton, Ia.; Bowbells, N. D.; Folsomdale, Ky.; East Smithfield, Pa.; Elizabeth, N. C.; Washington, D. C.; Cranville, N. D.; Pontiac, Ill.; Macon, Ill.; Chicago, Ill., and Fulton, Ia.

The Chesapeake and Potomac Telephone Company has awarded the contract for the construction of the proposed nine-story telephone exchange, 40 by 150 feet, on Light Street, Baltimore, Md. Two exchange boards, having a capacity of 10,000 lines each, and costing $200,000, will be installed. The building, which will be built by the Herbert A. Weeks Company of New York city, is to cost $400,000.

## Noise-deadening Method to be Tested on Chicago Elevated Road.

An order was passed by the Chicago City Council at its last meeting, presented by the local transportation committee, authorizing the Northwestern Elevated Railroad Company to test a scheme to deaden noise on the elevated road. The scheme which the company proposes will be tried on the Union Loop between Jackson and Monroe streets, and consists in laying 80-pound rail and embedding the ties in screened gravel, which is also to fill the spaces between the ties.

Considerable objection was raised to the plan by those who thought that the comprehensive noise-deadening plans prepared by B. J. Arnold were better and should be tried first. It was argued by the objectors that the proposed device of the company would shut out the light from between the ties and make the streets still darker. One of the aldermen suggested a continuous-rail device for the purpose of deadening noise, but the council decided to let the company try the gravel-bed scheme.

## Cylindrical Blue-printing Frame.

The General Electric cylindrical blue-printing frame is meeting with considerable success wherever it is installed. Two of the most noteworthy installations in the city of Philadelphia are those at the Electric Storage Battery Company's offices and at the Frankfort Arsenal.

At the office of the Electric Storage Battery Company the General Electric Company's blue-printing machine is regarded as an indispensable piece of apparatus. Since its installation there has been no delay in getting out prints, and the product is of the best and most uniform quality. The frame is used uninterruptedly on all cloudy days, and during the dark periods of the morning and afternoon on clear days. Electric blue-printing paper, which requires eight to 10 minutes to print, is used, so that the total time required to make a batch of prints, including the time allowed for refilling the frame, is 15 minutes. The frame is equipped with 110-volt direct-current enclosed arc lamps.

At the arsenal, the government requires all prints to be positives, and as the prints are made from brown paper negatives the time of exposures is lengthened to about 15 minutes. The arsenal officials state that the frame is satisfactory in its operation, and that they could not dispense with it. Alternating-current lamps of 110 volts are used.

The time required for printing can be materially reduced by the use of more sensitive papers than those employed in the two frames above referred to.

Many large manufacturing companies are to-day depending upon the sun alone for their blue prints, and must, therefore, be severely handicapped in their work. The great advantages secured by the use of the electric blue-printing frame are not as well understood as they might be. Discussion of the subject with manufacturers, engineers, contractors and other users of blue prints about the country would no doubt lead to the installation of many frames.

## New Electrical Repairing Company in St. Louis.

The Southwestern Electric Company of 24-26 South Tenth Street, St. Louis, is a company incorporated some months ago to do repairing of electrical machinery, installing of complete power plants and handling of second-hand apparatus. While the name of the company is comparatively new, a large amount of business is reported as already being done, due in part to the fact of its having absorbed the business and good will of D. J. Pine & Co., and also to the large acquaintance and experience of the individual members of the firm.

D. J. Pine is president of the company and has had 20 years' experience in the electrical business. Mr. Pine was formerly associated with the St. Louis office of the Western Electric Company and later with the firm bearing his name. He is well fitted to look after the construction end of the business, which is under his direct charge.

D. W. Stinson, who has charge of the repair department of the company, is a good practical mechanic in this line of work and has supervised the installation of and repairs on some of the largest electrical machinery in the vicinity of St. Louis. His experience in the electrical field dates back 18 years, 12 of them in the repair department of the Missouri Edison Company.

The office and financial end of the business will be under the care of J. C. Knight, who is secretary and treasurer of the company. Mr. Knight, like his associates, is an experienced electrical man and well qualified to give his department the attention it demands. The company employs none but expert mechanics, guarantees fully all work done. With its adequate facilities it is enabled to give prompt attention to all work, to shipping, etc. The company's location especially fits it to take care of trade in the southwestern, central and western states.

# CORRESPONDENCE.

## Great Britain.

London, May [illegible] proposed to appoint [illegible] between the postmaster-general and the [illegible] phone Company [illegible] House of Commons [illegible] got to work. The first [illegible] before it by Sir Robert H[illegible] General Post Office, and it [illegible] tages to be obtained from [illegible] agreement. [illegible] National Telephone Company [illegible] in 1911 and neither the postmaster-general nor anyone else is bound to buy [illegible] to sell the undertaking, while on the other hand the company would be legally barred from conveying a single message by telephone. Thus the whole telephonic business of the kingdom would come to a standstill. Foreseeing this the postmaster-general considered that the duty devolved upon him to prevent such an occurrence by making arrangements for a continuance of the service after December 31, 1911, and of the two methods of doing this, viz., erecting a new system or making arrangements to take over the company's undertaking on terms. The view of the postmaster-general was that the [illegible] was the most economical course, as it would also afford the free expansion of the system in the meantime, which would have been prevented and made impossible had the company merely continued in the position of having to cease to exist in 1911 and with no purchase price for its undertaking. Evidence is to be taken day by day.

The bill which was proposing the establishment of a system of pneumatic dispatch for parcels, etc., in London has met with a not unexpected fate. Without even calling upon the opposition to the scheme to develop its case the committee decided that the proposal should be rejected. The Batchelor Pneumatic Tube Company was engineering the scheme.

Two victories have been scored by the London County Council during the last week. The first was in connection with the tramways, for after many years' trials it has succeeded in inducing a committee of Parliament to sanction tramways over two of the Thames bridges and along the famous Thames Embankment. As a matter of fact the value of the new lines will be seriously discounted from the fact that the proposal to link up the northern and southern systems was rejected. Consequently the effect of the decision referred to above is merely to bring the two systems closer together, for the actual value of the extension to passengers from the south of London is not likely to be very great. What will happen to the project when it comes before the House of Lords for consideration is problematical.

The other matter in which the council has secured something akin to a victory is in connection with the municipal wiring of consumers' premises for the electric light. A bill to this end gave powers to the borough councils to expend money upon this work and also for the hiring out of motors, etc., and this has also been passed by the House of Commons. Great opposition was offered to the scheme, and realizing that the work in question was a trifle beyond the ordinary functions of a local authority the committee placed some rather onerous but nevertheless some sensible and necessary restrictions upon the borough councils in granting the powers sought. Each year the charges are to be so adjusted that all expenditure, including interest and sinking fund, is covered, and further, separate accounts for the wiring part of the undertaking are to be kept in order to demonstrate that this condition is complied with. The decision of the committee, however, still leaves out of consideration the question of depreciation, which, it has been contended, ought to have been included in order to absolutely prevent any possibility of a call upon the rates over the matter.

The differences of opinion which have existed for some time in connection with the working of the Pacific cable will soon come up for settlement, for the long-delayed conference of the colonial states interested in its working will be held toward the end of June. Next week also a deputation will be made to the colonial secretary with the object of seeking a reduction of the rates now charged for the transmission of messages by that route.

The London local authorities are again very much concerned about the frequent breaking up of the streets by electric-supply companies and gas and other companies. The opinion seems to be that the bodies should pay something toward the up-keep of the roads in addition to their share of the rate, which is a very heavy one. A resolution has been passed urging the introduction of a government bill to deal with this point, and a deputation is to be sent to the prime minister. At present the position is that all the companies are working under parliamentary powers which give a compulsory right to break up the streets for the purpose of a public service. It is hardly likely that the difficulty will be overcome in the manner anticipated by the local authorities.

All the electric power bills for London have now been dealt with by the House of Lords committee [illegible] area, viz., [illegible]

## New York.

[illegible] franchise to [illegible]

[illegible]

It [illegible] the Bronx and that about a month later the whole of the [illegible] traffic.

In connection with the electrification of the Long Island railroad [illegible] phone is being [illegible] Island City, so that the general superintendent will at all times be in control of the traffic. One hundred of these telephones will be placed in call boxes along the line about half a mile apart and 50 more will be in the signal towers and at the stations.

The Brooklyn Edison Company [illegible] after July 1st the rate for current to retail customers will be reduced to 12 [illegible] hour for lighting and to [illegible] latter price being subject to a special discount schedule. The company maintains a number of experts who will advise new customers as to the best means to utilize electric power.

The local press is printing highly unscientific but suggestive accounts of alleged interferences with space-telegraphic operations around New York harbor by the metal work of the statue of Liberty. This is offered as an explanation [illegible] the Caronia went aground a few weeks ago, the shore station was unable to communicate with the liner for five hours.

A German liner now in port has been fitted with the new signalling apparatus, which consists substantially of two microphones attached to the hull below the water line and which pick up the vibrations of bells sounded beneath the surface. The incoming vessel is said to have detected the bell of the Nantucket lightship when four miles distant.

Leo Bauman, Edward Schwartz and Hermann Liebmann of this city have incorporated as the Schwartz Wireless Burglar Alarm Company.

The Northern Westchester Lighting Company is extending its sphere of operation to obtain a monopoly of the lighting of four additional towns: Briar Cliff Manor, Croton, Ossining and Pleasantville, N. Y.

An electrical equipment is needed for the additions recently made to public school No. 104 in Fourteenth Avenue, Brooklyn. The probable amount of the work is $4,000 and bids are asked for on June 19th. D. W. W.

## Southeastern States.

Charlotte, N. C., June 10.—The Gallatin and Suburban railway of Sumner County, Tenn., has been chartered with $50,000 capital by C. H. Fidler, G. N. Guthrie and several others.

The Lenoir City Light and Power Company, Loudon County, Tenn., has been chartered. The incorporators are William Glass, R. M. Calloway and associates.

At Conway, S. C., the Conway Light and Power Company has been chartered with a capital stock of $10,000. D. A. Spivey is president and J. C. Spivey secretary and treasurer.

The Blue Ridge Light and Power Company has been incorporated at Staunton, Va. John M. Spotts is president and treasurer and C. P. Bowman secretary and vice-president. The capital stock is $50,000 and the concern has the right to operate a railroad with any kind of power desired.

A syndicate has been formed at Norfolk, Va., to build an electric railway to connect the summer resorts of Ocean View and Pine Beach. The amount involved will be $300,000 and the length of the line five miles.

The Buck Shoals Company of Arden, Henderson County, N. C., has been chartered, with $20,000 capital, to conduct a large variety of business, including the operation of electric railways. J. W. Sluder of Asheville is interested.

A deal has just been [illegible] at Cartersville, Ga., giving to the Etowah Power Company entire

ownership of the Etowah Development Company, including the control of the waterpower on Etowah River. It is said to be certain that the river power will be developed and 5,000 to 10,000 horsepower will be rendered available. L.

## New England.

Boston, June 10.—Preparations for the Bunker Hill Day carnival in the Charlestown district of Boston, June 17th, are completed and contemplate the repetition of what proved to be one of the most attractive features a year ago, namely, a grand electrical parade in the evening. "A Constellation of Countries" is the theme and floats will be in line representing all the nations of the world. The parade passes over the line of the street railway and the floats are mounted on car trucks, light and power being supplied as they are supplied to the trolley cars. Something over 10,000 electric bulbs of various colors will be employed in the illuminations and electrical effects.

The executive committee of the Massachusetts Association of Electrical Contractors had a meeting this week at Young's Hotel and the plans for the national convention in July were matured and discussed. The chairman, John P. Coughlin, reported that July 19th will be the big day of the convention. Delegates from 37 states have already arranged to be in attendance, it was stated, and the success of the affair is more than assured. At the annual meeting of the Massachusetts association the following officers were elected: President, Frank L. Barnes, Boston; first vice-president, John P. Coughlin, Worcester; second vice-president, W. B. Edgar, Fall River; secretary, Henry D. Temple, Worcester; treasurer, H. S. Potter, Boston; director to national association, S. B. Wetherbee, Boston.

Stone & Webster, owners of numerous trolley lines in various parts of the country, have purcased the Indianapolis and Martinsville railway, comprising 30 miles of track.

The old disused Van Choate Electric Company plant in Foxboro, which claimed so much attention a few years ago, was sold last week to a concern manufacturing mill machinery and cloth. It is said to have cost originally about $500,000 and comprises seven brick buildings and about 15 acres of land. The plant had not been disturbed since it ceased operations as a sequel to the litigation extending over several years. Some of the tools were on the benches as they were left when the plant closed down. The Foxboro assessors placed a valuation latterly of only $150,000 on the plant, but the price paid is said to have exceeded that figure considerably. B.

## Ohio.

Cleveland, June 10.—The Roberts & Abbott Company of Cleveland has made its report on the Toledo and Jackson line. This road will be about 70 miles long and it is proposed to run limited trains to make the trip in two hours, which is better time than the steam roads make. Chair cars will be used on these trains, while the regular trolley cars will be used on the local business.

The Columbus Public Service Company is contemplating the installation of steam turbines in its plant on Mound Street. The only question in the way is as to whether the exhaust steam from them will maintain the hot-water heating system, as with the other style of engines.

Within a short time the Cleveland, Ashland and Mansfield Traction Company will be incorporated. Plans have already been made to construct a line from Chippewa Lake on the Cleveland and Southwestern to Mansfield by way of Ashland, Lodi and some other small places. F. E. Myers of Ashland is one of the active spirits in the promotion of the road.

The Prospect Electric Light and Power Company of Prospect has increased its capital stock from $10,000 to $20,000.

There are rumors that gasoline cars may be provided for the line between Chagrin Falls and Sharon, Pa., and that they will run into Cleveland over the Eastern Ohio tracks.

The William Hall Electric Company of Dayton has been incorporated with a capital stock of $18,000. William Hall, C. A. Hall and others are interested.

The Warren Electric Manufacturing Company of Sandusky has been incorporated with a capital stock of $400,000. The incorporators are E. P. Breckenridge, H. B. Warren, L. G. Read, F. Warren and D. J. Mackey.

According to reports, the Rural Transit Company will be organized to operate a number of 50-horsepower gasoline automobiles from that city to Jamestown, Clifton and Cedarville and another line to Marysville. E. D. Evans is interested in the company.

A proposition has been made to the Toledo council by the Arbuckle-Ryan Company to construct a light plant to be turned over to the city. The plan is to have the city advertise for bids on a 2,000-light plant under specifications to be formulated, and when they are in the company will do the construction work at a price thus ascertained. It will not be necessary for the city to issue bonds under this plan. O. M. C.

## Indiana.

Indianapolis, June 10.—The Home Heating and Light Company of Indianapolis is asking the Board of Public Works for a new franchise under which it may be permitted to charge 20 cents a square foot of radiation for hot-water heating instead of 17 cents, which it is now receiving.

A traction line to connect Indianapolis directly with Huntington, Columbia City and Goshen, and with the Northern Indiana lake region, is proposed by the Huntington, Columbia City and Northwestern Traction Company, which began construction during the last week.

The Indiana Supreme Court has decided that street-railway companies operating within the limits of a corporation are not required to put in an interlocking device at crossings over steam lines. The court makes a distinction in this matter between street-railway companies and interurban companies.

W. D. Dodds, representing parties who are interested in the construction of an interurban road from Marion to Hartford City, has been granted a 50-year franchise through Grant County. The franchise gives the right to haul passengers, mail and express and do a general freight business. The passenger rate is not to exceed 1½ cents a mile.

A meeting of the board of directors of the Wabash and Rochester Traction Company was held during the last week and plans provided for reviving the project. The townships along the route have voted $110,000 in subsidies to it, and there seems to be no reason why the line should not be completed.

Eli Marvin, treasurer of the Indianapolis, New Castle and Toledo Electric Railway Company, announces that agents of the company have obtained options on land for the entire right-of-way of the proposed electric belt railway around Indianapolis. This right-of-way is 100 feet wide and 40 miles in length. Mr. Marvin says that the plans of the company contemplate the actual beginning of work on the belt line within a short time.

The Columbus Street Railway and Light Company will build a power house in Columbus. With the new power house will be combined a central steam-heating plant. S. S.

## Michigan.

Detroit, June 10.—George Y. Wisner, a well-known engineer of Detroit, has been appointed a member of the International Waterways Commission.

It is stated that the Ross Construction Company of Chicago will commence work at once on the new electric railway between Bay City and Detroit. It is known as the Detroit and Bay City Traction Company.

The Detroit, Ypsilanti, Ann Arbor and Jackson electric railway has finally succeeded in effecting satisfactory traffic arrangements with the principal boat lines out of Detroit. It is said that express service will now be given at freight rates for the handling of perishable freight, for points east and south.

The directors of the Detroit, Monroe and Toledo electric railway have authorized extensive improvements, principally that of double-tracking between Monroe and Toledo, and an extension of the line to Adrian, to connect with the proposed extension of the Detroit, Ypsilanti, Ann Arbor and Jackson road, from Ypsilanti to Adrian. It has also been decided to handle freight in carload lots, and the purchase of larger terminal facilities was ordered. Coal will be the principal commodity to be hauled between Toledo and Detroit. Monroe Piers, a summer resort, will also receive improvements; a new electric-lighting plant is one of them.

The conductors and motormen of the Saginaw Valley electric railway went out on a strike on Monday, affecting the Saginaw and Bay City traction lines and the interurban line running between these towns. The men want 21 cents per hour and the "two-turn" system, while the companies present a sliding scale of from 17 to 19½ cents. The companies have made no concessions, while the men have dropped their demands from 25 cents and overtime.

The following companies have been incorporated: American Electric Company, Detroit, capital $2,000; Northway Motor and Manufacturing Company, Detroit, capital $30,000. C. G. W.

## Dominion of Canada.

Winnipeg, Man., June 10.—The construction of a power house in Winnipeg by the Winnipeg Electric Light and Power Company, has been commenced and will be 70 by 130 feet, two stories in height. This will be the terminal of the line in Winnipeg now being built from Lac du Bonnet, and it is thought will be in readiness to deliver power to the railway at the city limits by October next. For some time past the work in connection with the generating plant of the Winnipeg electric street railway at Lac du Bonnet has been steadily pushing ahead. A large plant is being installed there, to be driven by waterpower, and develop energy for distribution in Winnipeg. By October next this will be ready for use. A large cable will carry the current to the city limits, and this will be connected with the big plant, which it has just been decided by the directors of the railway company to erect in Winnipeg.

Winnipeg is to have Sunday street cars, by the terms of an agreement between the council and the company.

The Niagara, Dunville and Erie electric railway has received a charter from the government to build a line from St. Catherines, Ont., to Dunville and Port Dover.

The Cataract Power Company has secured a site in Hamilton on which it proposes to erect a large power house.

St. Thomas, Ont., has taken over the gas and electric-light plant, which will in future be run under municipal ownership.

The Winnipeg Electric Company will extend its line from Winnipeg through St. Boniface, Man., to Birds Hill. Construction has already commenced.

The London, Chatham and Western Electric Railway Company has been incorporated with a capital of $3,000,000 as an electric road, and will build 113 miles of track, from London to Windsor, Ont. The company has been granted permission to sell power, with the consent of the municipal councils interested, and to sell light and heat, with the consent of the people. The road must be operated in four years. H.

## Rocky Mountain States.

Salt Lake City, June 9.—Judge John Porter of Iowa is preparing to establish an electric-railway system at Cheyenne, Wyo. His proposition to leading business men of the city is that if they will raise $20,000 of the fund needed by subscription he will furnish $80,000 for the consummation of the project. The enterprise is being favorably considered by local interests.

Col. Judson Spofford of Lewiston, Ida., has been granted a franchise by the City Council for the operation of an electric street railway, which will co-operate with the independent Lewiston-Grangeville electric road.

Simon Bamberger of Salt Lake City has petitioned the City Council of Ogden, Utah, for a franchise for his proposed electric railway in that city.

The Utah Light and Railway Company of Salt Lake City has been granted a substitute franchise in which its many franchises are extended so that all will expire in 45 years. The franchise applied for by the company was for a 50-year extension.

The City Council of Sumas, Wash., has been asked for a franchise for an electric plant for lighting purposes. H. W. Vanderhoof is the petitioner. G.

Reno, Nev., June 10.—The Washoe Power and Development Company of Reno, Nev., will not meet the 75-per cent. cut in rates made by the Reno Power and Water Company. Several cuts in rates have been made in the last few weeks and neither company at present seems willing to come to an understanding. "We cannot give away our products," said President Humphrey of the Washoe company. "We will turn on our current in a few days and what business we do get will make us a reasonable profit."

A representative of the Truckee River General Electric Company states that a survey is being made for a 20-mile extension of the power-transmission line from Carson City, Nev., through the valley of the Carson River to Anderson.

The Verdi Power and Canal Company is about to install a 20,000-horsepower electric plant at its dam at Verdi, Ariz. The purpose of the plant is to furnish power to the mining camps in the valley.

James J. Burke of Salt Lake, Utah, has the contract for the construction of a power plant on the properties of the Conrey Placer Company. The plant will have a capacity of 500 horsepower.

The Electric Light Company of Virginian, Nev., is planning to extend its plant by an addition to the sub-station. When the extension is completed the entire plant will be under one roof. A.

## Pacific Slope.

San Francisco, June 9.—The Ocean Shore railroad has been granted the application for rights-of-way between Santa Cruz and San Francisco. Secretary Bert Corbett of the company says that construction work will be commenced immediately at the Santa Cruz end of the line. The road is to be run by electricity, but the franchise was granted for a steam road so as to bring the line into that classification under the state law which grants certain privileges to steam roads. The attitude of the Southern Pacific steam road toward the progress of the new road is shown by the fact that it has brought suit in the name of the Coast Line railway to condemn rights-of-way on three pieces of property near the beach upon which the Ocean Shore road has secured options for a depot.

An electric fire-alarm system is about to be installed at Ukiah, Cal. Electric fire alarms are meeting with considerable favor throughout the western cities, and it is being proved that they are very successful in minimizing the loss of property by fire.

The San Joaquin Light and Power Company has

been incorporated at Los Angeles, Cal., with a capital stock of $[illegible],000,000. The directors are W. G. Kirckhoff, K. Cohn, A. Ha[illegible], H. W. [illegible], and others.

At a special meeting of the Battle Creek Power Company, held June 5th, it was decided to authorize an issue of 30-year bonds in the sum of $1,000,000. It is the intention to install a hydro-electric plant for the transmission of power from Battle Creek in Shasta County to the mining districts and towns in Northern California.

Bonds are to be issued by the San Luis Obispo Gas and Electric Company for the erection of a new electric plant at San Luis Obispo, Cal. W. F. Boaman, president of the company, and A. M. Hunt, electrical engineer, are making arrangements for the new plant. The building will cost about $35,000.

The Edison Electric Company of Los Angeles is buying a right of way through the northern part of the Toluca tract for its power line, running between Kern River and Los Angeles. Steel towers are to be used instead of poles.

The Edison Electrical Company has a large force of men employed in rebuilding the light and power system at Whittier, Cal. The secondary system now in operation will be replaced by a primary system of 220 volts. The transformers at the distributing station will be dispensed with and instead there will be a system of transformers placed throughout the city.

E. H. Liebe of Clarkston, Wash., has asked the city authorities of Spokane for a franchise for the construction of a street railway.

The streets of San Jose, Cal., will soon be free of telephone and electric-light wires in the business center. The city authorities have compelled the companies to place the wires underground. A.

## PERSONAL.

William von Puhl, superintendent of the electric department of the Cincinnati Gas and Electric Company of Cincinnati, Ohio, has resigned and will go south to enter business.

Professor E. B. Huntoon, it is announced, will succeed Prof. J. C. Kelsey, who resigned recently from the position of professor of telephone engineering at Purdue University, Lafayette, Ind.

Edward A. Leslie, general manager of the Kings County Electric Light and Power Company, died on June 5th at his home, 262 Hancock Street, Brooklyn, of pneumonia. He was born in Harrisburg, Pa., in 1849.

Professor Charles P. Matthews has been selected for the head of the department of electrical engineering at Purdue University, Lafayette, Ind., to succeed Prof. W. E. Goldsborough, who has severed his connection with Purdue some time ago.

The new executive committee of the Chicago branch of the American Institute of Electrical Engineers recently re-elected Mr. K. B. Miller chairman. Mr. H. R. King of the Western Electric Company was elected local secretary. Mr. Miller, as members of the Institute are aware from his previous fulfillment of the office of chairman, will perform his duties in his usual thorough and painstaking manner. Mr. King is one of the leading engineers of his company and will no doubt carry out his part of the work in the efficient manner of his predecessor, Mr. P. Junkersfeld.

W. S. Heger has recently been made assistant to the vice-president and general manager of the Allis-Chalmers Company. He was born in 1857 at Fort Simcoe, Wash., and received his education both in this country and Europe, spending seven years in Vienna, Austria. After receiving the degree of M. E. at Stevens Institute of Technology in 1879, Mr. Heger's business career began in the mechanical drafting room of the Edgemoor Iron Works. In 1885 he went into business upon his own account as a contractor and electrical engineer, and later became sales agent and constructor for the Edison Company for isolated lighting in the states of Delaware, Maryland, the Virginias and the Carolinas. In 1889 he was sent to San Francisco as district manager for the Pacific Coast territory for the Edison Company and for the Edison United Manufacturing Company. He built up the organization there, which exists today under the General Electric Company, and established a large and successful business. In 1892 he accepted the place of general manager of the Wilmington City Railway Company, Wilmington, Del., and spent three years there rebuilding and operating the road. Returning to the Pacific Coast again in 1895, he became the district manager for the Westinghouse Electric and Manufacturing Company, with headquarters in San Francisco. He built up a strong selling organization and made a wide market for the products of his own company and those of the Sawyer-Man Com-

W. S. HEGER.

pany. During Mr. Heger's [illegible] the [illegible] long-distance power [illegible] Pacific Coast were [illegible] of these many unbounded [illegible] the erection of [illegible] of the company in the [illegible] these long-distance transmission [illegible] valuable part of his experience. Mr. Heger [illegible] quarters with the Allis-Chalmers Company [illegible] the general offices in Milwaukee.

[illegible] M. Haines, second vice-president and general manager of the Northern Texas Traction Company, owning the interurban line between Fort Worth and Dallas, Texas, and the street-railway lines in Fort Worth, died on June 1st in Fort Worth. He was stricken with typhoid fever on May 1st. Mr. Haines was a well-known and well-liked civil and electrical engineer and drew the plans and superintended the building of the interurban road he managed. He also built a number of electric roads in other parts of the country, being for some time interested with the Bishop-Sherwin syndicate of Cleveland. He built the present electric lines in Para, Brazil, and in Caracas. Prior to going to Fort Worth he was for a time with the Northern Pacific railroad. Mr. Haines was born in Pennsylvania 45 years ago, where he studied, and subsequently he graduated from the Massachusetts Institute of Technology. His remains were taken to Boston. He is survived by his mother and two brothers.

## ELECTRIC LIGHTING.

M. Focht of Kansas City, Mo., it is reported, contemplates erecting an electric-light plant at Springdale, Ark.

The Lawrence Electric Light Company of Lawrence, Kan., has been incorporated with a capital stock of $40,000.

The city of Ozark, Mo., has granted a franchise to S. E. Branson to erect an electric-light plant and operate it for 20 years.

The New Valley Junction Water and Light Company of Valley Junction, Iowa, has been incorporated with a capital stock of $12,000.

An electric-light plant is about to be installed in Dayton, Iowa, and one of those interested in the project is H. E. Nelson, M. D., of Dayton.

J. L. and W. R. Page and others have incorporated as the Natural Gas, Electric Light, Heat and Power Company of Olean, N. Y., with a capital of $50,000.

The city of Monticello, Ga., has voted affirmatively on the proposed $30,000 bond issue for the construction of electric-light plant, waterworks and sewerage system.

Conway Springs, Kan., a thriving little city in the southern part of the state, is considering a proposition made by Bert Strong to put in an electriclight plant.

The electric-light plant at Anadarka, Okla., constructed by the El Reno Light and Power Company and costing $11,000, has just been put into operation. It will be run in connection with the waterworks.

The Columbus (Texas) Light Company has been incorporated with $10,000 capital stock by J. W. Towell, Carey Shaw and Josiah Shaw to operate an electric-light and power plant.

By the terms of an ordinance just passed by the Chicago City Council the local elevated railways are required to place an illuminated street sign at each end of the platform at each station and one sign in the center of each platform to be placed under electric lights.

A recent dispatch from the City of Mexico says: "The Mexican Light and Power Company, a Canadian concern operating here, has purchased all the light and power plants in this city. This is believed to be the biggest individual deal in the commercial history of Mexico. The amount paid the Mexican Gas and Electric Company is $5,000,000 and the Ildefonso company $4,000,000 in stock and $2,000,000 in bonds are given for its property, the total figuring $11,000,000. The total expenditures of the Mexican Light and Power Company, when work is completed, will be $40,000,000."

The proposition to light the streets and alleys of Chicago through means of the waterpower to be developed by the Chicago Drainage Canal at Lockport, Ill., is again up for consideration by the council. The proposition to generate electricity from the use of the Lockport waterpower was considered by the last council, but negotiations were suspended because the city insisted upon receiving the electricity at cost, whereas the canal board wanted a profit. City Electrician Carroll is quoted as saying that "There is some 20,000 horsepower there, while we now use only 6,000, but we cannot be expected to pay more than cost, because that is what the city is paying now for its own electricity. If the city can make arrangements with the canal board it can be made the best lighted city in the world, and well-lighted streets and alleys are one of the greatest assurances against crime."

## ELECTRIC RAILWAYS

[illegible]

[illegible]

[illegible] entry.

[illegible] nated by the traction companies and sent through St. Louis over the steam lines. While rates are rather demoralized on western lines, the traction [illegible] interline business and have met with considerable success.

A new 25-mile electric railway along the Hudson River from Albany to Catskill is being planned by the Upper Hudson Electric and Railroad Company. Headquarters are at Newburg, N. Y., the capital is $500,000 and the directors are Eugene Wolf of Athens, N. Y., Luke F. Gillespie of Newburg and F. J. Curnick of New York.

A certificate of incorporation has been issued to the Oran Electric Railway Company of Oran, Mo. The company is capitalized at $[illegible] and proposes to build an electric road 10 miles in length, running from Oran to Rockview, the entire line to be within Scott County. The incorporators are headed by M. G. Gresham.

The Kansas City, Stranger Valley and Western Railway Company of Kansas City, Kan., was chartered on June 8th. Its capital stock is $100,000 and its object is to build an electric line from Kansas City to Topeka, through Wyandotte, Leavenworth and Jefferson counties. The incorporators are W. Laming and S. J. M. Naughton of Tonganoxie, Kan., W. A. Adams and M. M. Gallagher of Easton, Kan., and James T. Manning, Charles Grover and E. M. Lamkin of Kansas City, Mo.

The Havana Central Railway Electric Company has been organized in New York by Canadian and American capitalists. The capital stock will consist of $5,000,000 in stock and $10,000,000 in bonds, but one-half the latter will not be issued for the present. The company intends building 120 miles of electric railway radiating from the city of Havana, and taking in 30 towns. One line will extend across the island to Del Rosario. Edwin Hanson of Montreal will probably be president.

The directors of the new electric road to North Adams, Mass., expect to have work begun on the line within a short time and to have the road in operation within the year. In securing the right-of-way they have been able to purchase at reasonable prices, except in a half-dozen cases, and in these, acting under the state charter, condemnation proceedings have been begun and an appeal has been made to the state Board of Railroad Commissioners, which will give a hearing and fix the damages to be paid the land owners who refuse to sell at what the directors consider a reasonable price.

Articles for the incorporation of the Green Bay (Wis.) Traction Company, with a capital stock of $1,000,000, were filed recently. A. M. Murphy, W. P. Wagner and B. L. Parker are named as the incorporators. This is said to be a step in the contemplated plan of consolidating the interests of the Fox River Electric Railway and Power Company, operating the city street-railway line and the lines to De Pere and Duck Creek, and the Knox Construction Company, operating the Green Bay-Kaukauna electric road. It is the intention to make extensive improvements in the lines already in operation and to construct and operate other lines, among them a road from Green Bay to Manitowoc.

The Washington, Baltimore and Annapolis Electric Railway Company, which has under construction a double-track electric railway from Baltimore to Washington, and which will convert to electricity the old Annapolis and Elkridge railroad, which it owns, has applied to the City Council in Baltimore for a franchise to permit its cars to enter the city. The Baltimore Terminal Company has been organized in the interest of the railway, and it is proposed to establish a terminal near the center of the city. The company has a private right-of-way for the entire distance and will be able to make high speed. It is said that there will be 27 miles of straight track in the 31-mile line between the limits of the two cities, and already more than 60 per cent. of the grading has been completed. John Sherwin of Cleveland, who is associated with T. Bishop in the Baltimore and Washington line, is vice-president of the Northern Texas

Traction Company. Others who are in the latter company from Cleveland are Messrs. Charles E. Adams and John Masterton.

## TELEGRAPH.

The Pacific Commercial Cable Company announces a reduction of 20 cents a word in the rate to Japan, to take effect on July 1st. The new rate will be $1.21 a word from San Francisco to Tokio.

George G. Ward, general manager of the Commercial Cable Company, sailed on the Campania for England on June 10th to complete, it is said, the contract with an English firm for laying a new Atlantic cable. This cable will be laid by the shorter route and will be of larger diameter than any cable at present owned by the company.

## SOCIETIES AND SCHOOLS.

The degree of B. S. was conferred by the Massachusetts Institute of Technology, at its commencement exercises this year, upon 244 graduates, and the degree of M. S. upon 18.

Owing to the conflict of dates with other societies it has been decided to alter the dates of the Erie convention of the International Association of Municipal Electricians to August 23d, 24th and 25th. Some of the plans for the entertainment of the delegates will be different from any had in the past. Papers to be read will be of importance and valuable in the conduct of the business of the association's members. Frank P. Foster of Corning, N. Y., is secretary.

## PUBLICATIONS.

A bulletin describing the battery equipment of the Frontier Telephone Company's exchange in Buffalo has been issued by the National Battery Company of Buffalo. The bulletin is well illustrated with pictures of the interior of the exchange. This installation was described in the Western Electrician last week.

Candee potheads and Okonite telephone and telegraph wires, for which the Central Electric Company of Chicago is agent, are described in a neat circular sent out by the company. The potheads are designed to prevent the destructive attack of moisture upon paper-insulated cables.

The Jeffrey Manufacturing Company of Columbus, Ohio, has recently issued an attractive bulletin on Jeffrey portable outfits for excavating and screening. The bulletin is well illustrated with fine half-tone cuts, showing the various applications of this type of machinery. Another bulletin is upon the subject of pulverizers for crushing coal, stone, etc.

Rossiter, MacGovern & Co. of Jersey City, N. J., who deal in all kinds of second-hand electrical apparatus, have issued a new catalogue of the machines they have available, which is very complete. The company guarantees all apparatus which it sells. It has extensive shops at Jersey City for the repair of machines, which are all thoroughly overhauled.

The American Steel and Wire Company of Chicago has issued a treatise on the use of sulphate of iron and copper in water purification. The pamphlet contains reports of experiments conducted at Anderson, Ind., by government experts. In the drawing of wire the steel is first dipped in acid to take off the scale. This, of course, produces a large quantity of sulphate of iron, which is therefore a by-product of wire mills. The American Steel and Wire Company produces much of the sulphate in its various mills.

The Cincinnati Milling Machine Company of Cincinnati has just issued a new treatise on tool-room grinding and grinding machines. This book contains considerable valuable information on the subject of cutter and tool grinding. Part 1 is devoted to the company's No. 1 Universal cutter and tool grinder. Part 2 is devoted to No. 2 grinder, which is a new one, and covers a field for which there has been no grinder thus far. The numerous illustrations show exactly how to handle the work, and the descriptions in connection with them give data on cutter grinding, no matter what machine is used. The book is sent free to those interested in this subject.

Words can hardly do justice to the handsome catalogue which has just been issued by the Wellman-Seaver-Morgan Company of Cleveland, Ohio. The book has 103 pages, 8¾ by 12 inches in dimensions. It is devoted to ore and coal-handling machinery, and a glance through its pages will reveal some of the very finest evidence of the printers' and engravers' skill. Many of the pictures take up a whole page, and they illustrate admirably the apparatus manufactured by the company. In these days of high-class advertising literature, handsome catalogues are common, but those which can equal this in the quality of work and the arrangement of the material are few and far between.

As brought out by Mr. John Craig Hammond at the Denver-Colorado Springs National Electric Light convention, the best kind of advertising is opportune advertising. The importance of this fact is evidently recognized by the Crocker-Wheeler Company of Ampere, N. J., for it has issued a new pamphlet upon "The Vital Subject of Lighting." The cover is adorned with a picture of a typical broncho-busting scene, and the picture will at once attract the eye of those who attended the convention, and saw the broncho busting there. As with electrical men, so it is with the broncho buster—the vital subject is "lighting." The pamphlet is devoted to alternating and direct-current generators for lighting.

## MISCELLANEOUS.

The amount of electricity sold in the London districts by the County of London Electric Supply Company during the first quarter of 1905 is estimated to realize about $209,000, which compares with $189,500 for the corresponding period of last year.

William Marconi sailed for Europe on June 10th on the Campania, and announced his intention of trying to keep the vessel in communication with both shores each day of the voyage, this feat having been accomplished for three days on a recent trip, it is reported.

The Western Union Gas and Electric Company, with headquarters at Aurora, Ill., is the name of a new lighting company formed by the consolidating and merging of the Joliet Gas Company, the La Grange Gas Company and the Elgin-American Gas Company.

A company has been formed to run a service of public electric buses between points in Malta not yet covered by the new street railway. For public service there will be a 20-horsepower 17-seat single-deck bus, four 24-horsepower 36-seat double-deck buses, and one 24-horsepower lorry.

For demonstrating the possibility of sustaining without harm a high-frequency high-tension current Prof. Elihu Thomson of Lynn, Mass., permitted a current at 500,000 volts to pass through his body, it is said. This was done without his experiencing the slightest physical discomfort. Professor Thomson adjusted a special apparatus to his body and a high-frequency current was used.

In connection with the telephone service which the Long Island railroad is installing, the railroad will begin road inspection by emergency crews of four men, who will constantly patrol the road in gasoline-motor cars running on the tracks. When the electrical road opens there will be two of these crews, which will keep in touch with headquarters by telephone. In particular they will look after the transmission lines. The automobiles weigh 750 pounds, and will carry complete kits of necessary tools.

The General Electric Company at Schenectady, N. Y., says the World's Work, employs about 800 men who devote much of their time to developing new ideas. It spends $2,500,000 a year in this development work. The Westinghouse Companies do the same thing; so does every progressive manufacturing concern of any consequence in the United States. And it is these unknown men, grappling with the every-day, practical problems of great manufactories, who make most of the inventions of immediate commercial value.

The Census Bureau is completing the first of the quinquennial census of the manufactures of the various states under the new provision for the compiling of these figures every five years instead of at 10-year periods as formerly. Michigan is the first state for which complete returns have been received. There are 14 establishments in the state for the manufacturing of electrical machinery, apparatus and supplies, with a combined capital of $413,732, under the control of eight persons. Of the capital stock $1,300 is invested in land, $6,500 in buildings, $81,847 in machinery, tools, etc., and $324,085 in cash and sundries. They carry on their pay rolls 60 salaried employes and give employment to 529 persons. The combined value of the product for the year, including custom and contract work, is placed at $702,102.

## TRADE NEWS.

The Nebraska Electrical Company and the Neally Bros. Company have consolidated their business at 312 South Twelfth Street, Lincoln, Neb.

William T. Spranley, L. C. Reed and others have incorporated as the Hattiesburg Electric Supply Company, Hattiesburg, Miss., with $10,000 capital stock.

H. L. Canfield, treasurer and general manager of the Delphos Electric Light and Power Company of Delphos, Ohio, has secured a complete franchise for 25 years, and a modern electric-light and power plant will be erected. Modern equipment will be used throughout. The plant will supply New Straitsville, Ohio and Delphos, two miles apart, and will be located at the former place. Bids for boilers, engines, arc lamps, poles, wires, etc., will be received by Mr. Canfield of Delphos.

The Toctos Medical Company, No. 1 Corso Romana, Milan, Italy, wishes catalogues and prices from American manufacturers of electric apparatus for medical use.

The Capital Electric Company of Richmond, Va., has been organized with $1,500 capital stock to do a general electric contracting business for the installation of power, light and heat plants, etc. F. J. Whybrew is president, J. J. Tresnon secretary, and W. B. Jennings treasurer.

The Chicago office of the Reeves Engine Company, which is under the management of Joseph B. Hall, has recently been moved from 1612 Monadnock Block to 805 Ellsworth Building. The telephone number remains the same. Mr. Hall reports the western business of his company as very satisfactory.

Sealed proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until July 11th for the installation of a conduit and electric wiring system for the court house and postoffice at Lincoln, Neb., in accordance with the drawings and specifications, copies of which may be obtained at the above office or at the office of the superintendent of construction at Lincoln.

The bureau of supplies and accounts, Navy Department, Washington, D. C., is soliciting bids until June 27th for furnishing eastern navy yards with the following: Schedule 301, motors, generating sets; schedule 302, generators; schedule 303, incandescent lamps, wire, rheostats, ebonite, mica and miscellaneous electrical supplies. Blank proposals, etc., can be obtained on application to the bureau at Washington or to the navy pay office in New York.

The Ingersoll-Sergeant Drill Company and the Rand Drill Company have been united into a new company called the Ingersoll-Rand Company. The new corporation was formed under the laws of New Jersey with a capital of $10,000,000, of which $5,000,000 is preferred stock and the balance common. This is a union of valuable patents and of expert engineres of large experience in this special line of work. Improved machinery and better service will result. The factories of the two companies are located at Phillipsburg, N. J., Easton, Pa., Tarrytown, N. Y., Ossining, N. Y., Painted Post, N. Y., Thirty-fourth Street, New York city, and Sherbrooke, Quebec. They will all be operated. The officers of the Ingersoll-Rand Company are as follows: President, W. L. Saunders; first vice-president, George Doubleday; other vice-presidents, Jaspar R. Rand, John A. McCall, J. P. Grace, W. R. Grace, George R. Elder; treasurer, W. R. Grace; secretary, F. A. Brainerd.

The many friends in the West among the electrical people of George W. Beltzhoover, formerly special passenger agent of the Pennsylvania railroad, with headquarters at Chicago, will be interested to know that Mr. Beltzhoover has been made district passenger agent, with headquarters still in Chicago. The appointment is one well deserved, as Mr. Beltzhoover has been with the Pennsylvania railroad for 29 years, beginning his career as a messenger boy at the Pittsburg offices of the company. The position which he has recently been given is a new one, and it was created with a view of pursuing a still more aggressive policy in the passenger affairs of the Pennsylvania railroad. Mr. Beltzhoover's extended railroad experience and business forcefulness, to say nothing of his courtesy and ease in making and holding friends, are qualifications which fit him eminently for this newly created position. Those who know Mr. Beltzhoover best prophesy for him a career as a rapidly rising railroad man.

Friends throughout the West of the popular railroad man, L. F. Vosburgh, will be interested to know of his recent promotion and appointment to the position of general western passenger agent for the Lake Shore railroad. For quite a number of years Mr. Vosburgh has been on duty, in command of the Lake Shore ticket office in Chicago, at the corner of Clark and Monroe streets, filling the position of general agent for the Lake Shore railway. Mr. Vosburgh has a large acquaintance, not only among the electrical people, but the general public of the West. Theatrical people, politicians, merchants and other high-class patrons of the passenger department of the Lake Shore railway are among his acquaintances. His work with the electrical people of the West has been largely along the line of handling electrical "specials," and in this capacity he has always proved himself not only courteous, but a thoroughgoing executive and master of the railway passenger business. Mr. Vosburgh's headquarters have been changed from the Shore railway at the La Salle Street depot, Chicago, city ticket office to the general offices of the Lake

An error in relation to the cuts illustrating Fort Wayne prepayment wattmeter, on page [illegible] of the Western Electrician of June 10th crept in after the press proof had finally been passed upon, the first two cuts being accidentally transposed by the printer. Fig. 1 is an outside view of the type K prepayment wattmeter, but the type W is shown instead, while type K is shown over the caption line belonging to type W. Fortunately the type letters of the two instruments show upon the faces, and it is hoped from this fact that no confusion has arisen over the error.

## BUSINESS.

The Pleasantville Electric Company of Camden, N. J., has been incorporated by Frank C. Meeter and others, with a capital of $125,000.

The Western Electric Company of Chicago reports a continuance of brisk trade in Sunbeam lamps. Its sales of Sunbeam lamps, for this season of the year are unusually large, which is undoubtedly due to the uniformly high quality of the lamp.

The Chicago House Wrecking Company, Chicago, states that its purchases from the St. Louis World's Fair enable it to furnish almost anything in the electrical-supply line. In addition to wires and cables, incandescent lamps and instruments, it can furnish almost everything used in electrical construction work, and will be pleased to send its new and complete catalogue to those interested.

The popularity of the [illegible] Sandiss motor [illegible] parts of St. Louis [illegible] with the many [illegible] motor. The [illegible] the month of May [illegible] lating motor [illegible] during the year 1904. It [illegible] size of one-half horsepower [illegible] 60 cycles, also winding them for [illegible] mercial frequencies. The company [illegible] heavy increase in the demand for [illegible] current ceiling fans, the factory being [illegible] the utmost to supply the demand at present.

Users and buyers of Bennett lever [illegible] switches and DeVeau telephones in the West will be interested to know that the offices and stockrooms of William P. Crockett, well known as western agent of these companies, have lately been moved to much enlarged quarters in the same building formerly occupied at 165 South Canal Street, Chicago. The entire ground floor and basement will be occupied and the stock carried has been materially added to. Mr. Crockett, who for the last five years has represented the manufacturers of this apparatus in his present capacity, took hold of this agency when the business in this section of the country was comparatively undeveloped, and the wide sales of these goods in this territory at present speaks emphatically for his energy and enterprise. Mr. Crockett was recently elected as director of the [illegible] tion.

[illegible] and Lima Traction Company. The order called for 2,000 40-foot, 7-inch poles, which were shipped in less than three weeks. That, the company says, is [illegible] Hamilton and [illegible] portant orders for Michigan poles. A novelty which this company manufactures is a small special wrench for [illegible] wrench is a great convenience in installing this class of apparatus.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued (United States Patent Office) June 6, 1905.*

791,457. Apparatus for Treating Liquids. Leon Dion, New York, N. Y., assignor to the Americus Electro-Hermatic Company, New York, N. Y. Application filed May 24, 1904.

Electrodes arranged within a receptacle or reservoir above and below the entrance of the inlet-pipe are used for supplying an electric current to the liquid.

791,464. Electric Motor-controlling Device. Arthur E. Handy, Providence, R. I., assignor to the Rhode Island Elevator and Machine Company, Providence, R. I. Application filed September 19, 1904.

An electric motor having a double winding and two commutators is supplied with an auxiliary switch and an electromagnet controlled in its action by the movement of the auxiliary switch to throw the windings on the armature from multiple to series and vice versa; the switch can only be made to make or break the connections to the magnet when the motor is at rest.

791,491. Facsimile Telegraph Apparatus. Herbert R. Palmer, Cleveland, Ohio, assignor to the Electrograph Company of America, Cleveland, Ohio. Application filed February 25, 1901.

In a facsimile telegraph instrument are a power mechanism for frictionally driving the instrument, mechanism for retarding the instrument, a device for controlling the retardation operated by the power mechanism, and an electric device for causing the application of the power to the retarding mechanism.

NO. 791,494.—APPARATUS FOR MAGNETIC SEPARATION.

791,492. Dynamo Electric Machine. Charles A. Parsons and George G. Stoney, Newcastle-upon-Tyne, England, said Stoney assignor to said Parsons. Application filed April 18, 1904.

A continuous-current dynamo, comprising field magnets having pole-pieces separated by air gaps or non-magnetic bridge pieces and a main shunt field winding, has a series winding uniformly surrounding the armature having its axis in the line of commutation. The number of ampere turns in the series winding exceeds the number of ampere turns in the armature by at least one and one-half to three times.

791,494. Apparatus for Magnetic Separation. Clarence Q. Payne, Stamford, Conn., assignor to the International Separator Company. Application filed February 2, 1903.

A transversely laminated separating carrier is provided with magnetizable laminæ whose edge faces are provided with projecting portions which create a series of point and line dispersions of the flux density on the surface of a cylinder. Means for magnetizing the cylinder are provided. (See cut.)

791,528. Sewing-machine Motor. Homer J. Young, Toledo, Ohio. Application filed February 20, 1904.

An electric motor comprising a rotor is mounted concentrically upon the shaft and has driving connection with the latter. A journal, rigid with the rotor and arranged concentrically within the latter, carries a stator mounted concentrically within the rotor, with means for holding the stator against rotation.

791,537. Barrel-head Planer. Gustave Cluthe, Cincinnati, Ohio. Application filed December 27, 27, 1904.

The planer consists of an electrical motor, having handle for guiding it and a knife disk secured to the end of the motor shaft, the disk being rounded upon its edge, and having a series of radial slots. Knife blades are secured in the slots and project beyond the face of the disk, the amount of projection increasing toward the circumference.

791,547. Vapor Electric Apparatus. Samuel Ferguson, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed January 18, 1904.

In a vapor electric apparatus is a pivoted member for supporting a rectifier or similar vapor electric device. A magnet having an armature, pivoted to the member, is provided with an exciting circuit. Means actuated by the rocking or tilting of the pivoted member open the exciting circuit.

791,555. Process of Stripping Tin. Henry W. Hemingway, Walthamstow, England. Application filed October 29, 1902.

A process for stripping tin from tinned iron, recovering the tin and revivifying the exhausted stripping liquor consisting in immersing the tinned iron in a bath composed of a solution of persulfate of iron slightly acidified. This is treated electrolytically for the purpose of depositing the tin in a metallic state upon any suitable cathode.

791,556. Trolley Wheel. John Hensley, Huntington, Ind. Application filed July 20, 1904.

A lubricating device in connection with the trolley wheel is the feature of novelty.

791,562. Electric Flash Sign. John C. Lion, Philadelphia, Pa. Application filed February 20, 1905.

Associated with a number of contacts forming circuit terminals is a revoluble drum carrying interchangeable bars. Each of the bars is angular in cross-section and provided with a web arranged to follow the contour of the drum, the remaining web being cut away at intervals to form tongues for engaginng the contacts.

791,572. Bipolar Vacuum Electrode. Earle L. Ovington, Boston, Mass. Application filed March 6, 1905.

A bipolar vacuum electrode for therapeutic treatment is of such a construction that the electric circuit through the electrode may be completed by the body of a patient.

791,573. Audiphone Instruction Apparatus or Set. Herman G. Pape, New York, N. Y. Application filed November 9, 1904.

An audiphone instruction set includes a primary circuit, a teacher's receiver in the circuit, an earpiece and an induction coil paralleled in the primary circuit. A secondary circuit includes the secondary winding of the induction coil, an earpiece in the secondary circuit and provision for cutting either the first named earpiece or the induction coil out of circuit, one independently of the other.

791,574. Automatic Railroad Signaling. Frank P. J. Patenall and George H. Dryden, Baltimore, Md. Application filed March 13, 1905.

In a railway signal system are combined a signal mechanism adapted to indicate danger, caution and clear and controlling mechanism for the clear and caution positions, one operated from the home and the other from both the home and a distant station, whereby upon failure of one the other will perform its functions.

791,582. Automatic Starting Device for Vapor Apparatus. Robert E. Russell, Schenectady, N. Y., assignor to the General Electric Company. Application filed March 16, 1904.

Combined with a vapor rectifier having main electrodes and a starting electrode are a storage battery, a resistance and a starting and controlling switch for starting the rectifier through a local circuit including the resistance and battery, and for then eliminating the resistance and placing the battery [illegible] rectifier.

791,591. Electromagnet. August Sund[illegible] L. Lindquist, Yonkers, N. Y. Application filed October 27, 1904.

A vertically disposed [illegible] able armature. A frame [illegible] surrounds the armature and [illegible] coinciding with the [illegible] Frames are [illegible] frame, and means for [illegible] tween the side frames are [illegible].

NO. 791,656.—TELEPHONE REPEATER.

791,594. Electromagnetic Block System. Guion Thompson, Two Harbors, Minn., assignor to the Thompson Safety Appliance Company. Application filed May 16, 1901.

Combined with a series of normally [illegible] circuits, each including a source of electricity, are the coil of an electromagnet, a normally [illegible] contact adapted to be closed by the [illegible] net is energized and a normally closed [illegible] contact adapted to be opened by the [illegible] other of the circuits when the last-named magnet is energized.

791,603. Electrical Contact Device. Henri [illegible], Paris, France, and Cipriano Portillo, Madrid, Spain. Application filed July 10, 1902.

A current-taking support for [illegible] and the like is provided with a base [illegible] having a grooved edge, and also [illegible] taking rods held fixed in use and [illegible] grooves.

791,633. Trolley. David Lippy and Abraham Nicodemus, Mansfield, Ohio, assignors of one-third to George Moorhouse, Mansfield, Ohio. Application filed November 7, 1904.

Divergent arms fixed to the trolley harp keep the wheel upon the wire.

791,635. Electrode for Primary Batteries. Theodor Mann and Carl Goebel, Duisburg, Germany. Application filed January 21, 1903.

An electric primary battery is composed [illegible] carbon electrode having a working surface which is greater than the surface of a plane having the same [illegible] dimensions as the electrode. A zinc [illegible] acid-proof insulators that reduce its working surface, is a special feature of the device.

791,655. Telephone-current Reinforcer or Relay. Herbert E. Shreeve, Newton, Mass., assignor to the American Telephone and Telegraph Company, Boston, Mass. Application filed July 8, 1904.

Telephone-current retransmitting and reinforcing apparatus comprises a magnet [illegible] force. A receiving or magnetization-varying coil surrounds the pole of the magnet [illegible] initial field. A veritable-resistance transmitting medium and a magnetic connection [illegible] extending directly between the varying magnetic field and the transmitting medium complete the apparatus.

791,656. Telephone-current Reinforcer or Relay. Herbert E. Shreeve, Newton, Mass., assignor to the American Telephone and Telegraph Company, Boston, Mass. Application filed February 28, 1905.

In a system for the reinforcement or renewal of telephone currents are a main telephone circuit and a relay apparatus associated therewith, comprising a receiving magnet and transmitting electrodes actuated thereby to receive telephonic impulses from one circuit or part circuit, and to amplify and retransmit the impulses in another circuit. (See cut.)

791,657. Telephone Transmitter. Emil R. Snyder, New York, N. Y., assignor of one-half to Rudolf Lenk, Brooklyn, N. Y. Application filed March 21, 1904.

A telephone transmitter comprises a casing, diaphragms set therein, a support located between the diaphragms, disks or plates, carried by the support yet insulated therefrom, loose contact bodies interposed between the disks and the diaphragms, and means for conducting an electric current to the disks and diaphragms respectively.

791,673. Electric Meter. Frank P. Cox, Lynn, Mass., assignor to the General Electric Company, Schenectady, N. Y. Application filed March 2, 1903.

In the meter are two main-current armature paths in which the currents conspire to produce rotation, and means for adjusting the proportion of current flowing though the paths. A feature of the meter is a bath of mercury in which the movable element is submerged.

791,691. Electric Heater. William S. Hadaway, Jr., East Orange, N. J. Application filed August 4, 1903.

An electric heater comprising a resistance plate is composed of wrought sheet metal cut into a continuous strip and having its original grain undisturbed.

791,730. Electrical Mouth Bath. Johan J. Stanger, Ulm, Germany. Application filed June 1, 1903.

A perforated vessel adapted to receive a liquid forms one electrode of an electric circuit. A porous covering is placed about the vessel, and a second electrode is arranged to be applied to any portion of the body. The vessel is then inserted in the mouth.

791,750. Trolley-retrieving Device. Henry B. Clarke, Oak Park, Ill. Application filed September 3, 1904.

Besides the usual spring device on the trolley base there is a dash-pot arrangement operatively connected with the trolley pole.

791,780. Electric Time Switch. Jacob Helmstadter, Jr., McKeesport, Pa. Original application filed December 11, 1903. Divided and the application filed July 26, 1904.

Combined with an electric switch are an alarm-winding shaft in an alarm clock, an arm on the winding-shaft, a spring piece extending around and under the switch in its lowered position, and a single lever formed of wire actuating the switch.

791,797. Electric Self-winding Clock. Apollinarius von Kaspis, Weehawken, N. J. Application filed June 23, 1904.

A self-winding clock comprises a spring shaft and a spring-driven clockwork, an electric motor, an electric circuit for the motor and a motor switch in the circuit, operated from the intermediate driving gear of the clockwork.

791,816. Current-collecting Device for Electric Cars. Leon W. Pullen, Philadelphia, Pa., assignor to the Wireless Railway Company. Application filed July 18, 1904.

A current-collecting device extending from axle to axle close to the roadbed is sustained by insulated supports from the axles, with freedom of lateral movement. Connecting means are placed between the collecting device and vehicle body whereby the body is free for vertical movement, but not lateral movement, relatively to the collecting device.

791,835. Trolley. Louis M. Steele, Middletown, Ohio. Application filed November 12, 1904.

Details are described.

791,836. Electric Train-control System. August Sundh, Yonkers, and Axel Magnuson, New York, N. Y. Application filed February 16, 1905.

A source of alternating-current supply drives alternating-current motors on the cars. Circuits adapted to connect the motors to the source of supply and controlling circuits therefor on each car, and inductive means for operatively associating the controlling circuits between the cars, are the essential features.

791,856. System of Electrical Distribution. Vincent G. Apple, Dayton, Ohio. Application filed February 18, 1904.

In a system of electrical distribution is a working circuit including the winding of a transformer and working devices. A condenser, a path for the discharge of the condenser including another winding of the transformer and a circuit closer, a path for charging the condenser having a gap therein through which the condenser cannot discharge and means for creating electrical impulses in the charging path of the condenser capable of jumping the gap are the patentable features.

791,882. Thermostat. John H. Cornelison, St. Louis, Mo. Application filed February 15, 1905.

A spring member susceptible to temperature variations makes and breaks the electric circuit.

791,885. Controller for Electric Motors. Arthur C. Eastwood, Cleveland, Ohio. Application filed September 14, 1904.

A controller having a spindle and segmental contacts carried thereby, includes contacts arranged to form a reversing switch. A contact arm is operated from the spindle. A starting rheostat is connected to fixed contacts and a series of contact buttons are placed to coact with the contact arm.

791,886. Controller for Electric Motors. Arthur C. Eastwood, Cleveland, Ohio. Application filed September 16, 1904.

A controlling system for electric motors includes a bank of resistance, switches connected to govern the resistance including a switch for cutting out the entire bank of resistance, a magnet movable adjacent to the switches, contact strips and brushes carried by the magnet in engagement with the contact strips.

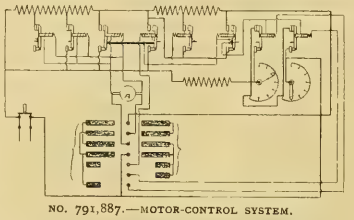
791,887. Motor-controlling System. Arthur C. Eastwood, Cleveland, Ohio. Application filed October 24, 1904.

Means are provided for reversing the motor, also means for automatically causing a step-by-step variation of the current flow occurring between the time when current is applied after operation of the reversing means and the time the armature reverses its direction of rotation. (See cut.)

791,892. Telephone Transmitter. Milton J. Fletcher, San Antonio, Texas. Application filed March 3, 1904.

A telephone transmitter, having a cup carrying a fixed and a movable electrode, the two electrodes being held in spaced relation, has also an integral stem, a cap on the stem, a spring contacting with the cap, a granular resistance substance interposed between the two electrodes and a diaphragm having an adjustable device cooperating with the movable electrode.

791,929. Power Installation. William Morrison, Chicago, Ill. Application filed October 27, 1904.



NO. 791,887.—MOTOR-CONTROL SYSTEM.

In a power installation run by a gas engine is a dynamo having both its field and armature rotable, one of the elements being mechanically connected with the engine, and the other being arranged for mechanical connection with the load. Means are provided for energizing the field and armature of the dynamo, for preventing the rotation of the dynamo element connected with the engine, and for preventing the rotation of the other dynamo element.

791,938. System of Electrical Distribution. Granville E. Palmer, Boston, Mass., assignor of one-half to Charles B. Price and Frank S. Price, Boston, Mass. Application filed July 5, 1904.

A primary alternating-current circuit, a secondary circuit, a constant-current transformer, a switch in the primary circuit, an underload-release mechanism in the secondary circuit, an overload-release mechanism in the primary circuit and means by which each of the mechanisms causes the opening of the switch are the essential parts of the system.

791,951. Crane. George W. Shem, Alliance, Ohio. Application filed March 17, 1905.

A crane having a bridge with main hoisting trolley mounted upon the main girders of the bridge, is provided with a supplementary trolley mounted upon supplementary girders independent of the main girders, the supplementary girders being located between the main girders.

791,954. Time-controlled Electric Switch. Joseph G. Swallow, New York, N. Y. Application filed July 23, 1904.

A time-controlled gravity-drop mechanism comprises an operating-arm, a guide-channel, an unattached weight and a weight-releasing mechanism adapted to release the weight to cause it to fall in the guide-channel. The arm is adapted to occupy a position within the channel in the path of the weight before its fall, to be withdrawn from the weight afterward.

791,958. Automatic Blast-temperature Regulating Valve. Samuel W. Vaughen, Lorain, Ohio, and John W. Cabot, Johnstown, Pa. Application filed January 10, 1903.

The valve for the hot blast pipe is operated by an electric motor and a pyrometer controls the circuit of the motor, its action being determined by the temperature in the furnace.

791,961. Burglar-alarm System. Joseph Weatherby, Jr., New Cumberland, Pa., assignor to the Weatherby Electric and Manufacturing Company, New Cumberland, Pa. Application filed March 31, 1904.

In an electric burglar-alarm system is a balanced electric circuit with means to vary the resistance in localized portions without unbalancing the circuit. Means independent of the resistance-varying means vary the potential of the electric current in the circuit.

791,972. Automatic Electric Signaling System for Railways. David C. Wolfe, Lyons, Kan. Application filed January 5, 1905.

Signaling apparatus carried by a train and a signaling apparatus at a station co-operate with a pair of conductor-wires arranged along the road-bed and divided into blocks. Means carried by the train electrically connect one of the conductors to the signaling apparatus at the station, the circuit passing through the signal mechanism on the train. Means at the station complete an electric circuit through the alarm mechanism on an approaching train.

791,975. Skeleton Tower. Robert L. Allen, Syracuse, N. Y., assignor to the Archbold-Brady Company, Syracuse, N. Y. Application filed December 29, 1904.

A steel tower for carrying high-tension conductors is described.

791,977. Snap Switch. Walter A. Church, Binghamton, N. Y., assignor to Edward P. Hatch and Jonathan Camp, Hartford, Conn. Application filed June 17, 1903.

On a base of insulating material are a movable contact and a stationary contact, the stationary contact being provided with a recess having one wall of the recess forming a positive stop to prevent rotary movement of the movable contact.

791,982. System of Electrical Traction for Railways. Maurice Leblanc, Paris, France. Application filed August 29, 1901.

A series of current-supplying points co-operate with a fly-wheel motor-generator, receiving at intervals a motive current from the supplying points, and supplying working current to the vehicle.

791,983. Electric Motor-generator. Maurice Leblanc, Paris, France, assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Original application filed August 29, 1901. Divided and this application filed December 9, 1904.

A fly-wheel dynamo for rotating at high speed comprises a frame for supporting its stator, a universal joint for supporting its rotor, the surface of the rotor and stator adjacent to the air-gap being shaped as spheres having the universal joint for a center, and a standard on the rotor having a loose bearing in the frame.

791,984. Train-controlling Mechanism. Henry V. Miller, Chicago, Ill., assignor to the Miller Signal Company, Chicago, Ill. Application filed January 14, 1905.

A local partial electric circuit is associated with a transient mechanism comprising a transient partial electric circuit containing a magnet through which the local partial circuit may be completed. An armature controlled from the magnet. An electric device controls the valve and is controlled by the armature.

## EXPIRING PATENTS.

Following is a list of patents (issued by the United States Patent Office) that expired on June 12, 1905:

384,271. Electric Pendulum Clock. A. L. Parcelle, New York, N. Y.

384,289. Automatic Switch for Secondary Batteries. J. S. Sellon, Hatton Gardens, County of Middlesex, England.

384,320. Printing Telegraph. E. J. Mallett, Bay Side, N. Y.

384,321. Polarized Electromagnet. E. J. Mallett, Bay Side, N. Y.

384,322. Printing Telegraph. E. J. Mallett, Bay Side, N. Y.

384,323. Automatic Pole Changer. E. J. Mallett, New York, N. Y.

384,324, 384,325. Automatic Telegraphy. E. J. Mallett, New York, N. Y.

384,326. Automatic Pole Changer. E. J. Mallett, Bay Side, N. Y.

384,350. Combined Telegraph Key and Sounder. J. Doggett, Plain City, Ohio.

384,404. Machine for Covering or Insulating Wire. J. D. Thomas, South Framingham, Mass.

384,430. Electrical Annunciator. H. S. Downerd, Zanesville, Ohio.

384,440. Electric Circuit Controller. O. F. Grein, Newark, N. J.

384,447. Regulating Commutator for Secondary Batteries. E. Julien, Brussels, Belgium.

384,455. Printing Telegraph Receiver. H. Mahnken, New York, N. Y.

384,472. Electric Winding Attachment for Clocks. A. J. Reams, Augusta, Kan.

384,476. Police Electric Signal System. C. E. Scribner, Chicago, Ill.

384,477. Multiple Switchboard Circuit. C. E. Scribner, Chicago, Ill.

384,561. Electric Comb. C. Busch, Chicago, Ill.

384,562. Electric Railway. G. H. Condict, Philadelphia, Pa.

384,570. Electric Circuit-Closing Device. M. W. Groversteen and P. G. John, New York, N. Y.

384,576. Electric Railway. R. M. Hunter, Philadelphia, Pa.

384,580. Apparatus for Electric Traction. E. Julien, Brussels, Belgium.

384,581. Electric Railway Car. E. Julien, Brussels, Belgium.

384,594. System of Electric Locomotion. H. A. Seymour, Washington, D. C.

## SPECIAL MENTION.

Pass & Seymour of Solvay, N. Y., make a specialty of fuseless cleat rosettes, National Code fuseless attachment plugs and sign receptacles. In regard to the quality of these products, they receive many flattering comments from their customers. The manufacturers assert that "prices in themselves are not conclusive. You must weigh the goods with the price."

The traveling public, especially business men making hurried trips between Chicago and New York, will appreciate the reduction in time of the Twentieth Century Limited, via the New York Central Lines, taking effect Sunday, June 18th. To give longer time in Chicago and reach New York no later next morning, it has been arranged to schedule this train from Chicago at 1:30 p. m., an hour later than at present, reaching New York at 9:30 a. m., reducing the running time of the train to 19 hours. Westbound, the Twentieth Century Limited will continue to leave New York at 2:45 p. m. daily, reaching Chicago at 9:45 the next morning.

Howard V. Weaver on June 10th resigned as advertising agent of the Chicago and Eastern Illinois railroad and has become associated with the Corbitt Railway Printing Company, 383-389 La Salle Street, Chicago. Mr. Weaver has had an extended experience in railway and advertising work and his wide acquaintance and popularity will prove a valuable asset in his new connection.

Slow-speed motor drive for all sorts of machines is very satisfactorily accomplished by the use of Northern back-geared motors. This is a compact, self-contained device which accomplishes slow speed without the necessity of employing motors designed for slow armature speed. This secures a motor of low cost for operating slow-speed machines. Bulletin No. 44 issued by the Northern Electrical Manufacturing Company of Madison, Wis., illustrates representative applications of back-geared motors in industrial-plant service.

# WESTERN ELECTRICIAN

EVERY SATURDAY

Vol. XXXVI. CHICAGO, JUNE 24, 1905.

## Engineering Equipment of the Minneapolis Chamber of Commerce.

By Charles H. Coar.

During recent years Minneapolis has come rapidly to the front as a grain center and trading market, and, because of this growth, the members of the Board of Trade were compelled to seek more spacious quarters in which they could conduct their business. After having some difficulty in securing a good location for a new building, plans were prepared during the year 1901 for a fine 10-story building. The site chosen is adjacent to the old Chamber of Commerce Building and has a frontage of 157 feet on Fourth Avenue South, by 132 feet on Fourth Street. The building, which is 10 stories in height above the street level, is built to these dimensions, with the exception of the basement, which extends out and under the sidewalks to the curb lines of the streets.

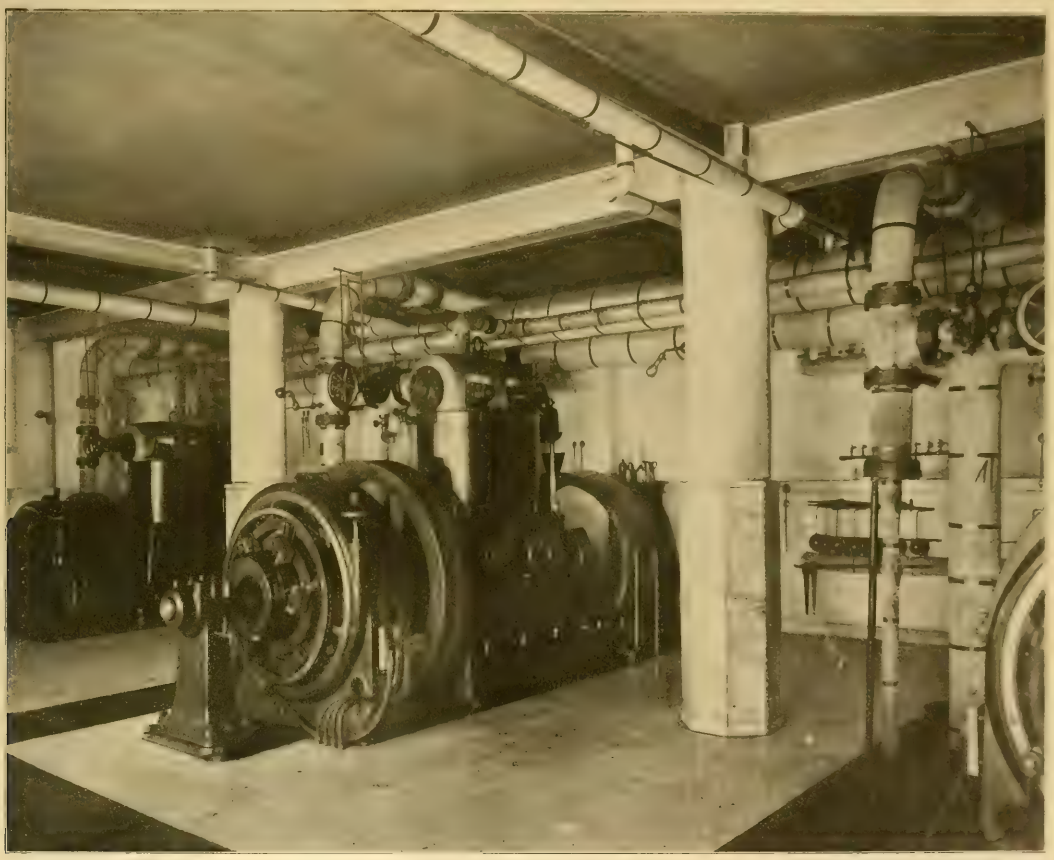


FIG. 1. VIEW IN ENGINE AND GENERATOR ROOM OF MINNEAPOLIS CHAMBER OF COMMERCE.

The steam and electric equipment of the building is complete, having been carefully designed and laid out with reference to permanence, maintenance and cost. In the boiler room, which is in the basement, there are located five 150-horsepower Scotch marine boilers. Each boiler is equipped with a Clarke automatic water control located inside the boiler, which regulates the height of the water, and in addition there is an ordinary glass water gauge outside the boiler. Each boiler is also provided with a safety valve connected to the exhaust pipe beyond the reducing valve, in order that the steam may easily escape in case the steam pressure [illegible]

The boilers are all equipped with Crosby steam gauges reading from 0 to 200 pounds. The steam header for the five boilers is located about three feet in height over the rear portions of the boilers, and long-bend connections are provided, with extra heavy gate valves to connect the different boilers to this header.

The smokestack is constructed of iron and brick within the walls of the building and is five feet in diameter. Directly connected to the stack is a smoke intake, five by five feet, of steel construction, which passes in front of all the boilers, where two-by-five-foot uptakes from each boiler feed into it. A forced draft is used.

Coal is used as fuel, and a bunker having a capacity of 300 tons is provided under the alley, where openings are placed through which the bunker is filled. A track system from this bunker extends in front of all the boilers, in addition to passing over a scale platform, which is used in weighing the coal as it is consumed. A similar scale of 10-ton capacity is also placed at the rear of the building, to weigh in coal when it is purchased by the car on the railroad.

There is also located in the boiler room a water heater and purifier, an exhaust muffler and three Marsh steam pumps 8-12 by 7½ by 12 inches—all of which obtain their water supply from the city water mains. Two of these pumps force water into the [illegible]

The main 10-inch steam header from the boiler [illegible] there are located three engine taps taken from through-gate valves. Placed in this steam header, [illegible] arator, which is in turn connected to a Crane steam trap that discharges into the feed-water heater.

The engine equipment consists of three West- [illegible]

The engine room is 50 feet in length and 40 feet in width, and is provided with a 15-ton traveling crane, which is used in handling the engines and generators. The switchboard is located in the engine room, and is of the Westinghouse type, consisting of [illegible]

The engines are operated at a speed of 250 revolutions a minute. Two of these engines are 125 horsepower, and one is 80 horsepower, all being directly connected to Westinghouse compound engine-type generators. The splash system of oiling is used in the crank cases of these engines, the outboard bearings being oiled by rings, as is customary in Westinghouse engines.

A partial view of the engine room is shown in Fig. 1. The exhaust from each engine opens into a 12-inch main exhaust, which is provided with a Detroit grease extractor, before the exhaust steam enters the muffler tank. From the muffler tank the exhaust-steam connections are so arranged that the exhaust steam escapes through coils used in heating the building, or into the water heater direct, as the occasion requires. The water heater, as used, is divided into two sections, all exhaust steam passing in one end through one-inch copper tubes, which are surrounded by the water

to be heated, while the other section has a bed of coke placed in it, through which the feed water is forced before it reaches the boilers. This coke removes all foreign substances, such as boiler scale or sediment, from the water. The coke end of the heater is provided with a live-steam tap, connected directly to the boiler header, for the purpose of forcing steam through the coke at intervals, in order that any collected hard scale, etc., may be dislodged into a catch basin provided for that purpose. The exhaust steam from the heater escapes into the outer air at the roof.

Space is provided in the engine room for the installation of a fourth unit, if such be found necessary, and in order to facilitate this installation a panel is reserved in the switchboard.

The generators all deliver current at 230 volts pressure, and the current from the generators is conducted to the respective switchboard panels by means of heavily insulated cable in conduits placed under the tile floor of the engine room.

The switchboard is set off at one side of the units, about 10 feet from the wall, thus insuring ample space in which to work at the rear connections. A front view of the switchboard is shown in Fig. 3. The front is composed of six panels of black marble 6½ feet high. These panels are supported in a white Italian marble frame held between two white marble columns, as shown in

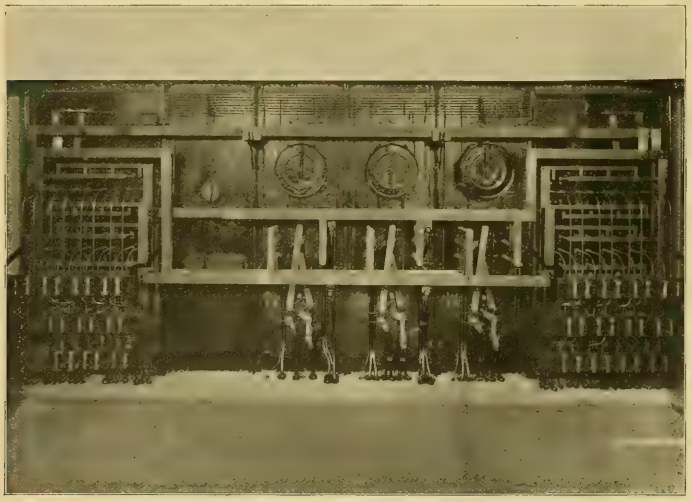


FIG. 2. REAR OF SWITCHBOARD IN MINNEAPOLIS CHAMBER OF COMMERCE.

the illustration. Extending back from the right end of the switchboard to the wall are five panels of black marble, which are used as meter panels, while on the left end four panels are installed for storage-battery instruments. A wall having a door is built on from these panels to the building wall proper. This encloses the rear connections of the panels, thus insuring freedom from outside interference.

Of the six front panels, the two end sections are the power and lighting panels, the four remaining ones being used for generator panels, with the exception of one, which is held in reserve, as already explained.

Each of the three generator panels is equipped with a Keystone amperemeter, a Ward Leonard rheostat, ground-detector lights, a voltmeter switch, a double-pole double-throw knife switch, by which the generator may be connected to either the power or lighting buses, a single-pole double-throw knife equalizing switch, used when the generators are thrown in parallel, and an I.T.E. overload double-pole circuit breaker. The apparatus on one of these panels is suited to 75-kilowatt generators, while the other panel is equipped to suit a 50-kilowatt machine. The first or power panel is equipped with a Bristol recording ammeter, a Keystone voltmeter and 12 double-throw double-pole knife switches. Eight of these control floor lights, while three are used to control the current to the ventilating motors. The remaining switch is used in case the fuses on the regular feed break down, or in time of excessive loads, to assist the regular feeders. The sixth or lighting panel proper is a duplicate of the power panel, with the exception of the switch control. Eight of the switches in this panel control building lighting circuits, one switch controls the current supply to the electric elevators in the old Chamber of Commerce Building, and two switches control the current to two 50-horsepower Otis controlled motors, which drive high-pressure triplex pumps in the elevator system. The remaining switch in this panel controls the current to a 10-horsepower motor, arranged with Cutler-Hammer tank control. This motor drives a low-pressure triplex pump, which handles the water discharged by the pilot valves of the elevator system.

As will be noted in the view of the switchboard, the steam instruments are mounted above the electrical apparatus, such not being considered the best practice, by some, but in this instance necessary, so special arrangements were made to catch any moisture or drippings from the steam instruments. A copper catch basin, provided with drain pipes at each end, extends the entire length of the board beneath the steam instruments.

A view of the rear of the switchboard is shown in Fig. 2. The generator, bus and switch connections are such that the lighting and power may be operated separately or as one system, and any of the generators may be connected to any set of bus bars, or to both at the same time. All the generator switches are double-throw, so that any of the generators may be thrown into service on certain bus bars to meet any desirable division of the load. Bus connections are so arranged that in case it becomes desirable to install a storage battery in the future a differential battery booster may be connected in between the two sets of bus bars, to prevent flickering in the building lights in case the power load fluctuates. The generator and bus connections are simple but effective.

The current consumption is very carefully computed, as wattmeters are provided for measuring the total current generated by each generator, the current consumed by the elevator-pump motors and the current consumed by the ventilating motors. In addition, the current used in lighting the corridors is measured separately. Each tenant receives his current supply through individual meters. A meter is also provided to measure the current used from the city central-station mains in case of a total shutdown, as provisions are made to utilize this current if it becomes necessary. It can be readily seen that, with the readings from these meters, in addition to the curves taken from the recording amperemeters and steam meters, that it is possible to figure very closely as to the operating cost. Four panels are also provided for use in connection with storage-battery instruments, in case these be installed. Fig. 4 is an ammeter record showing the variations in load during the day.

All the service wires of the building, including the telephone and telegraph wires, are installed in enameled electrogalvanized iron conduits, placed in the walls or under the floors. This offers the best fire protection, in addition to being free from mechanical injury. The wires in the different conduits were not installed until the construction work of the building was nearly completed, so it is still possible to replace any of the circuits or wires with good wires in case they become faulty.

About 40 cut-out cabinets for the control and protection of the tenants' lighting circuits are installed at the most accessible points in the different floor corridors. These cabinets are very attractive and consist of a black-marble switchboard upon which are mounted the different copper buses, switches, etc. This is then set in a black slate frame and iron box, the whole being trimmed with white marble. The doors are constructed of heavy plate glass set in an iron frame of pretty design. The conduit piping is provided with outlet boxes at every point where the wires emerge for fixture connection, and although an abundance of floor and base-board receptacles were installed to which connections could be made, it was deemed wise to install a flexible steel-covered cable in a special molding placed above the walls of each room. By means of this cable it is possible to install a light at any position on the walls with very little labor and without marring the room to any extent. The tenants' meters on each floor are mounted on a black marbleized-slate board located in a room provided for that purpose. The meter connections are so arranged that the room circuits may be materially changed without affecting the metering.

About 150,000 feet of rubber-covered wire was used in the old building in wiring the lighting and power circuits, and approximately 500 base and floor receptacles are used for distribution, in addition to the regular fixtures. Upward of 5,000 incandescent lights are used in the lighting system, but no arc lights are employed.

Telegraph and telephone cables are placed in conduits up to their respective distribution centers. The telegraph circuits terminate mostly in the trading room proper, but the telephone cable conductors are distributed throughout the different floors by means of terminal strips located on the different floors. The telephone cables of both the Bell and Independent companies are brought into the building from street manholes to large distribution boxes located on the first floor. From this point the cables pass up to the various floors through the meter rooms.

In the meter rooms the cable conductors terminate on suitable cross-connecting strips, provisions having been made for proper distribution, where connection can be made with the room wires, which are placed in conduits and special molding. There are upward of 20 private telephone-exchange systems in the building. The Bell company has a toll exchange located on the trading-room floor which handles the long-distance calls to and from the booths located there. Both telephone companies have installed an ample number of booths for the convenience of their respective patrons. Practical systems of signaling, which involve the use of incandescent lights, are used, in conjunction with the telephone systems and also on the quotation board.

The old Chamber of Commerce Building, which was all rewired, receives its power and heat from the new plant, but otherwise is separate from the new building. The motor equipment of the plant is very complete and consists of the following installations: For heating and ventilating the building proper there are used two motors arranged for 220-volt service. One of these motors is of 40 horsepower and the other is 30 horsepower.

A 20-horsepower motor is used for heating and ventilating the trading room, this being controlled entirely separate from the main heating system. There is also located on the roof of the trading room a 10-horsepower motor and an exhaust fan which has outlets placed about the base-boards of the room to assist the air circulation of this room when it is crowded. A 10-horsepower motor is used to run a circulating pump in the air purifier, and one of five horsepower is used to furnish cool air in the engine room. Another five-horsepower motor is used to run fans for toilet-room ventilation. All the motor equipment mentioned is supplied with Cutler-Hammer Universal motor controllers according to the designing engineers' specifications.

There are awo 50-horsepower motors which drive two 35 by 16 by 12-inch triplex pumps for the elevator system. These motors are arranged with Otis elevator control and are used as an auxiliary to the steam-driven pumps or during warm weather or breakdowns. A 10-horsepower motor is utilized to run a small automatic triplex pump, which pumps

[illegible]

FIG. 3. SWITCHBOARD IN MINNEAPOLIS CHAMBER OF COMMERCE.

a slate board four by four feet. These magnets are actuated by an accumulator weight which carries a sliding bar, operating cam switches, in this manner closing circuits through the solenoids in the main controlling board. By means of the automatic control there is a reserve pressure maintained at all times in the high-pressure system which operates the cars. On the piston of the high-pressure elevator cylinder is mounted a 35-ton accumulator weight, arranged in such manner in regard to the pumps that it has to be maintained at a certain height, which insures a sufficient reserve pressure in the system to propel one car a complete trip, or it lowers sufficiently to engage contacts already mentioned, or other mechanism, which operates the valves on the steam pumps. The electric operation is such that when the accumulator weight lowers sufficiently to engage the contacts it closes the solenoid circuits on this motor control, first starting one motor and pump and gradually bringing it up to its capacity by means of the accelerating magnets contained in the control. If sufficient pressure is not then maintained, the remaining motor and pump is also started and brought up to its maximum capacity in a like manner. When both pumps are in operation the pressure in the system is rapidly restored, and as the accumulator weight rises the pump motors are automatically cut out of circuit in their respective order.

It will be seen that the circuits are so arranged

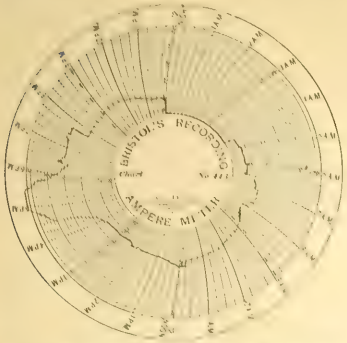



FIG. 4. RECORD OF LOAD ON PLANT OF MINNEAPOLIS CHAMBER OF COMMERCE NOVEMBER 15, 1904.

that by throwing a small triple-pole double-throw knife switch, the pump motors can change in their starting position, thus insuring a uniform amount of wear on the apparatus. The steam-operated pumps are controlled in a similar manner by mechanism which operates on the steam feed valves to the pumps.

An indirect system of heating is employed for [illegible]

[illegible] air, the [illegible] mostat arrangement of the rooms is such that the [illegible] mostats of the rooms that the coils heat.

These latter coils can raise the temperature to [illegible] cient to heat the building during the coldest day. There are nearly 1,100 automatic valves in the heating system and about 300,000 cubic feet of air is passed through the building and out to the roof each minute. As mentioned before, this air is all moved by electric-driven fans.

The conduit and switchboard [illegible] plant was done by the W. [illegible] Minneapolis, under the supervision of the designing engineer, Mr. Charles [illegible] Minn.

The plant is under the excellent supervision of Mr. William Robertson, who is chief engineer and superintendent of the building. Mr. Robertson is assisted by Mr. G. R. Scott, who is chief electrician. The writer wishes to make acknowledgment to both these gentlemen for the many courtesies extended him during the preparation of this article.

## A History of Franchises in Benton Harbor and St. Joseph, Mich.

Benton Harbor and St. Joseph, Mich., on the east shore of Lake Michigan, across from Chicago, are the center of important lighting and traction interests. The company operating in these two cities is the Benton Harbor and St. Joseph Electric Railway and Light Company, with headquarters in St. Joseph. The president of the company is W. Worth Bean, well known among central-station men, while his son, W. Worth Bean, Jr., is the secretary and manager. The successive steps which have been taken during the last 16 years leading up to the present-day situation are of interest.

The elder Mr. Bean, on Feb. [illegible], 1880, bought a third interest in the Benton Harbor and St. Joseph Street Railway Company, and on February 7th of the same year he had organized the Benton Harbor and St. Joseph Light Company. In September, 1891, Mr. Bean, after obtaining a controlling interest in the street-railwaay company, brought about the passage of a bill by the state legislature allowing horse railways and electric lighting companies to consolidate. On March [illegible], 1880, he had obtained franchises in the two cities for furnishing light and power for 30 years, and, October 19, 1891, ordinances to operate cars by electricity for 30 years.

Following these moves, the next step in the development was the securing of an ordinance in South St. Joseph for electric-car operation, also for 30 years. This was done on June 29, 1896. On September 18, 1901, all street-car ordinances were extended to make a uniform period of 30 years.

In October, 1900, all electric-railway and light company ordinances were consolidated and all the stock was then in the hands of Mr. Bean. On May [illegible], 1903, the electric light [illegible] March [illegible], 1880, was amended to read 30 years [illegible] 1905, with permission for high and low-tension operation. All street-car ordinances were also extended for 30 years on May [illegible] of this year. At the same time the franchise of the Indiana Railway Company, granted in June, 1901, was purchased and extended for 30 years. One hundred leading citizens were present at the council meeting and urged all extensions, with the privilege of carrying freight during the whole [illegible] of the day. This [illegible]

[illegible]

## Typical Independent Telephone Exchange for Small City

[illegible]

FIG. 1. INDEPENDENT TELEPHONE EXCHANGE BUILDING IN PORTAGE, WIS.

their plant [illegible] are at this time confronted with a proposition of how to rebuild, if possible, without increasing the capitalization of their organization and to make the changes out of the proceeds of the business.

An Independent exchange which clearly shows what is now considered by conservative and unbiased engineers and practical telephone men to be the best method of rebuilding, and the most economical and safe plan of re-equipping, is the remodeled plant of the Portage Telephone Company at Portage, Wis. A brief account of the rapid growth of this exchange and its present system will be of considerable interest, especially at this time when many of the exchange companies are figuring on some change in their own systems.

The exchange [illegible] years ago by a number of the leading business men of that city, the most prominent of whom were H. H. [illegible] The plant was [illegible] ers, and was built with an ultimate capacity of 100 lines, with instruments of the regular generator-call type, and the line construction with a ground-return circuit.

The exchange [illegible] years when it had reached its ult[illegible] positions.

[illegible]

wire leads were [illegible]

In making the change of apparatus it was decided to re-equip the central office with a switchboard that could be used first in connection with the generator-call instruments then installed, and later changed to full central-energy system, when the old generator-call instruments could be replaced with central-energy telephones.

The equipment adopted was the "growing" exchange system put on the market by the International Telephone Manufacturing Company of Chicago. This system is designed so that a plant can be rebuilt at intervals by first installing the switchboard to be used in connection with individual generator-call local-battery telephones, and later at any time changed to complete central-energy without discarding any of the apparatus installed. It is also designed so that the switchboard can be first installed as a straight trunking equipment, and having a capacity in the frames so that when the exchange is increased to 400 or 500 subscribers or more the necessary multiple springjacks, with wiring, etc., may be added to the sections, and the board changed from a transfer system to a strictly multiple equipment without discarding any of the apparatus except the trunk-line jacks. Fig. 2 shows a view of the Portage exchange room and switchboard.

The switchboard is built in sections arranged for one operator's position each. The sections are built of well-seasoned quartersawed-oak woodwork, with golden-oak finish, highly polished. The key shelves are hinged so that they may be raised, making the wiring and apparatus readily accessible. They are built of five layers of the wood of which the board is constructed, glued together—the grain of the two outside and central layers running lengthwise and the grain of the other two layers running cross-wise. The plug shelves are covered with the best belt leather, one-eighth of an inch in thickness. The back of each section is provided with a paneled double-hinged door. The front of the board is provided with a substantial brass foot rail.

The first position of the board is equipped with 40 toll-line and country party-line equipments, consisting of high-wound bridging non-inductive tubular mechanical self-restoring drops and jacks. The combined drops and jacks are mounted individually in strips of five. They are clamped to a substantial steel mounting strip by the ferrule of the jack, from the front of the board. The jacks and drops are thoroughly insulated from the mounting strip by one thirty-second-inch sheet mica with hard-rubber bushings insulating the jack ferrules. The drop and jack may be removed without dismounting the drop shutters. The shutters are mechanically restored by a small trigger mounted in the path of the plug, which operates and throws up the shutter when the plug is inserted into the jack. The restoring trigger is supported on a heavy german-silver compensating spring, to allow of its permanently retaining its adjustment, making it impossible for the shutter to fail in restoring when the plug is inserted. The jack springs are constructed of the highest grade german silver No. 18 sheet.

FIG. 2. PORTAGE EXCHANGE ROOM AND SWITCHBOARD.

The first position is also equipped with the regular local-battery switchboard transmitter, with transmitter arm and other auxiliary apparatus, together with an operator's receiver, receiver cord, plug and cut-in jack, including a hand generator, power generator key, night-bell switch, and special switches for cutting together the different operators' circuits. This position is also equipped with the necessary connecting appliances for making connection between the central-energy exchange and toll lines, and vice versa, and also between the different toll lines and country party lines.

The second and third positions are each equipped with 200 lamp-line equipments, and the fourth position with 60 lamp-line equipments, and fully wired for 200 lines.

Each position is also equipped with 16-pair cords, plugs, weights, ringing and listening keys, with double-lamp supervisory clearing-out signals, together with complete operator's telephone and other auxiliary apparatus.

In Fig. 2, at the top in the face of the board, are shown the white line pilot lamps and the red supervisory clearing-out signal pilot lamps. The line signals are mounted in connection with their associated jacks in strips of 10. The answering jacks and lamp jacks are mounted on the opposite sides of a substantial brass base having the jack springs firmly clamped between mica insulations by heavy binding screws passing through them and terminating in metal nuts. The lamps are provided with a brass tube, clamping the lamp and also supporting the opal, and are so designed that they are placed into the lamp jack from the front of the board. The lamp-jack springs are so constructed that it is impossible to insert the lamp excepting in its proper position. The lamps can be removed and replaced without the use of special tools or devices.

FIG. 3. RELAY RACK IN PORTAGE EXCHANGE.

Strips of combined lamps and answering jacks are mounted on a strongly constructed steel frame, firmly fastened in the front of the switchboard cabinet. The strips are fastened into the frame by heavy binding screws passing through the strips from the front of the board. The space remaining for the additional capacity of line equipments and also the capacity for additional trunking equipments, or the multiple jacks necessary when the system is changed to a multiple equipment, are filled in with blank steel strips of the same dimension as the lamp and jack-mounting strips. This enables increasing the exchange with 10-line equipments at a time, by removing one of the blank strips and inserting a strip of 10 combined lamp and answering jacks, and making the necessary wire connections already provided. The mounting-strip binding screws are covered with a neat stile strip fastened from the front of the board.

Supervisory clearing-out lamps are provided, with a shell attachment similar to that of the line lamps, and, to protect the opals from impact of the plugs, they are provided with an arched wire protecting guard. The supervisory lamps can be readily removed from the top of the keyboard.

The present equipment of the board is provided with a flashlight transfer system between the positions. The plugs are the regular multiple switchboard plugs. The jack mounting strips, being of steel construction, enables building them so that an extremely short plug may be used, which allows making the plug small and compact and at the same time give it the proper strength. The plug is provided with a loose sleeve, avoiding the use of binding screws passing through it. This construction makes the use of a thin sleeve possible, and it being so mounted that it turns on its shank, prevents kinking the cord when twisting the plug while inserting.

The line signals and supervisory signals are controlled by individually encased tubular relays, supported on an iron rack, as shown in Fig. 3. The relays are constructed with a coil placed in a heavy soft-iron tube, which completely closes the magnetic field when the armature is drawn up. The coil terminals pass through the rear of the tube and are insulated with hard-rubber bushings, making the tube practically air-tight when the armature is closed. The core of the coil passes through the rear of the tube, from which it is thoroughly insulated with hard-rubber bushings and mica washers, and forms a support for the relay springs, which are firmly clamped between sheet-mica insulations by heavy binding nuts. The springs are so formed that they pass from this mounting base up over the iron tube to the armature hinge. The armature is hinged on an L-shaped brass hinge, supported on a knife edge. This construction gives a relay in which all the lines of force act on the armature. The armature hinge being more than an inch in length, gives a wide sweep for making and breaking the contacts. The relay is clamped to a round brass base, threaded at its outer edge, upon which is screwed a heavy brass tube shell, to make the relay absolutely dust-proof. The relays, with shell, are individually mounted on a substantial steel mounting strip, to which they are clamped by heavy hexagonal brass nuts. The terminals of the springs, as well as the coil terminals, pass through the mounting strip, from which they are properly insulated by hard-rubber bushings. The relay rack is provided with bus bars, mounted on a marble slab. The proper fuses are provided for individually fusing each strip of relays.

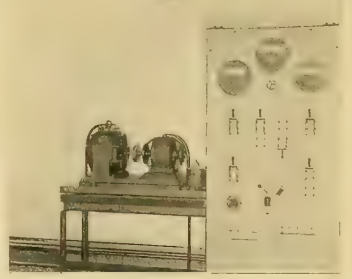


FIG. 4. POWER PLANT IN PORTAGE EXCHANGE.

Fig. 3 also shows an end view of the American Electric Fuse Company's make of carbon lightning arresters and self-soldering heat-coil protectors, supported on an architectural-iron distributing frame and mounting rack.

Fig. 4 shows the power plant. The charging machine consists of a Roth Brothers dynamo, with an output of 12½ amperes, 35 volts, 1,900 revolutions per minute. It is provided with a round-type field rheostat, and is mounted on the same base with a Westinghouse one-horsepower 110-volt single-phase 133-cycle motor. The charging machine is mounted on a heavy hardwood platform, resting on large soft-rubber balls, set in a hardwood frame, supported by an architectural-iron rack table.

The power switchboard is constructed of a large blue Vermont marble slab, with beveled edges, supported on a heavy angle-iron rack. At the top, in the center of the board, is mounted a type F flush-style polished copper-finishel Weston direct-current double-scale 0 to 50 and 0 to 3 voltmeter. Immediately underneath the voltmeter is mounted an ammeter switch, with index plate and hand wheel, of the Crouse-Hinds type. The power board is also provided with two direct-current, 0 to 25, flush-type Weston ammeters. Immediately below the reading instruments are mounted three double-pole single-throw and three double-pole double-throw 125-volt 50-ampere non-fuse copper knife switches, back connected, emery-wheel finished. Directly underneath the knife switches is mounted a Ward Leonard type DK overload and underload circuit breaker, back connected, of polished copper finish—underload three amperes, overload 10 to 20 amperes. At the bottom of the power board are mounted the necessary copper bus bars.

FIG. 5. STORAGE BATTERY IN PORTAGE EXCHANGE.

Fig. 5 shows the storage-battery plant, consisting of two sets of 24 volts each, type E5 Chloride accumulator storage batteries. The batteries are supported on a heavy and strongly constructed wooden rack, supplied with heavy slate shelves. The legs of the several cells are burned together. All battery leads and bus bars are of copper and of sufficient size to insure against cross-talk. The heavy power wires are run through circular loom, to make the work perfectly safe and substantial.

The wires of the lighting, power circuits and storage-battery leads are of the highest grade rubber-covered wire, and of sufficient size to fulfill the requirements of the National Board of Fire Underwriters. The cable used in the switchboard is of No. 22 B. & S. gauge, tinned annealed copper-wire conductors, 98 per cent. pure, and covered with two layers of silk and one of cotton, the outside layer of cotton, colored in accordance with a predetermined color code, facilitating the handling and testing of lines.

With the present careful management of the company, which is under the direct supervision of Mr. F. H. Runkel, secretary and manager, who is well experienced in the telephone line, and with the class of work above described throughout the exchange, it is in position to give the subscribers the most efficient and convenient service obtainable, with the

cost for maintenance and operation reduced to a minimum.

It is estimated that with [illegible] the central office equipment [illegible] will not be necessary [illegible] the equipment when it is required [illegible] system, or later to change [illegible] and with the [illegible] part which is subject to wear or disarrangement [illegible] per cent [illegible] depreciation is more than offset.

## Localization of Faults in Low-resistance Cables.

For the purpose of locating faults in cables of comparatively large carrying capacity, and consequently low resistance, the Wheatstone bridge when used for locating faults is impracticable for several reasons.

An ordinary bridge or testing set especially adapted for locating faults by means of the Varley-Murray loop method is accurate only when the

LOCALIZATION OF FAULTS IN LOW-RESISTANCE CABLES.

cables under test are of comparatively high resistance, such as telegraph or telephone cables. When used for cables of low resistance, as, for instance, a 250,000 circular mill transmission line, the limitations of such an apparatus are great, and the accuracy with which the fault can be localized is low. Also, the calculations involved, while not complex, necessitate a considerable amount of figuring.

While it is a fact that the greater number of faults in underground cables occur in the manholes of the transmission lines, it is nevertheless desirable to locate the fault with the greatest possible accuracy. The readiness and ease with which such a test can be made is quite important when considered from the standpoint of economy in line maintenance.

The location of the ground or cross on a cable can be very easily accomplished by the following method, which utilizes a slide wire bridge for testing by means of the Murray loop.

The method is described in the "Wrinkles" department of the National Electric Light Association by Mr. K. E. Rice, a diagram of the connections being shown in the accompanying illustration.

A slide wire bridge having a bridge or slide wire of very low resistance (say 0.5 ohm) and which has a scale divided into a given number of parts is connected as follows:

A cable on which the ground is located is connected to one end of the slide wire and a perfect cable of known length is connected to the other end. The distant ends of the cable are connected together by a jumper or clamp of negligible resistance. A milli-voltmeter having its zero in the middle of the scale or a very low-resistance galvanometer is connected across the slide wire as shown at (G) and (G'). The contact-maker on the slide wire is connected to the one terminal of the storage or primary battery (preferably one of very low resistance); the other terminal of the battery is grounded. The electromotive force of the battery need not be over a few volts, except for very high-resistance grounds. The ordinary Murray loop formula is then used:

Let L = total resistance of cables A and B.

X and Y = resistance to faults.

A and B = value of bridge arms when balance is obtained.

Then

$$X = \frac{B}{A + B} L$$

In applying this formula to the slide wire bridge A + B is obviously constant, and it may be considered as having unit value. Also consider that L has unit value; therefore L and A + B are eliminated by cancellation and

$$X = B.$$

The quantity B is then a decimal which, when multiplied by the length in feet of the cable, will give the value of X in feet distance of the ground from G'.

In practice the cable must be connected to the bridge by leads of as low resistance as possible. If the maximum accuracy is demanded, then the resistance of the leads must be considered. By connecting the milli-voltmeter to (G) and (G') the error due to the leads (l') and (l'') is included in the length of the cables under test and a suitable correction must be made. If the galvanometer is connected at the junction of the leads (b) (b') to the cables (A) and (B) then the leads form an extension of the slide wire. In this latter case, the leads being equivalent to a definite number of scale divisions on the slide wire, the scale of the bridge will not then begin at zero, but will start at the figure which corresponds to the number of scale divisions to which the leads are equal. In simplifying the method [illegible] suggested.

[illegible] the metal strip.

One of these [illegible] light [illegible] time. In making a test the [illegible] the cable under measurement [illegible] scale of the bridge and the [illegible] may be read directly from the scale.

Under favorable conditions an accuracy of 1-25 per cent is obtainable, and under ordinary conditions an accuracy of 1-10 per cent [illegible] bridge may be constructed at small cost, obviously dependent on the degree of accuracy with which measurements are required.

## A New German Space-telegraph Equipment.

The accompanying illustrations show the details of construction and connection of a new German space-telegraph equipment designed by Ernst Ruhmer of Berlin. Figs. 1 and 3 show, respectively, the sending apparatus and its electrical connections, while Fig. 2 shows the receiving apparatus in the form of an electric lamp used as a wave detector. This apparatus is of special importance for demonstrating the effects of electric waves and the interesting phenomena of electrical resonance as employed in tuning the receivers and senders utilized in space telegraphy.

The sending apparatus includes two zinc rods forming an adjustable spark gap and fitted in a

Fig. 1. Transmitter. Fig. 2. Receiver.

NEW GERMAN SPACE-TELEGRAPH APPARATUS.

micanite cylinder so as to eliminate the acoustical effects as well as the luminous effects of the spark discharges, together with a high-tension condenser and a self-induction coil which may be regulated, the latter being wound on a hard-rubber cylinder and constructed so as to be movable in any position desired. It also includes a number of resonance coils wound on tubes of hard rubber, together with two brass tubes, sliding one over the other, and forming an antenna, one of the brass tubes having a small ball on the end.

Electric lamps are used as receivers for detecting the waves. One type includes a small electric incandescent lamp as a wave detector responding to current intensities in a similar manner to an electrolytic cell, the lamp being inserted in a node of current intensity. Another type (Fig. 2) makes use of a small Geissler tube in addition to the lamp, which responds to the high tensions, and is connected like a coherer on the antenna in a tension node.

FIG. 3. CONNECTIONS OF SPACE-TELEGRAPH TRANSMITTER.

the effects of electric waves [illegible] ing apparatus at a distance [illegible] coils are employed as a receiving [illegible] ends of the coils being grounded, and [illegible] the contact over the bare wire of the resonance coil, or by shifting the antenna tubes, a proper tuning of the receiving system is accomplished. The secondary vibration circuit may also be tuned to the primary by changing the capacity, and the proper vibration of the secondary circuit may be altered accordingly, moving the two sliding tubes which constitute the antenna for this purpose. As mentioned above, the self-induction coil is made by the use of bare copper wire and is wound on the hard-rubber cylinder in slots, a spring pulley and crank being provided for rotating the cylinder.

## Space Telegraphy for Trains.

From a scientific point of view the tests of space-telegraph apparatus for train service recently carried out by the Chicago and Alton Railroad are interesting. Preparatory to the installation of wireless apparatus on their limited trains, officials of the company had a number of tests performed under the supervision of Dr. Lee De Forest, whose apparatus was used. Train No. 3 leaving Chicago carried the outfit, which, on account of numerous elevated crossings along the line, had no upright conductors.

For some time when the train approached the Mississippi River above the elevated stretch leading to Merchant's Bridge, the increase in strength of signals was very marked, but when the train entered the truss of this bridge it was found that signals died away almost entirely, due to the screening action of the truss. It was observed also, that the signals were stronger when the train was broad side to the transmitting station, running at right angle to it.

The fact that radiations were following the course of the river in preference to overland paths was again made very marked as the train pulled out of Alton, Ill. At one point the track goes within a few hundred feet of the river, and at this particular point the signals, which at this distance from St. Louis (30 miles) had become relatively weak, were increased in intensity to a surprising degree.

The success of the tests on the Alton were so satisfactory that the officials, it is said, have definitely decided to install the wireless system permanently upon their two trains, "The Red Limited," running daily between Chicago and St. Louis, and changes will be made in the cars which are now building in Pullman shops to accommodate wireless apparatus. It is estimated that the three De Forest stations at St. Louis, Springfield and Chicago, with the addition of one more at Bloomington, will keep these trains in practically continuous communication throughout their run.

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## DATES AHEAD.

National Electrical Contractors' Association (fifth annual convention), Mechanics Hall, Boston, Mass., July 19th, 20th and 21st; electrical exhibition, July 15th to 22d.

Ohio Electric Light Association (annual convention), Hotel Victory, Put-in-Bay, August 16th to 18th.

International Association of Municipal Electricians (annual convention), Erie, Pa., August 23d, 24th and 25th.

Old Time Telegraphers' and Historical Association (annual meeting), New York city, August 29th to September 1st.

American Electrotherapeutic Association (annual meeting), Academy of Medicine, New York city, September 19th, 20th and 21st.

American Street Railway Association (annual convention), Belleve Stratford Hotel, Philadelphia, September 25th to 29th.

THREE electrical bodies hold conventions this week—the American Institute of Electrical Engineers at Asheville, N. C., the Canadian Electrical Association at Montreal and the National-Interstate Telephone Association at Chicago. The sudden and distressing death of Mr. Sheerin at the last-named gathering is recorded on the opposite page. The Western Electrician extends sincere sympathy to the friends and relatives of this sturdy champion of Independent telephony.

THE applications of the discoveries of modern science are numerous, and it may happen that these applications are perverted and made to accomplish ends which are not justified in the eyes of the law. An example of this is the "floating poolroom" which is proposed by gamblers to evade the laws of Illinois against poolroom gambling, which have been enforced with stringency during the last year. The floating poolroom is projected to be located on a steamboat which it is proposed to anchor a short distance out from Chicago in Lake Michigan. It is to be completely fitted with space-telegraph apparatus for sending and receiving massages, and it is expected that followers of the racetrack will come out in large numbers to do the gambling on board the steamer which they cannot do safely in the city. This, surely, is an adaptation of "wireless" which was never contemplated by the inventors.

THOSE persons who believe that the garbage reduction of American cities contains the possibility of a mine of wealth in the way of raising steam for industrial purposes, particularly for driving electrical generators, should read the article on the subject in this issue of the Western Electrician prepared by our London correspondent. In England the street "dust" or refuse is generally of a more favorable character for combustion than the garbage of cities in the United States; nevertheless the results of the undertakings of this character by various municipal bodies in Great Britain have not indicated that, considered economically, the steam-raising possibilities of refuse destructors are to be considered successful. As a destructor of refuse, the apparatus appears to be all right and perhaps a valuable addition to the municipal equipment; but the steam generated is largely in the nature of a by-product, compared with the main purpose of the operation, and is hardly to be relied upon as a steady and economical source of power.

WITH the advance of sanitary knowledge and the consequent precautionary measures to prevent the spread of disease, electric cars as well as other public conveyances are nowadays subjected, and rightfully, to more rigid inspection. Thus, at a recent conference in Indianapolis, representatives of the State Board of Health and of the steam railroads and electric interurban railways prepared a code of rules which will doubtless be formally adopted at a subsequent meeting. Among the rules is one requiring the cleaning of day coaches at the end of each trip, this cleaning to include dusting the upholstering and scrubbing the floors. A sign prohibiting spitting is to be displayed in each car, and at every station in the state of Indiana. Parlor, buffet and dining cars, as well as trolley and street cars, are to be cleaned in like manner, and in addition the food boxes, refrigerators, etc., are to be cleaned and scalded and treated with a one per cent. solution of formaldehyde at least once a week. The rules also contain provisions for the thorough cleansing of sleeping cars.

This joint action is not only another indication of the importance now accorded to electric railroading, but is in line with the best hygiene of the day and deserves the careful attention of all railroad managers.

THIS is the season of the year when the professors, the "old grads" and many other well-meaning friends tender words of advice to the budding engineer as he steps from college halls with all the hopes and fears that the momentous occasion involves. An esteemed contributor who confesses that he is among those "whose recollection of college days is yearly growing dimmer" sends us some reflections on the career of the 1905 graduate in engineering, for which, to our regret, we cannot find space in full. Like those embarking on the uncertainties of matrimony, the young man—and the young woman, too—who is facing the world at commencement is sure of the kindly interest and sympathy of his more experienced fellows. Perhaps the fledgling engineer will feel, after receiving some hard knocks in the inconsiderate world of business, that this sympathy is more academic than practical, but nevertheless the feeling of good will toward the hopeful graduate does exist in widespread degree. Availing ourselves, therefore, of some of the suggestions of our correspondent, we may make a few points of observation that may possibly prove helpful.

For trained, intelligent, hard-working men the opportunities in the technical field are almost innumerable. It is not true that this avenue of endeavor is so overcrowded that there is nothing in it worth while for the inexperienced graduate. Money rewards are small at the beginning, as they should be, for the average embryo engineer has to learn many things after he leaves college. But to the right sort of chap experience comes fast; in a short time—a few months perhaps—he should acquire a certain amount of balance and familiarity with business methods which will lead him to the right perspective of men and things.

Present practice in almost any industrial process may be revolutionized in the next few years. Who can tell? Perhaps the graduates of 1905 may bring about important economies and changes. But if, as is more likely, their work shall consist in widening existing principles and applications, the possibilities of such development are almost unlimited. To cite a few examples in applied science, the use of reinforced concrete in civil-engineering construction, the adoption of electric power in certain classes of heavy railroad service, the increase in the weight, speed and power of battleships, the further development and application of the steam turbine and gas engine, the stopping of financial leaks in every branch of industrial operation—these and many other similar investigations command the best thought of the modern technical expert and offer many unsolved problems.

There is a danger that the graduate will fix his attention too firmly upon following the more technical and highly specialized work of a single branch of engineering, failing to recognize that engineering is a business as well as a profession, and not appreciating the financial bearing of even comparatively small operating and construction details. In far too many cases the simple problems of arithmetic required to be solved in checking up material are neglected on account of a mistaken idea that such work is unimportant in comparison with the determination of the equations of curves and similar questions in which technical education delights. The vital importance of doing even simple work well, of adding straight, and of writing a report in a terse, grammatical style cannot be over-emphasized.

A casual examination of any register of engineering-school graduates shows that many men ultimately cast their lot with very different work from that for which they were directly prepared. No one can foresee the development of his professional or business life in a country like this, and it is well to be not too insistent as to the exact kind of work one takes up, if the financial reward is sufficient, unless one is prepared for sacrifices which many years of activity may not overcome.

In the development of the engineer's career no more important matter can be studied than how to deal with men. Occupying a position naturally appreciative of the problems of employer and employe, the broad-minded engineer is bound to be felt as a force which makes for industrial betterment, not only in iron and steel propositions, but also in the inter-dealings of men. The comprehensive study of public affairs is, therefore, something which ought not to be neglected by the graduate anxious to broaden into a well-rounded professional man, and the influence of the engineer in the great politico-industrial movement of the times has already demonstrated the value of such knowledge

[illegible]

## Sudden Death of S. P. Sheerin at the Opening of Chicago Telephone Convention.

Just as the Western Electrician is going to press comes the distressing and saddening news that Mr. Simon P. Sheerin, president of the New Long-distance Telephone Company of Indianapolis, and one of the most prominent Independent telephone men of the United States, was stricken while addressing the National-Interstate Telephone Association at the Auditorium Hotel. The meeting was called to order on Tuesday morning, June 20th, at 10 o'clock by James B. Hoge of Cleveland, president of the National Independent Telephone Association, who, with Theodore Gary of Macon, Mo., president of the Interstate association, formed the committee in charge of the present joint convention. Mr. Hoge explained the proceedings by

S. P. SHEERIN.

which the two associations were consolidated by a joint committee of 10 members, five from each association, which had power to effect a consolidation. The details of the consolidation have already been printed in the Western Electrician. Mr. Hoge then asked the old National association to take action upon the consolidation committee's report, and upon the motion of Col. J. D. Powers of Louisville, Ky., seconded by E. B. Fisher of Grand Rapids, Mich., its action was ratified. The Interstate association had previously ratified the work of its committee, and the consolidation of the two organizations was thus completed.

At 10:15 a. m. Col. J. D. Powers, who had been selected temporary chairman, called to order the first meeting of the National-Interstate Telephone Association. Mr. Powers requested each state represented to select one man, these to constitute the nominating committee, which was to report at the afternoon session. Mr. Powers made no address at this time, saying that he would talk to the association later. He then introduced Mr. Howard S. Taylor, city prosecuting attorney, the personal representative of Mayor Dunne of Chicago, who heartily welcomed the delegates and visitors to the city. Mr. Taylor left no mistake as to his sincerity in offering the freedom and hospitality of Chicago and soon had the convention in a happy state by his humor. He said he was glad the association was organized as "Independent" and that it was founded upon principles of honest competition.

Mr. Sheerin then arose to respond to the welcome from Mayor Dunne. He began:

"On behalf of the delegates present and the 2,500,000 telephone users in the United States whom we have the honor to represent, I thank you most sincerely for this cordial welcome to Chicago. Although the greater number of us only came in on this trip last night, we are by no means strangers in your beautiful city. Chicago has had most intimate relations with the Independent telephone movement since its very inception. Of the $250,000,000 invested in the business, at least $75,000,000 have been spent for switchboards, telephones and other equipment, and I am quite sure it is entirely safe to say that 80 per cent. of this latter sum has been paid to Chicago manufacturers. The Chicago manufacturers, like all other good Chicagoans, have a way of getting there that is all their own."

At this point Mr. Sheerin stepped to Col. Powers and in a whisper said: "I fear I will not be able to finish this." Before the chairman fully realized the situation, Mr. Sheerin reeled and fell heavily backward onto the floor. Physicians were called, but in less than half an hour life was extinct. Apoplexy is believed to have been the cause of death. Mr. Sheerin's address had been prepared in advance, and a melancholy interest will attach to the concluding portion of it—written but never spoken—which is as follows:

"We are glad, however, to be officially assured that we are welcome in Chicago. Your very excellent and enterprising newspapers have carried the [illegible]

[illegible] sity, that should be handled promptly and intelligently.

"We have given proof of the faith that is in us by the work I have indicated. We will spend $1,000,000 to build toll lines into Chicago, just as soon as Chicago is ready to receive them. We want the closest possible relations with you. We will come in and spend our money with you, if you will only kindly open your door.

"Again, sir, I thank you for this most hearty welcome. We are glad to be your guests, and will endeavor so to conduct ourselves as to merit the confidence and closer relationship of our host."

The convention immediately adjourned after this sad incident to meet at three o'clock in the afternoon, at which time some action was to be taken concerning the further progress of the meeting. A further report of the proceedings will appear in the Western Electrician next week.

The convention opened with bright prospects. Most of the prominent men in the Independent operating field, as well as many from the manufacturing, financial and promoting ends, were present. Besides the large number of accredited delegates, telephone men from nearly every state in the Union where the Independent telephone is known were in attendance.

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Mr. Sheerin was well known and well liked among Independent telephone men. He was second to no one in his prominence in the movement. He was president of the New Long-distance Telephone Company of Indianapolis and also of the Indianapolis Telephone Company—two of the most prosperous concerns in the Independent-exchange field. He was always active with voice and pen in favor of the movement, and as he was a man of substance and standing, what he had to say was always regarded with attention. He served for some time as secretary of the Independent Telephone Association of the United States—one of the predecessors of the National-Interstate Association. He wrote papers and reports for conventions, and was active in other ways. Formerly he was active in political life, being at one time secretary of the Democratic National Committee. He differed with his party on the free-silver issue, however, and of late had taken little part in politics.

The decedent was a courteous, polished gentleman, kind yet decided in bearing, with strong intellectual powers and the faculty of making and retaining friends. His death will be very sincerely and generally regretted.

## James Dalrymple Returns to Scotland.

After going over street-railway conditions pretty thoroughly for about two weeks in Chicago, and also spending a day or so each in Minneapolis, St. Paul, Cleveland, Buffalo, Philadelphia, Washington, New York, Montreal and Boston, James Dalrymple, manager of the street railway system of Glasgow, Scotland, was scheduled to leave the latter city for home on June 20th. Mr. Dalrymple came to this country at the invitation of Mayor Dunne of Chicago to tell how the street-railway system of Glasgow is conducted by the municipality.

As to Mr. Dalrymple's conclusions about the operation of street railways in America and as to the nature of his advice to Mayor Dunne in the latter's ambition to take over the street railways of Chicago, nothing official is at hand—his views are to be written on the boat and sent to Mr. Dunne—but from his public utterances in various cities it may be concluded that in his opinion the municipal ownership of street railways in this country under present conditions is not likely to be a success.

In one of his last interviews Mr. Dalrymple denied the newspaper reports that he had criticized American politics, but he added that politics is at all times a peril in city ownership. He does not see how public utilities can be operated by Americans under a "spoils system" and he believes a good man at the head of a department should stay there regardless of which party is victorious at election. It is his opinion, apparently, that a change in the methods of municipal government in American cities is essential before any important movement toward municipal ownership should be undertaken.

[illegible] eral matt[illegible]

## Entertainment of Electrical Men in Colorado Springs.

[illegible] guests arrived in Colorado Springs Thursday afternoon and Friday morning, June 8th and 9th. After going to their respective hotels the delegates began the various trips provided for their entertainment, starting from the [illegible] day afternoon. [illegible] "classes," each provided [illegible] distinct color. Each coupon gave admission to some one feature. On [illegible] excursion to Cripple Creek over the Short Line. A list of these "events" is as follows:

Drive to Bear Creek Cañon [illegible]

Electric car ride [illegible] interurban Railway [illegible] station of Colorado Springs [illegible] mines at Austin Bluffs.

Electric car ride [illegible] pany in Manitou [illegible] road.

Drive to the Garden of the Gods [illegible] estate of General Palmer).

Concert and dance at [illegible] gentlemen on Friday evening). Special electric cars were provided.

Excursion to Cripple Creek, the great gold mining camp, over Short Line (steam) railroad. This was for the whole party and was enjoyed on Saturday. A dainty basket luncheon was served on the train, which was run in three sections and carried about 600 people.

These features were carried out on Friday afternoon, Saturday and Sunday. In addition an informal dance was arranged for Saturday evening in the ball-room of the Antlers. Many, also, remained on Monday and [illegible] trips in the beautiful mountain region about Colorado Springs. Each "class" was in charge of a local chairman and six assistants.

An unusual feature—and one greatly appreciated—was the extending of the full privileges of the clubs to the various delegates and guests of the convention by the El Paso, the Pike's Peak and the Elks clubs of Colorado Springs. This was the first time that the exclusive clubs of that city threw open their doors to every member in attendance at a convention. Particular credit should be given the Town and Gown Golf Club for extending its privileges to the delegates and guests of the association who desired to play golf at any time during their stay in Colorado Springs. The association was given the exclusive privilege of using the links during Friday afternoon, June 9th, at which time a golf tournament was held and prizes of two fine silver cups, donated by President E. H. Davis of the association, were presented to the winners of the two matches, one for ladies and one for gentlemen. Mrs. Percy Ingalls of Arlington, N. J., won the ladies' cup, and Louis A. Ferguson of Chicago the gentlemen's cup.

No charge was made for any of the entertainment features except the ride up Pike's Peak, for which a reduced rate was obtained. The donations for the entertainment were received from the Denver Gas and Electric Company, the Colorado Springs Electric Company and many other electrical companies during business in the state of Colorado, the city councils, the hotels and the business men of both Denver and Colorado Springs, together with liberal contributions from manufacturing and supply companies throughout the United States.

The Colorado people felt that it was a good thing to bring such [illegible] West for the first [illegible] ciation, and for the first time west of Chicago since 1893 [illegible] and pleasure, the association officials will, in the future [illegible] attending a convention at a central western point once every three or four years.

It only remains to be said that the entertainment so liberally provided was on a greater scale than anything [illegible] association. It was thoroughly enjoyed, and the convention will ever be remembered as a red-letter one in every respect.

## Electricity Generating Stations and Refuse Destruction.

[From the London correspondent of the Western Electrician.]

The disposal of town refuse by burning has now been accomplished for many years, and to electrical engineers has been given the credit of having appreciated the modern destructor at its true worth. It is undoubtedly a fact that from the inception of the idea of combining an electricity generating station with a dust destructor—i. e., utilizing the heat produced in the destructor furnaces for generating steam—the cost to the municipality of disposing of their refuse has decreased, and if that were the only point of view from which the matter must be looked at, those concerned would be very contented individuals. But like so many new inventions, the policy surrounding its adoption has given rise to a vast amount of controversy which at the present time in Great Britain is as far from a settlement as ever it was. I notice that in an American popular journal some sweeping statements have recently been made as to what has been done in Great Britain in the matter of combining dust destructors and electricity works, and it is with the object of correcting any false impression that these may be likely to have caused that the following few facts have been collected.

To electrical engineers the question of combining their electricity works with the dust destructors is one of the gravest importance, and with the greater experience in the matter which time brings the hesitancy would appear to be the more pronounced. The most enthusiastic admit that the prime consideration is to dispose of the street garbage in the most sanitary manner. There are in Great Britain at the present something like 200 refuse destructors at work, of which about 50 are worked in conjunction with electricity generating stations. Thus it will be seen that the practice of combining the two is by no means universal, although very fair results have been obtained where the two have been worked conjointly. Leading men here take the view that too rosy an aspect should not be taken of this matter, and the reasons for this are summed up below.

The first instance in which a dust destructor was combined with electricity works was, I believe, at Shoreditch in London. This is a district largely given over to the cabinet and furniture-making trade, and consequently a large percentage of the refuse was comparatively of a high calorific value than is the case in most places. When the Shoreditch plant was first put into operation some glowing accounts were published in the daily papers as to the probability that practically all the electricity consumed in the district would be generated from the steam raised from the burning of the refuse. But Shoreditch is wiser today than it was at the opening of its electricity works, although a considerable quantity of steam is supplied from the destructor boilers. As pointed out above, some 50 other places have followed the example of Shoreditch, but all the wild talk that the public lighting of great cities like New York could be maintained from generators driven from destructor boilers is rather discounted when the average caliber of those towns that have combined electricity works and refuse destructors is taken into account. Not one has the slightest pretension to being a city that may be termed large in the broadest sense of the word. To Glasgow is given the credit of being the most go-ahead city in Great Britain, but there the combination has not been adopted; and the remark applies to other large places such as Sheffield. The real fact is that so many complications are introduced in order to insure smooth working between a dust destructor and the generating station that the results obtained hitherto do not in the opinion of the majority of the independent experts justify its use. It may be said that those engineers in charge of dust destructor generating stations have definite and opposite opinions on this matter. That is so, but there is a qualification to such a statement. In the origin of nearly all municipal electricity undertakings in Great Britain an outside consulting engineer is called in to advise. In many cases before he arrives on the scene the local authority has determined to adopt a combination of the refuse destructor and generating station, and the expert, when advised of this, like a sensible business man, devises a scheme to carry out the wishes of the council. And it is peculiar how deep rooted is the idea of combining the two in the case of the small local authorities. When the consulting engineer has finished his work and the station has been erected a resident engineer is sought to run the combined undertaking. Is it in human nature than an engineer in charge of a works will decry the principle upon which they are erected? Naturally he will try his utmost to make them a success.

However, even from engineers who have been and still are in charge of such undertakings, words of warning have issued quite recently, and it is mainly from these gentlemen that the most valuable cautions have been uttered. In the first place we have been told that the varying character of the refuse makes the steam-raising property a most uncertain factor. Again, the most suitable site for a generating station conducted upon the most up-to-date lines is necessarily not the most suitable site for a dust destructor. Obviously, to avoid too much carting through the streets the best site for a dust destructor would be in the center of the town, whereas with high-tension generation and distribution a certain flexibility exists in the choice of a site for the generating station, which may even be several miles outside the town. Another authority has stated that the fine film of dust which finds its way into the generating station from the destructor is most detrimental to the machinery, and that a high brick wall should be built between the two to avoid this. A further suggestion is that no windows should be built in the destructor house on the side nearest to the generating station. The more drastic opinion was once expressed that there were few engineers who did not regret the combination, if they had charge of it, after four or five years.

On the other hand, the following conclusions given by Mr. W. G. Adams (who is an ardent enthusiast of the combination and not connected with any particular works) before the Institution of Electrical Engineers in London this year show that an indiscriminate advocacy of the combination of a dust destructor and an electricity works is to be deplored—a conclusive answer to those in America who believe that the opposite is the opinion generally held here:

"1. The remarkable figures obtained in some undertakings, as demonstrated in the series of curves I have had the privilege of laying before you, are evidence that great advances have been made in the problem of utilizing waste heat from burning refuse in destructors since the pioneer works were started.

"2. That these results still leave room for substantial improvement—(a) by closer attention to the details of the construction of furnaces and flues and the general arrangement of the plant; (b) by improving the methods of handling and burning the refuse, and (c) by careful utilization of the steam and the adoption of an economical form of blast.

"3. That, given suitable conditions, there is without doubt a substantial gain to be effected by the combination of electricity and destructor works; but owing to the variation in the calorific value of refuse in different localities and to other special local considerations every proposed case of combination needs to be considered on its merits by persons qualified to make an independent and intelligent inquiry."

It should be pointed out that the results described above were not accepted by many other engineers, owing to the difficulty of discovering in the various London works, which were there referred to, the exact method of measuring the units generated from refuse and the units generated from coal.

Without, however, going too much in detail, it will be seen from the above that this matter is a very open one in Great Britain at present. But with modern methods of electric supply there is one factor which may have a very serious effect. Great Britain during the last five years has been "districted" between a number of electric power-supply companies which supply energy for power purposes to manufacturers, and also to local authorities for distribution in detail. Agreements for the latter form of supply are now becoming very numerous, the energy being delivered at a sub-station for transformation. Thus the opportunities for combining destructors and generating stations will tend to diminish rather than increase.

As mentioned before, the object of these few notes is to correct a wrong impression that may possibly be caused by writers in popular magazines as to what are the facts of this matter in Great Britain. As a means of disposing of refuse a dust destructor whether combined with a generating station or not is quite obviously the most sanitary method extant, and if the steam generated by it can be put to some useful purpose the more economical will be the results. But it is not going too far to state that the advantage to an electricity works in having a refuse destructor in conjunction with it is nothing like so great as is sometimes popularly supposed. One fact alone is sufficient to demonstrate this. The refuse is brought in in the morning and must of necessity be burned at once just at a time when, in most works in ordinary localities, the amount of power demanded is very slight. The refuse cannot be stacked for the evening load. Quite a number of places here have electricity works and destructors erected in different parts of the district, and, of course, not connected in any way. G.

## Simplon Tunnel Exposition.

The principal objective point of both the Simplon and the St. Gothard tunnel is Milan, the commercial center of Italy, and for two years past plans have been underway for the celebration of the completion of the Simplon Tunnel, by means of an exposition. The exposition is given under the patronage of the king, who makes a personal contribution of $19,300. The government has voted $96,500, together with valuable concessions and numerous awards. The city of Milan and private subscriptions provided $772,000. It has been decided to give special prominence to transportation and the fine arts. The exposition will open in April, 1906, and continue until November. Transportation exhibits are open to all countries, but the fine arts exhibits will be purely Italian. Harlan W. Brush, United States consul at Milan, says that American manufacturers of anything that can be included under the general head of transportation, including traveling cranes and electric locomotives, should give the exposition early attention.

The boring of the Simplon Tunnel, the largest tunnel in the world, was completed on February 24th. It is the fourth of the great Alpine tunnels, and the second between Switzerland and Italy. It was commenced in August, 1898, and was built by the Swiss and Italian governments. The total cost up to December 31, 1904 (the latest date for which statistics are available), was $13,317,000. The total length is exactly 12 miles and 458 yards. With the completion of the boring, the work of equipping the tunnel was commenced. The lining must be finished, the permanent way built and the signaling apparatus installed. Electric power will undoubtedly be used in the operation of the tunnel.

## Proposed Amalgamation of Harvard University and the Massachusetts Institute of Technology.

The amalgamation of the interests of the Massachusetts Institute of Technology with Harvard University was tentatively decided upon at a meeting of the corporation of the former institution recently, and if the alliance can be consummated without legal complications the corporation of Harvard University is invited to co-operate with the Institute trustees for a union between the two institutions.

A great majority of Technology graduates have been opposed to the alliance, and a vote taken a few weeks ago, it is said, showed that they were against it in the ratio of 3 to 1.

The plan as proposed contemplates that Harvard shall abandon the field of industrial science now cultivated in the Lawrence Scientific School, divert to the Institute all its funds now or hereafter available for this purpose, receiving a minority representation on the executive committee of the Institute, and adding to the Institute faculty its own faculty of industrial science. Students of either may take courses in the other, and "Tech" students may have the use of the Harvard playgrounds, museums, and libraries. The Institute of Technology is to move to Brighton, opposite the site of Harvard College on the Charles River, selling the property it now occupies in Boston. But it is not to lose its name nor the validity of its own degrees. It is simply to do its own work in co-operation with Harvard University.

## Western Union Quarterly Report.

The Western Union Telegraph Company reports for the quarter ended March 31st net revenue of $1,546,087, which, added to the surplus of $15,793,257 on January 1, 1905, leaves a balance of $17,339,344. Dividend of 1¼ per cent., paid April 15th, and interest on bonded debt amounted to $1,517,821, which left a surplus on March 31st of $15,821,523. The net revenues of the quarter ending June 30th, based upon nearly completed returns for April, partial returns for May, and estimating the business for June, will be about $1,750,000. Deducting dividends and interest will leave an estimated surplus for the present quarter amounting to $10,023,202. The executive committee recommends that a dividend of 1¼ per cent. on the capital stock of the company be payable on and after the 15th day of July next, to stockholders of record at the close of the transfer books on the 20th day of June.

## The New "Wunder" Arc Lamp.

The Ball Electric Company of Brooklyn, manufacturer of the well known Ball system of arc lighting, with the prestige given it by its experience in the electrical field covering a period practically since the inception of the first commercial arc apparatus, presents as its latest product a direct-current constant potential enclosed arc lamp called the "Wunder." This lamp has been constructed to burn on 100 to 130 volt direct-current circuits, and is adjusted to consume five amperes of current, which is the accepted standard. This current may be varied, however, one way or the other, if necessary. Fig. 1 is a general view of the lamp.

Ample provision is made for the liberation of heat above the arc enclosure to prevent the transmission of any additional heat to the operating works, with its deteriorating effect on the insulated wire of the magnets. The lamp contains an efficient vent for the escape of gases. The supply of oxygen to the arc is restricted in such a manner as to insure long life to the carbon.

None but fire and weather proof insulating material is employed in the construction. The length of the lamp is, over all, 29 inches.

The operation of feeding the mechanism of the lamp is actuated by double solenoids with a U-shaped armature, which is connected to a dash-pot and clutch by a rod, the whole being mounted on a central tube carrying the upper carbon holder.

FIG. 1. GENERAL VIEW OF "WUNDER" ARC LAMP.

The dash-pot, Fig. 2, is provided with a graphite plunger which is so constructed as to perform its function with the least possible amount of friction, thus insuring positive regulation when in operation.

For the steadying resistance there is used a spiral rheostat consisting of two coils mounted on a porcelain base, and suspended from the top of the lamp. A variable resistance may be obtained to suit the line voltage by means of a device employed for that purpose.

Particular attention is directed to the device for maintaining the inner globe in position. An inner globe with single opening is used. The globe entirely surrounds the lower carbon holder and the single negative rod on which it is supported, and is held in place by a metal cup at the bottom of the globe. This cup is connected to the bottom plate of the lamp by means of a flexible rod controlled in such a way that the globe is not held rigid, therefore responding readily to the variations in temperature. This obviates breakage of the globe due to expansion and contraction resulting from these changes.

The outer globe is spherical in form and is held in position on the lamp by a locking device connecting the band ring surrounding the flange of the globe and the bottom frame of lamp.

The clutch used in this lamp is not complicated, having but one movable part which grips the carbon in a manner precluding all possibility of slipping, and at the same time insuring the proper release of the carbon when the tripping device is brought into action.

It is asserted that the lamp will burn from 150 to 170 hours with one set of carbons. The most satisfactory result in the life of the lamp is dependent upon the quality of carbons used and the amount of current consumed. When retrimming the lamp, the stub remaining of the upper carbon may be used as a lower carbon.

## Operating Features of Vertical Curtis Steam Turbines.[1]

By Ar[illegible]

[illegible] requests [illegible] uninterrupted [illegible] high speed [illegible] on the rotating parts [illegible] maintenance of a good [illegible]

The [illegible] good alignment of the [illegible] the shaft. [illegible] moving the top bearing [illegible] ing field of the generator [illegible] ing devices are provided [illegible] shaft should run true and the bearing shield should be concentric so that the [illegible] will not exceed [illegible]

FIG. 2. FEED MECHANISM OF "WUNDER" ARC LAMP.

from 500 to 5,000-kilowatt capacity, respectively.

The generator bearings require the same attention as would be given to ordinary dynamo bearings. The middle bearing on account of heat conduction through the shaft from the turbine runs warm but with perfect satisfaction because of the light loads imposed on it by the vertical shaft.

The oil is fed to a reservoir with sight-feed glasses mounted at the top of the generator and also provided with an overflow pipe leading to the drain. To insure a full reservoir the supply is adjusted to cause a slight overflow. From the sight-feed glasses independent pipes supply oil to the two upper bearings under a sufficient gravity head to insure perfect lubrication under all circumstances.

To eliminate the packing at the lower end of the shaft the step bearing is generally water lubricated, the shaft being fitted with a bronze sleeve running in a babbitt-lined guide bearing. With water lubrication no attention is required beyond running the pressure pump, which may supply one or a number of turbines, the division of the water being automatically cared for by the baffler, the purpose of which is to make turbines of the same size or different sizes take their proportional share of the total flow of lubricant supplied by the pumps. This baffler is supplied with every vertical steam turbine and is a fluid-friction device of simple construction and readily adjustable to give any pressure drop desired. By its use it is possible to operate turbines of 500-kilowatt and 5,000-kilowatt output from the same pumps and piping system economically and satisfactorily under every condition.

The water used for lubrication of the step bearing and guide bearing is ordinarily permitted to flow over into the condenser and so on to the hot-well and feed-water tank, from which water is again taken for the step-bearing pumps so that

[illegible]

ism which will ultimately prevail as the simplest [illegible]

[illegible] turbines under various conditions. It is desirable that the valve casings be drained to the casing of the [illegible] machine is at rest, so that it can be started and the load quickly applied in case of need.

[illegible] tionary and revolving parts has been fixed by extensive experience and is made sufficient to satisfy the most exacting practical requirements. For example, instantaneous loads have often been applied to a 2,000-kilowatt turbine by means of an oil switch, [illegible] both condensing and non-condensing, and instantaneous loads of from 7,500 to 8,000 kilowatts have been thrown off and on a 5,000-kilowatt machine repeatedly with perfect freedom. The rapidity with which the machine may be started up is not in any way limited by the clearance of the machine and is only controlled by the speed with which the steam piping may be warmed up.

The multi-stage construction of the turbine affords the facility, which has been made use of in some cases, for abstracting steam, after being partly expanded, for feed-water heating and other similar purposes. The steam so expanded in the turbine is more economically used by the turbine than by most types of engine-driven auxiliary apparatus and so offers an economical means for making use of electrically driven auxiliaries, which are generally more desirable on account of less cost of attendance and maintenance without the disadvantage usually incidental to electrically driven auxiliaries, namely, insufficiently heated feed water. It is possible to build small turbines of the Curtis type which will yield exhaust steam for feed heating even more economically (for the reason that the pressure in the main turbine varies with the load), and such machines are frequently employed as exciters. Their simplicity and reliability combined with the absence of lubricating oil in the exhaust, making it possible to use open feed heaters and waste no water, will no doubt creat a demand which will justify their development for driving centrifugal circulating pumps, hot-well pumps, feed pumps, etc. Means are at hand for simply and automatically varying the speed of such turbine-driven pumps according to the load on the main turbine.

A number of turbines are now under construction, designed to work at an initial steam pressure of 15 pounds absolute, and expanding to the best vacuum obtainable, taking steam at this initial pressure from the exhaust of reciprocating engines in plants already built, but operating non-condensing. The energy available between these pressure limits is approximately equal to that due to the drop in pressure in the engines, and the turbine may be expected with a 27-inch vacuum to develop a kilowatt-hour for about 42 pounds of steam, so that the output of the engines will be equally [illegible] doubled if low-pressure turbines are installed of the same rated capacity as the engines without adding to the equipment of boilers, high-pressure steam piping, etc., and without increasing the coal consumption. The turbines receive only what steam is exhausted by the engines, and their output will therefore vary in the same degree as the load on the engines, the turbines floating on the system and contributing as much power to the total station output as the amount of steam supplied by the engines makes available. The amount of steam taken from the boilers is then controlled solely by the cut-off of the reciprocating engines. Since the no-load steam consumption of the turbines will be less [illegible] the turbines will never be a drag on the engines.

Turbines operating at the other extreme of the steam expansion [illegible] also under consideration, taking steam at say 250-pound pressure and expanding it to [illegible]-pound pressure, after which the

[1] Abstract of a paper read before the Denver-Colorado Springs convention of the National Electric Light Association June 6, 1905. Mr. Kruesi is designer for the General Electric Company.

steam is used for pulp digesters and other heating purposes.

To conform with prevailing practice based on steam engine experience the steam pipes for Curtis turbines have been proportioned for a steam velocity of about 6,000 feet a minute at full load, non condensing. Economy both in capital cost and in operation, however, makes small piping desirable, and there are a number of reasons why the whole of the steam piping for turbine stations should be designed on a different basis. The low velocity mentioned is probably well suited to engine work to avoid vibration of the piping due to the pulsations in flow of the steam and which do not exist in the case of the turbine, and to hold the pressure drop within the economical limit imposed by the engine and give the full pressure up to the point of cut-off. The turbine, on the other hand, takes steam continuously and the maximum flow is the same as the average. A reduction in pressure below that for which the engine cylinder and cut-off dimensions are designed causes a larger increase in steam consumption than in the case of the turbine, whose mode of operation makes it more flexible in this respect. An increase in the pressure drop allowed between boiler and turbines is even more justifiable when the steam is superheated, in order to reduce radiation losses, and involves no increase in initial cost, boilers costing substantially the same whether built for 150 pounds or 200 pounds. The mere increase in pressure from 150 pounds to 175 pounds by gauge reduces the volume by 12 per cent. and permits a six per cent. reduction in the diameter of pipes. It therefore seems desirable to make the rated boiler or safety-valve pressure about 25 pounds higher than the rated turbine pressure and permit a certain variation in pressure under extreme conditions and correspondingly less for normal load, etc., thereby reducing the size of the pipes and fittings and materially reducing the cost of the piping, securing drier steam, avoiding the frequent blowing of pop-valves, and, incidentally, another important advantage, namely, less trouble from leaky steam joints, especially when superheated steam is used.

## Combined Telephony and Telegraphy.[1]

By Samuel G. McMeen.

Perhaps the advantages of combined telephone and telegraph working on the same circuits can be shown more clearly in a picture than otherwise. Fig. 1 is intended to show what is at present possible in this direction. In this figure, it will be seen that over a line of a single wire, using earth as a return, one telegraph and one telephone service may exist at the same time. Over a two-wire line, by one method of operation, one telegraph and one telephone service may be secured at the same time; and this may be accomplished in two different ways so far as the apparatus and principles are concerned.

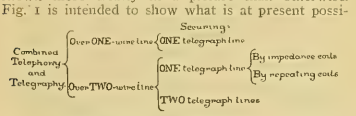


FIG. 1. CHART SHOWING ADVANTAGES OF COMBINED TELEPHONE AND TELEGRAPH WORKING.

By another method of working, a two-wire line may be made to furnish one telephone and two telegraph services at the same time. In all of these arrangements, under proper conditions, there is no interference between the two classes of service. The whole matter of superadding telegraph to telephone service on a one-wire line, or the reverse, may be dismissed by saying that it is not yet shown to be possible to do both things over a single wire without reducing in some degree the quality of the telephone service; the principal commercial application of such a plan is to convert the existing grounded telegraph lines into combined ones, thus securing telephone service of some value, without serious interference with the simplicity and convenience of the telegraph service. This is accomplished by the introduction of certain rather delicate apparatus for signaling, of more than usually powerful transmitters and of receivers of less than usual sensitiveness. A little thought will show that circuits specialized in this way cannot be connected to the standard telephone systems of cities, so that this form of combined working must be considered special, though valuable.

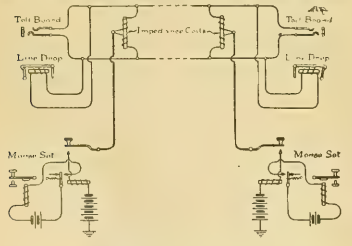


FIG. 2. ONE TELEGRAPH CIRCUIT WITH IMPEDANCES IN BRIDGE.

Combined working over two-wire or metallic circuit telephone lines, however, is free from this objection, and, indeed, from many other very serious ones. I shall try to show what and how important are the limitations which may be expected.

Any metallic circuit telephone line which is good enough for quiet commercial telephone service, may be made to furnish one telegraph circuit by having impedance coils bridged across it, as shown in Fig. 2. These coils should contain turns enough to enable them to be bridged across the circuit with no greater reduction in telephone transmission than would be caused by bridging across a high impedance standard drop or ringer. The magnetic circuit may be opened or closed; that is, the windings may be upon a straight bundle of iron wires, or upon a ring-shaped core. A tap is to be taken from the middle of the winding, or, which is equivalent, from the junction of two similar windings on the same core. This tap is carried to the telegraph apparatus and may be considered simply to be the end of the telegraph line. Any desired arrangement of telegraph apparatus may be added to the circuit thus secured, the only limitation being that the method of working should not involve high frequencies, such as are met in the Edison phonoplex or in any of the high-speed systems of automatic telegraphy.

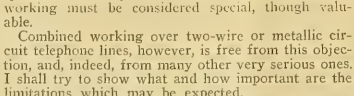

FIG. 3. TAP FOR TELEGRAPH CIRCUIT TAKEN FROM IMPEDANCE COILS.

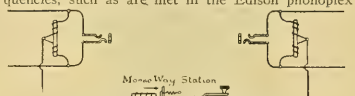


FIG. 4. TELEGRAPH SET IN TAP BETWEEN IMPEDANCE COILS.

Should it be desired to build up a telegraph circuit longer than the available metallic circuit, or to carry the telegraph circuit over a route not already provided with a telephone circuit, the tap for the purpose may be taken from the telephone pair through an impedance coil and into another pair in a similar way. This arrangement is shown in Fig. 3.

If desired, a telegraph set may be inserted at such a point as this, where the telegraph line transfers from one pair to another. Fig. 4 shows this condition.

Should it be desired to insert a pay-station in a telegraph circuit at a point which is not a terminus of a telephone circuit, condensers may be inserted in each of the wires, impedance coils bridged beside them, and the Morse apparatus inserted in the bridge wire which thus emerges from the pair. This arrangement is shown in Fig. 5.

In all the foregoing plans involving the use of impedance coils, there exists the difficulty that in case the two telephone lines so equipped are switched together through a toll board having no condensers or repeating coils in its cord circuits, the two sets of Morse apparatus will be connected together and confusion may result, quite as it does when two telegraph lines become crossed. Inasmuch as condensers of two micro-farads of greater capacity do not interfere with successful telephone transmission, cord circuits so equipped will be free from this fault. For the same reason the loop arrangement shown in Fig. 5 is free from any telephonic objection.

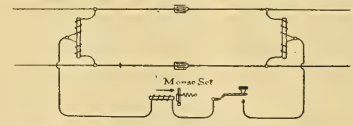


FIG. 5. PAY STATION INSERTED AT A POINT OTHER THAN TELEPHONE TERMINUS.

There is another fault in the impedance coil plan, in that ringing generators, suitable for local exchange line signaling, often require to have one terminal permanently grounded, or to have temporary grounds applied during the time signals are being run upon party lines, grounded rural lines, or other circuits involving ground in any way. If the same source of ringing current is used for toll line signaling, a little thought will show that the telegraph outfit will frequently be disturbed by a series of dots, caused by ringing current passing to ground through the Morse relays.

A preventive for such a derangement is found in providing separate ringing apparatus for toll operators, or by securing the ringing current for these operators through special transformers.

Roughly speaking, the best conditions of operation with the impedance-coil plan will be secured when, with a high resistance total Morse circuit, high resistance telegraph relays are used. It is not required that the resistance of the impedance coils be great, but only that their inductance and consequent choking due to voice currents be great. This is an immediate result of the iron core and the turns. For an expedient, a ringer may be used as such a choke coil, its two terminals being bridged across the telephone line, and a telegraph tap taken by extending the junction between the wires of the two spools. Such an arrangement, if the spools are at all nearly equal, will be quite successful. If a number of circuits are so treated, the ringers of the different circuits must not be stored close together with their cores parallel, or cross-talk between the circuits may result. This may be prevented by placing the adjacent ringers with their cores at right angles to each other.

It is obvious that a high impedance tubular drop having a middle terminal may also be used for such a telegraph tap, and in such a case the danger of cross-talk disappears, being prevented by the shield.

If such high impedance devices as ringers and drops are used for these taps, the Morse relays should be wound to high resistance, say 500 to 1,000 ohms.

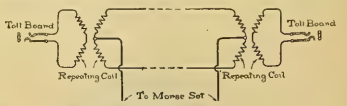


FIG. 6. TELEGRAPH TAP TAKEN FROM LINE SIDE OF REPEATING COIL.

By the use of repeating coils to be permanently inserted in the telephone line at the points where the telegraph tap is to be taken from the circuit, one Morse line may be secured from a two-wire circuit quite as has been described for the use of impedance coils. Fig. 6 illustrates how the tap is taken from the line side of the repeating coil. Coils may be secured in the market with arrangements made for taking out this tap. Connections to Morse apparatus are quite the same as are shown in Figs. 2 and 4. This arrangement has the advantage that no connections between telephone lines in the way of ordinary switching, nor any peculiarities of ringing apparatus, will affect the telegraph apparatus adversely. It has the disadvantage that the introduction of two repeating coils in a circuit causes a distinct loss in both voice and signal transmission, all the more marked when several lines so equipped are connected together. From the practical standpoint, this plan is not recommended for other than short lines, and then only under excellent conditions where freedom from interference is the thing most greatly to be desired.

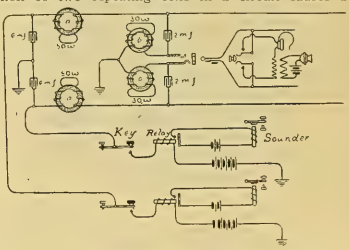


FIG. 7. TWO TELEGRAPH AND ONE TELEPHONE CIRCUIT FROM SINGLE PAIR.

The reason for non-interference between the telegraph and telephone services in either the impedance coil or repeating coil plans is that at any point where telephone apparatus connects to the two wires of the circuit, the potential difference of the two wires due to telegraph currents is always zero.

The arrangement of things shown in Fig. 7 is that which gives two telegraph circuits in addition to one telephone circuit from each pair of wires. The drawing shows the situation far more clearly than it can be described in words. The principle involved is that of different frequencies, the pulsations which make up the telegraph signals being so very much slower than those of the voice currents. When it is remembered that this drawing shows the equipment at one end of the line, and that the distant equipment is an exact duplicate; that the impedance coils (a a) are capable of passing telegraph impulses with little or no harmful effect upon them; that these coils further act with such a choking effect upon voice currents as to be practically opaque to them, and that the condensers of two micro-farads each are relatively transparent to alternating currents and opaque to direct currents, it will be easy to see how the two systems of communication can go on at the same time.

A close examination of the drawing will show that the direction of windings in the coils (a a) is such that the two halves of the total winding are connected in the familiar differential or reverse relation to each other. It will also be noticed that this is not true of the coils (b b). In the coils (a a) therefore, so far as direct currents are concerned, the

1. Presented to the National Inter-state telephone convention of June 20-22, 1905, in Chicago. Mr. McMeen is a consulting telephone engineer in Chicago.

[illegible] and the telegraph line [illegible] at the highest frequency used in telegraph [illegible] work, but for current of such high frequency and small volume as those of speech [illegible] each may [illegible] practically [illegible] independent [illegible] [illegible].

While the other arrangement which has been devised [illegible] between the two systems of communication by preventing the telegraph from producing any effect at all in the telephone receivers, this plan operates to modify the telegraph signals in such a way that, although they affect the receivers, they do not produce audible sound. A careful examination of the diaphragm of a receiver properly connected across a composite line while the telegraph is working, will show that it is moving through a considerable range, even though nothing whatever can be heard when the instrument is held to the ear.

I have indicated that each of the plans has some disadvantages. The flaw in this plan is that the shunt across the circuit through the coils and condensers is sufficient to prevent any ordinary ringing. Signals from one station to another require to be given over some Morse line, or by the assistance of special apparatus adapted to respond to currents of very high frequency. As the voice current is of a high frequency and can pass over the pair, so some other high frequency, but of larger volume, may be used to operate a relay at the distant station, and that in turn to display a signal. I have no plan to recommend, however, as there is no simple and convenient arrangement available.

The ordinary ringing current is of about 16 cycles per second; a skilled telegraph operator will send 32 dots per second; the half waves of the ringing current are less abrupt in change than the telegraph dot. For these reasons it is apparent that one may send ringing current instead of telegraph current over any composite Morse line without interfering with the telephone. This possibility enables one to sell the service of one side and retain the other for ringing. The arrangement of keys and signals is obvious.

Telegraph circuits secured in any of these ways may be treated as may be desired within reason, in the way of extending by repeaters.

There are three reasons why it is commercially of advantage to apply these composite methods to some of the circuits operated by almost any long-distance organization.

One of them is to secure an additional earning from the property, because by the very nature of things the lines are practically out of use during a large part of each total day. It is not found difficult to secure an annual telegraph revenue equal to five per cent. on the total cost of the circuit, and this without establishing offices or maintaining a special organization to care for commercial messages.

There is more demand for telegraph service in its private line form than is being fulfilled by all the existing telegraph equipment. An active canvass of commercial interests in one's locality, and particularly of those having offices, factories and branch houses in different places, is certain to produce contracts, at a rate less than for other methods, which will supply the consumer with a better result than he is now securing.

The investment on the part of the telephone company per telegraph station, varies with the different plans, but in all cases is only about as great as the cost of the line and equipment of a telephone subscriber located a similar distance from the central office. This statement is meant to cover the complete equipment, including the telegraph apparatus required at the consumer's station.

The second reason is the advantage of ticket wires over which much or all communication between toll operators may take place. Naturally, this enables toll operators to prepare for one conversation over an important circuit while another is going on. An intelligent use of such facilities will enable the carrying capacity of the more remunerative lines to be increased enough to defer the stringing of additional circuits.

The third reason is in the transaction of the official business of the telephone company. By its very nature such a company has its offices scattered about the country, and it is too often its tendency to overburden its own circuits with its official business during the day, while on certain routes there may be too few circuits to carry even the remunerative business of the public. It is inconvenient to force the official business into the less busy hours of the day. A very small investment in composite circuits, and a slight rearrangement of the company's organization, will enable an official to dictate telegrams which the stenographer herself, with a little knowledge of Morse, may place immediately upon the line. Such business may or may not be confirmed by mail. It is not essential that the operators be skilled to high speed, as training in accuracy only is sufficient, and even 15 words per minute is a sufficient rate. Very fast operators reach 60.

If it is not desired to extend the telegraph network over an entire system, official telegrams may be landed in important centers and transmitted by telephone to destination. Experience in this method of handling messages will show that errors are less frequent than might be expected.

## Milo G. Kellogg's Telephone Work.

During the last [illegible] [illegible] for, or in the interest of, Milo G. Kellogg, and in furtherance of a general plan of his to reinstate himself in the telephone manufacturing business, from which he was dispossessed, when, as he says, his attorneys sold out the control of the Kellogg Switchboard and Supply Company to [illegible] telephone interests at a time when he [illegible] seriously ill in California, and it was not expected that he would recover his health, at least sufficiently to take up active work again.

During the last year, also, some of the foremost telephone engineers, inventors and patent experts whom Mr. Kellogg had in his employment in the Kellogg company, and a few other telephone engineers and inventors, have been quietly at work in offices in the Association Building in Chicago. It was generally believed that these men also were working for or in Mr. Kellogg's interest in furtherance of the same object. Mr. Kellogg has now consented to give out some statement as to what his plans and objects are in the establishment and maintenance of this engineering and inventing corps and experimental shop.

MILO G. KELLOGG'S TELEPHONE WORKSHOP.

When Mr. Kellogg learned of the sale of his stock six months after it had occurred, and when he had become convalescent, he determined to take every step within his power to regain the control of his company and thereby be in a position to carry out to the end his plans for which he had worked for many years, and thus meet the expectations of his customers in the Independent telephone field. He at first adopted the course of negotiations to obtain the recovery of his stock. These negotiations were carried on for some time with apparently good prospects of success. When they finally failed, he adopted the alternate course which he had had in mind from the start—that of endeavoring to recover his stock and the control of his company by litigation.

As soon as Mr. Kellogg filed his bill for the recovery of his stock, which was in November, 1903, he began the employment of electrical engineers and inventors on his own account to carry on lines of development and improvement in telephone apparatus and systems such as had been carried on during his control of the Kellogg company; and in 1904 he established his experimental shop to put into concrete commercial form the improvements in apparatus and systems which his engineering and inventing corps had devised and were devising.

While Mr. Kellogg has strong grounds for expecting a favorable conclusion of his suit, he realizes that the law, like medical and other professions, is not a positive science, and that the out[illegible]

## American Telephones in the Foreign Field.

[illegible] been secured by the International Telephone Manufacturing Company [illegible] public exchange [illegible] ical self-restoring drop and jack switchboard, with fuse and carbon lightning arresters and central office apparatus, together with telephones, and a large quantity of construction material for the St. Catherine and St. Bastile Telephone Company of St. Catherine, Quebec. Additional apparatus for a 2,400-line capacity self-restoring drop multiple switchboard for the Company Telephonica do Estado de S. Paulo of Sao Paulo, Brazil; an order of central-energy telephones for the public service exchange at Port Arthur, Ontario, Canada; a complete central office equipment of the self-restoring drop type, with telephones for a public exchange at Santa Rosalia, Chihuahua, Mexico; additional apparatus for a 1,000-line capacity central-energy lamp signal double supervisory switchboard and central energy telephones for the town of Fort William, Ontario, Canada; a complete central-energy equipment shipped to Apostolos Agathocles, at Athens, Greece, and a shipment of telephones for increasing the public service system at Neepawa, Manitoba, Canada, are other orders secured by the company.

The International company asserts that while the European manufacturers have the great advantage of cheaper labor and raw material for the production of their goods, and also have the benefit of the general belief that European manufactured articles are of a finer quality than those made in this country, it is being generally conceded that it has so simplified its system by avoiding the use of much of the delicate and costly apparatus formerly deemed necessary in telephone systems and has so improved its machinery and methods of manufacture that it is in a position to produce more convenient, efficient and durable systems at as low a cost, quality of work considered, as can be furnished by foreign manufacturers.

## Ohio Telephone Notes.

A Toledo syndicate, consisting of James S. Brailey, H. A. Ashbrook, Secor & Bell and others, has purchased a large block of securities of the Cuyahoga Telephone Company of Cleveland. The stock, said to be 10,000 shares, represents one-third of the capital of the company. It was taken at $20, while the bonds, sold upon a basis of something like 86, making the whole transaction over $500,000. The syndicate is to have representation in the directorate, but the company does not pass to its control. It has been announced that there will be absolutely no change in the management and that this was one of the stipulations in the sale. The Toledo people paid more than the stock and bonds were selling for in the market, but because of the rapid growth of the business of the company, they consider they have acquired an interest in a plant that will be one of the best in the country within a short time. The company has $1,500,000 six per cent. cumulative preferred stock and the same amount of common, each having a par value of $50 per share. But $600,000 of the preferred stock has been issued, while all the common stock is out. E. W. Moore conducted the negotiations for the Cuyahoga company, and it is understood that all the money received for the securities will be put into the improvement and extension of the plant. The company on June 1st had 17,127 telephones in use. The surplus for May is on the basis of $150,000 for the year.

Work on the new plant of the Central Union Telephone Company at Columbus will probably be begun about July 1st. The building will cost about $100,000 and will house the exchange, which is to be entirely new, the Columbus district headquarters, the Ohio division headquarters and the district headquarters of the American Telephone and Telegraph Company.

H. W. Lloyd, Edgar Hampton and others have incorporated as the Holland Home Telephone Company of Holland, with a capital stock of $5,000.

The surplus of earnings of the United States Telephone Company for April were $5,838, which is less than for the corresponding month last year, because of an increase in expenses and taxes and the required deductions. The gross earnings were over $3,000 more than last year.

Manager Frank L. Beam of the Ohio Independent Telephone Association, after a trip over the state, expressed his entire satisfaction as to the conditions found. He said there is hardly an exchange that is not behind in filling its contracts. The demand is wonderful, and the growth of the business is assured.

The Grand Rapids Mutual Telephone Company of Grand Rapids, Wood County, has been incorporated with a capital stock of $10,000 by L. E. Carson, E. A. Hall and others.

Incorporation papers have been issued to the New Carlisle Telephone Company, New Carlisle, with a capital stock of $25,000. T. P. Sylvan, T. P. Shelton and others are interested. Another corporation in which T. P. Sylvan is interested is the Home Telephone Company of Mt. Sterling, with a capital stock of $15,000. W. H. Alkire, G. M. Fisher and others are among the incorporators of this company.

The Citizens' Telephone Company of Waterville has been incorporated with a capital stock of $50,000 by J. D. Farnsworth, E. B. Southard, George W. Moss, C. H. McDonough and W. C. Rowe.

The Lowell Farmers' Telephone Exchange Company of Lowell has been incorporated with a capital stock of $10,000 by H. H. Gessel, J. M. Merritt, Jerry Swain and others.

A certificate of incorporation has been issued to the Citizens' Telephone Company of Rock Creek. The capital stock is $4,800, and C. W. Harrington and E. R. Mills are among the incorporators. C.

## Indiana Telephone Items.

The Farmers' Mutual Telephone Company of Patriot, Ind., has filed articles of incorporation with $5,000 capital. The company proposes to establish an exchange in Patriot and will extend the line throughout the eastern part of Switzerland County.

An application has been filed with the Board of Public Works of Marion, Ind., for a franchise for a new Independent telephone company. The company is represented by Marion Evans, a prominent merchant of Marion. Mr. Evans says: "The Independents do not propose to be frozen out in Marion. The company I represent is ready and financially able to build a telephone exchange in Marion for local and outside connections, and will put in a complete system." The application provides for underground conduits within the fire limits and overhead wire in other parts of the city. A 50-year franchise is asked. The price to be charged for dwellings is not to exceed $18 a year, and the maximum charge for business houses not over $30 a year. This application, following so close on the consolidation of the interests of the United and the Central Union telephone companies, is evidence that the Independents are planning to cover the lost field.

The old German Baptist Brethren in national conference at Flora, Ind., have decided that the members should not be permitted to use a telephone in their homes, and those now using them will be requested to have them taken out.

The Central Union Telephone Company will issue new directories at Shelbyville and Crawfordsville. This is made necessary because of the greatly increased number of subscribers to the service.

Judge Welborn of the Posey Circuit Court, has granted the St. Wendell Telephone Company of St. Wendell, Ind., a perpetual injunction against Fred Brune, enjoining him from attaching his private telephone system to the company's line. S.

## Telephone News from the Northwest.

The Beeman Telephone Company of Valley City, N. D., has built 150 miles of lines this year and expects to double that by fall.

Materials have arrived at Groton, S. D., for the installation of a city telephone exchange.

The Nicollet County Telephone Company, with headquarters at New Sweden, Minn., has declared a dividend of eight per cent. The company has bought the system at St. Peter and has established exchanges at New Sweden, Cleveland and Nicollet. Headquarters are to be changed to St. Peter.

A friendly suit will be brought in the Supreme Court of South Dakota to determine the power of taxing a municipal telephone plant. The question will come up from Brookings, S. D., which is operating such a plant.

The Donnybrook (N. D.) Telephone Company will build a number of rural lines.

The International Telephone Company of International Falls, Minn., has been incorporated by Minneapolis capitalists who are developing that point. The capital stock is $50,000.

The Comfrey (Minn.) Rural Telephone Company will construct additional lines this summer.

The council of Redwood Falls, Minn., has finally granted the Tri-State Telephone Company the right to install as many instruments in that city as may be necessary to handle a long-distance business, instead of limiting it to a single connection as first proposed.

It is proposed at Gary, S. D., to increase the capital of the local telephone company and improve the system.

A. Schlaifer and associates have purchased the controlling interest in the Table Rock (Neb.) Telephone Company.

The Northern Telephone Company has purchased the system at Pocahontas, Ia.

The Sagola Telephone Company is constructing a line to Iron Mountain, Mich.

The Brighton Telephone Exchange Company has been granted a franchise at Brighton, Iowa.

The Corn Belt Telephone Company of Waterloo, Iowa, has been incorporated. The capital stock is $300,000. A. T. Averill and S. S. Lichty are interested. R.

## TELEPHONE MEN.

Charles Thomas, who has been with the Beeman Telephone Company of Valley City, N. D., has gone to Moose Jaw, Assiniboia, Canada, where he becomes superintendent of the Moose Jaw Telephone Company.

L. G. Richardson has been formally chosen to the presidency of the Cleveland Telephone Company, and Alexander H. Kirkwood, formerly cashier, has been chosen treasurer to succeed the late J. P. McKinstry. S. E. Fisher was elected auditor and assistant secretary. All the other officers were re-elected. John Sherwin was chosen director to take the place made vacant by the death of Mr. McKinstry.

C. P. Wainman, general manager of the Northwestern Telephone Exchange Company, with headquarters in Minneapolis, has been made vice-president of the company, which operates for the Bell system in Minnesota, North and South Dakota. He has also been made vice-president of the Duluth Telephone Company and of the Mesaba Telephone Company. The office of vice-president has been open since the promotion of H. J. Pettingill to be president at the beginning of the year.

## NEW COMPANIES.

D. C. Perry will establish a telephone line from Elizabeth City, N. C., to Okisko.

The People's Telephone Company of Tehuacana, Texas, has been incorporated with a capital stock of $2,500.

The Scottsburg-Houston Telephone Company has been organized in Scottsburg, Va. J. T. Lacy is president and R. A. Walden, secretary.

At Lawrenceville, Va., the Brunswick Mutual Telephone Company has been organized with $25,000 by L. H. Raney, president; F. W. Davie, secretary-treasurer, and I. E. Spatig, vice-president.

At Rome, N. Y., the Wire and Telephone Company of America has been incorporated with a capital of $600,000. The directors are J. S. Dyett, Rome; S. C. Houghton, Syracuse; and C. F. Niles, Toledo

## Method of Using One Telephone for Two Floors.

A unique device for using a single telephone for two floors is described by Mr. F. Ellwood Smith of Somerville, Mass., in the "Wrinkles" department of the National Electric Light Association. In the case Mr. Ellwood describes the company had been using for two years a separate telephone on the up-stairs and down-stairs floors. During the daytime the down-stairs telephone was seldom used. A box extending from the first floor to the second floor was then made and in this box was placed the up-stairs telephone, arranging it so it could be raised or lowered something like a dumb-waiter. The telephone wires were connected to two brass rods, which extended from the first to the second floor in the box, and connection was made from these rods to the telephone through sliding contacts which were open-arc lamp carbon brushes. A counter-weight was attached. During the daytime the telephone would be at the top, and used in the office on the second floor. At night the telephone would be pulled down-stairs and used there. This has been used for a number of years, and saves the company $75 a year.

## Space Telegraphy in the Navy.

It is said that all the space-telegraph companies except the Marconi, have been given contracts to install their systems on ships of the American navy and at the shore stations. The Maryland and the Pennsylvania are equipped with the Shoemaker system, the Illinois and the Alabama are fitted with the Fessenden system, and the West Virginia and the Colorado are equipped with the De Forrest system. The Telefunken system will be installed at the New Orleans station, and the Massey system will be placed on three shore stations. In each case the contract calls for a communication of 250 miles. The rival companies are confident they will be able to meet the departmental requirements. The Marconi people are still holding out for the exclusive arrangements which they claim to have made with the English and Italian governments. The result is that the Navy Department has made no arrangement with that company, as it has adopted the policy that better results are destined to be derived from rivalry such as that which requires a specified distance in the exchange of messages.

## GENERAL TELEPHONE NEWS.

Stone & Ginn have succeeded to the telephone business of Wall & Head at Edgerton, Mo.

The Pioneer Telephone and Telegraph Company has absorbed the plants of the Long-distance and the Shawnee Telephone companies at Shawnee, Okla., and is putting in a new 2,500-capacity exchange.

The Cincinnati and Suburban Bell Telephone Company has purchased the plant at Independence, Ky., 20 miles south of Cincinnati. The exchange has 150 subscribers. It is stated that no toll charge will be made for Cincinnati connections.

Circuit Judge Shaw has rendered a decision to the effect that the franchise granted the Merchants' Police and District Telegraph Company in Covington, Ky., is invalid on the grounds that the franchise was not advertised for sale, as required by law. This is the company that S. P. Kineon purchased to give him connection with Cincinnati for his Kentucky lines. The case will be carried to the Court of Appeals.

About 30 members of the Missouri Independent Telephone Association met in Sedalia, Mo., recently to revise the constitution of the association, thereby giving greater scope to the Independent companies. The following officers were elected: President, Frank Buffum of Louisiana; vice-president, W. B. Scruggs of Harrisonville; executive committee, Theodore Gary of Macon, J. A. Hudson of Columbia, and F. G. Taggart of Richmond.

The secretary of state recently issued a license for the Rockford and Interurban Long Distance Telephone Company in Illinois. The capital stock is estimated at $30,000. John H. Camlin, E. W. Brown and T. M. Ellis were granted the papers. The extensions will be made to northern Illinois, Wisconsin and Iowa. The first extensions will be made to Beloit, connecting with the Badger State Independent Telephone Company, thence to Belvidere and to Freeport, to connect with western lines extending into Iowa.

The Engineers' Club of Philadelphia has issued a very neat leather-bound book containing a directory of the members of the club and also the charter and by-laws. The book is of handy vest-pocket size and will be found very acceptable to the members of the club.

## New Electrical Water-purifying Device.

A French engineer named Otto [illegible] has been completed a device which can be put up in [illegible] and, by utilizing current from electric-light [illegible] be used as the housekeeper in purifying drinking water. The method, already used by a number of municipal waterworks, is based upon the germ-killing effects of ozone, which is cheaply engendered by electricity. In an electric discharge takes place between two glass tubes, one inside the other, whose surfaces facing each other are coated with metal, ozone is developed in the space between the tubes.

The kitchen apparatus consists principally of a small closed box, the metal cover of which is made conductory with the bottom. In the box is an ozone developer, an interrupter and a tin tube. Through the latter the ozone, which first has to pass through a cotton stopper, to free it from dust and germs contained in the air, is conducted into the water and mixed therewith. If much ozone has been absorbed, the water becomes phosphorescent in the dark. The most important part of the apparatus is the mixer, action of which can be interrupted at will. The apparatus is capable of purifying about 60 gallons of water an hour, it is said, and the cost per hour is about the same as that of an ordinary electric incandescent light.

## Ganz Three-phase System to Be Introduced in America.

The Ganz system of three-phase alternating-current electric traction, which is well known in Europe, is to be introduced in America. This system, for which much is claimed in the way of cheaper initial cost and operation over the existing electric railway construction methods at present in vogue in this country, is to be exploited by the Railway Electric Power Company, in which several New York capitalists and railroad men are primarily interested.

The company has acquired the electric traction patents and manufacturing rights of Ganz & Co. of Budapest. These rights, etc., cover the United States, Mexico, Cuba and all the West Indies other than those under British supremacy.

The board of directors of the company is composed of John E. Borne, president of the Colonial Trust Company; William L. Bull, of Edward Sweet & Co.; Henry Seligman, of J. & W. Seligman & Co.; Stephen Peabody; H. R. Duval, of the Atchison, Topeka and Santa Fe Railroad; Leopold Wallach, of Wallach & Cook; Henry L. Sprague, of Stetson, Jennings & Russel; Gustav Lindenthal, former commissioner of bridges, and Gustave Leve. L. B. Stillwell, electrical director of the Interborough Rapid Transit Company, and Frank N. Waterman are the consulting electrical engineers.

## American Enterprise Appreciated.

The New Orleans and Carrollton Railroad, Light and Power Company, of which Joseph H. De Grange is vice-president, issued a little booklet giving views of its special electrical illumination during the recent Mardi Gras celebration in New Orleans. As readers of the Western Electrician are aware, this illumination was executed in a particularly artistic and pleasing manner and was carried out on a more elaborate scale, perhaps, than anything of the kind previously attempted in the South. One of the booklets fell into the hands of Fred W. Teele, general manager of the Trinidad Electric Company of Port-of-Spain, Trinidad, British West Indies, and he wrote an appreciative letter to the manager of the New Orleans company, from which the following extract will be of interest:

"I certainly think you are to be congratulated upon the result of your work, and also upon the enterprise shown in getting out the illustrated booklet, thus helping your fellow railway and lighting engineers [illegible] from us [illegible] that [illegible] other instances. [illegible] central depots [illegible] pass every [illegible] I am [illegible]

## New Factory of the Universal Electric Storage Battery Company.

In the Western Electrician of [illegible] caption was given of the Manufacturing [illegible] tery, which is being manufactured by the Universal Electric Storage Battery Company, with offices at 1355 Railway Exchange.

This company has recently equipped a new factory, located in Chicago at 36 Union Park Place, which is particularly well fitted to carry out with expedition the manufacture of the batteries. The accompanying illustrations are reproduced from photographs showing sections of two of the floors. The factory now occupies about 50,000 square feet of space and is running day and night at its full capacity. It is thoroughly up to date in all respects. Work is being turned out in a lively manner, and there is a marked air of activity about the place.

The company makes a specialty of batteries of large ampere-hour capacity for car lighting and for heavy electric-truck service, the high-watt efficiency of the Morrison battery making it entirely practicable to build car-lighting batteries of 800 ampere-hours capacity, and larger, and electric-truck batteries of 600 ampere-hours capacity. It is possible to make these batteries of such weights and dimensions as can be conveniently installed and operated.

VIEWS IN NEW FACTORY OF UNIVERSAL STORAGE BATTERY COMPANY.

## "Inner Tip" Incandescent Lamp.

The tip on an ordinary incandescent lamp, which is formed in the sealing-off process, is sometimes the cause of the destruction of the lamp, as the projection is liable to be broken and thus allow the air to reach the interior of the lamp. Various styles of lamp without a tip have been devised, but they are necessarily more expensive to manufacture, since the lamp must then be exhausted through the stem.

"INNER TIP" INCANDESCENT LAMP.

A new lamp which is a compromise between the tipless lamp and the ordinary lamp is one which is illustrated herewith, manufactured by the Missouri American Electric Company of St. Louis, and called the "Inner Tip" lamp. The lamp is covered by patent No. 786,231, issued to Mr. McDonnel on March 28, 1905. In the manufacture of this lamp the air is exhausted in the same manner as in all lamps made by the usual process. After this by the patent process the tip is reversed inside the lamp as shown in the cut. The inner tip so formed is said to be considerably strengthened and there are no thin places in the glass to break and cause a leak. It has the further advantage that there is no projecting point to be broken off in transportation or to injure the hands of those handling the lamps.

The Allan liner Virginia, one of the new turbine boats, recently broke all previous records by the southern route across the Atlantic, having made the trip from Mobile to Cape Race in four days and seven hours.

## Electric Traction in Great Britain, Ireland and Belgium.

[illegible]

[illegible] electricity, and are used instead of comparatively expensive ordinary steam [illegible] there is little traffic, and where it is economical to use lighter rolling-stock which can stand idle in the interval between two successive trains, without costing anything except for the time of the staff, as working expenses.

As one uniform system of electric traction is to be adopted on the English railways, my work will principally consist in showing the different types which characterize the applications of this system on the different electrified lines.

LENGTH OF LINES ELECTRIFIED

| | Length Equipped | | Length Operated or Equipped for Operation |
|---|---|---|---|
| Electrified Sections of Steam Railways | Double Track. | Sidings (Including Sidings) | Double Track. |
| | Miles. | Miles. | Miles |
| Lancashire and Yorkshire railway (Liverpool-Southport) | [illegible] | [illegible] | [illegible] |
| Mersey railway | [illegible] | [illegible] | [illegible] |
| Metropolitan Railway of London | 28.8 * | [illegible] | - |
| Metropolitan District railway | [illegible] | [illegible] | - |
| Northeastern Railway suburban lines north of the Tyne | [illegible] | 82 | 14.9 |

(* Part now being equipped
" Length which is going to be electrified

But there is one common feature which applies to all these cases of electrification, and that is the relative position of the surface of the positive rail, from which the shoes of the vehicles take the current, and of the rolling surface of the track rails. An agreement was arrived at on March 3, 1903, at the London Clearing House, between all the English railways, that, in view of the possible extension of electric traction to lines over which the rolling-stock of several companies runs, the upper surface of the third rail should be placed exactly three inches higher than the rolling surface of the nearest track rail, and that its center should be three feet 11½ inches from the axis of the track.

The electrical resistance of the metal, which is a low-carbon steel, is not more than 7½ times that of pure copper. These rails [Liverpool-Southport line] are supported about every 10 feet; the positive rail is generally laid in the six-foot way and supported on insulators of artificial stone and fastened by two claw plates, bolted face to face, all the plates on one side being first put in place and held by a bolt passing through the insulators till the third rail is put in place; then the second set of plates are put on and the nuts screwed up.

The fourth rail or negative rail is supported on wooden blocks placed between the track rails, which are 30 feet long, and are all bonded electrically at their two ends with the fourth rail. The top

1. Extracts from a report made to the International Railway Congress in Washington. Mr. Gerard is inspector-general of the ministry of railways, posts and telegraph of Belgium.

of the latter is three-fourths inch lower than the rolling surface of the track rails.

Two kinds of electric bonds are used to connect the conductor rails, because there is no expansion gap at each joint, but only at every fifth joint. At the intermediate joints without gaps, the bond consists of strips of copper riveted to the soles and of flat links of copper wire riveted to the web and covered by the fishplates; at the expansion gaps, four sets of flexible strips are bent below the rails and riveted to the soles. The riveting is done by a hydraulic press.

One advantage of the system adopted is that it avoids the necessity of electrically bonding the track rails, as such bonds are subjected to alternating stresses when trains pass and tend to become crystalline and hence brittle; another advantage is that it is possible to repair the track—to take out any track rails in order to replace them without breaking the return circuit.

On the Mersey railway the weight of the positive rail varies between 100 and 60 pounds per yard, according to the amount of current it has to carry. The bonds consist in part of curved copper strips placed below the sole, to which they are riveted at four points by means of a hydraulic riveter; other flat flexible bonds are placed below the cast-steel fishplates.

Every fourth joint is a joint with expansion gaps. In the tunnel, however, where the temperature varies less, expansion is only provided for at every eighth joint. The bonds have a total cross-section of 400 square millimeters (0.620 square inch), part being under the sole and part against the web of the rails. The conductivity of the metals of the conductor rails is one-seventh that of pure copper. The insulators are of glazed earthenware and form six-inch cubes. Those placed below the fourth rail have the same horizontal cross-section, but only half the height. Along the whole length of the positive rail a single line of deals is fixed to it, with wooden packing pieces interposed, as protection.

The use of primary alternating currents makes it possible to locate the power station at a non-central point, favorably situated as regards cost of land, water supply and the handling of the fuel. We shall see that it is in this way that several of the companies which we are considering have dealt with the question. Two of them, however, the Lancashire and Yorkshire and the Mersey railway, were able in each case to install their power station at a point sufficiently near the center of the electrified lines to justify calling them by the old name of "central station." These two companies also use ordinary reciprocating steam engines, with very large flywheels, whereas the others have preferred steam turbines.

*Liverpool-Southport.*—The power station is at Formby, not far from Formby railway station, 10¼ miles from Liverpool, on the banks of the Alt, from which the water required is obtained. Its actual capacity is 12,000 horsepower. The building, which is 280 feet long, is divided into two bays, one, 50 feet wide, containing the boilers, and the other, 65 feet wide, containing the steam engines and the alternators; in each bay there is a 20-ton traveling crane.

In the engine house there are four cross-compound horizontal Corliss condensing engines of 2,360 horsepower each, running at 75 revolutions per minute, able to work with 20 per cent. overload; the flywheel is 22 feet in diameter and bolted direct to the rotor of a 1,500-kilowatt alternator generating three-phase current at 7,500 volts and a frequency of 25. The rotor, the windings of which are of star type, weighs 48,500 pounds, the poles alone (of which there are 40) weighing 12,800 pounds. The stator, which weighs 75,800 pounds, is on a slide, so as to be readily jacked away from the rotor when access to the windings is required. There is also a vertical compound engine working a 700-kilowatt alternator, running at 94 revolutions per minute. The exciting current is supplied by three generating sets, each consisting of a Willans engine and a 100-kilowatt dynamo. A special room, known as the high-tension chamber, contains the switchboard, from which the current is distributed to the four sub-stations, which are situated at Formby, Seaforth, Sandhills and Birkdale, respectively. They receive the primary current through paper-insulated, lead-sheathed cables (the paper of each cable being differently colored, according to phase), armored with galvanized-steel wire. They are tested to 30,000 volts and have a total length of 70 kilometers (43.5 miles). Of the four sub-stations, three are provided with four rotary converters each, and the fourth with only three.

*Metropolitan Railway.*—In order to supply current to the London Metropolitan railway, a power station has been installed at Neasden, which is to the northwest of the metropolis, and where there is a station on the Metropolitan extension, between Baker Street and Harrow-on-the-Hill. This power station, which is to generate from 14,000 to 17,000 horsepower, covers a space of 327 by 101 feet, not counting various subsidiary buildings. This power will be developed by three Westinghouse turbo-alternators of about 3,500 kilowatts each, capable of being overloaded considerably. Room is provided for a fourth generating set. The three-phase alternators, which are designed to supply 184 amperes at 11,000 volts, run at 1,000 revolutions per minute. The four-pole rotating-field magnets give a frequency of 33 1-5 per second. Owing to the dangers which such a speed involves, it is made out of a special quality of fluid compressed steel manufactured by Messrs. Armstrong, Whitworth & Co. Special devices are also provided to keep the windings in place, by confining them between bronze caps. The efficiency of the alternators is guaranteed to amount to 96.5 per cent. at full load, 95.5 per cent. at three-quarters load and 93.75 per cent. at half load.

The turbines, which are of 5,000 useful horsepower each, are of the multiple-expansion double-flow type. With steam at a pressure of 175 pounds per square inch and superheated 180° F., the guaranteed consumption of steam is 17 pounds per kilowatt-hour at full load and 20.25 pounds per kilowatt-hour at half load.

*Metropolitan District Railway.*—The power station which will operate the electric traction service of this railway is located at Chelsea Creek, on the banks of the Thames, and has a frontage on Lots Road.

It is well known that this enormous power station has not been erected for the needs of the Metropolitan District alone, but in order to supply a group of railways which will take current from it at the net cost plus 10 per cent. This group consists of:

| | |
|---|---|
| Metropolitan District railway | 39.95 miles |
| Baker Street and Waterloo railway | 3.65 miles |
| Great Northern and Brompton railway | 7.78 miles |
| Charing Cross, Euston and Hampstead railway | 8.02 miles |
| Edgware and Hampstead railway | 4.04 miles |
| Total | 63.44 miles |

or say 127 miles of single track, without counting sidings, etc.; moreover, arrangements have been made with the London United Tramways Company to supply the current required for its system, which will extend over 75 miles of road.

This remarkable installation is being built on a piece of land having a frontage 1,100 feet in length on the Thames, and another 824 feet in length on Lots Road. The main building is 454 feet long by 175 feet wide and 140 feet high, and there will also be other buildings for offices and other purposes.

*Northeastern Railway.*—The Northeastern Railway did not itself generate current; it has a contract with the Newcastle-upon-Tyne Electrical Company, which has hitherto supplied it with current from one of its power stations, Neptune Bank Central station; but, as this did not suffice, the company recently built the Carville power station, on the banks of the Tyne, which was one of the first in England to use Parsons turbines for driving dynamos. The general plan of this station is designed so as to make large extensions possible. The building which has actually been erected contains the installations necessary for several generating sets—one turbine working a 2,000-kilowatt alternator and two turbines working two 3,500-kilowatt alternators, as well as the corresopnding exciting dynamos. The current generated is at 5,500 volts and has a frequency of 40 cycles when running at 1,200 revolutions per minute.

The steam for the turbines is supplied by 10 boilers working at a pressure of 200 pounds per square inch and superheated 150° F. Mechanical stoking is applied. Each tubular boiler has a direct heating surface of 4,500 square feet and each superheater one of 900 square feet. The grate area is 120 square feet; it is divided into two parts, moved separately by the mechanical gear. Water for condensing is taken from the Tyne by means of Gwynne pumps.

There are five sub-stations. Altogether, they contain 14 rotary converters, with static transformers of 800 kilowatts each, which are distributed in accordance with the amount of power required by the traffic on the sections supplied by the different sub-stations.

### Electric Automobile Cars in England.

Apart from the electrification of some of the lines on its system, the Northeastern Railway Company has, on other sections, put to work some automobile cars to meet certain limited demands in the way of passenger service.

The type adopted, which recalls the principle of the Heilmann locomotives, is as follows: A generating group is placed in a compartment located at the end of a bogie carriage. This generating group consists of a petrol motor with a well-balanced heavy flywheel, coupled generating dynamo and a small exciter; the current operates two series motors, which drive the two axles of the bogie beneath. The running is regulated from one or the other end of the carriage or from either side. A battery of accumulators, of 38 cells giving 120 amperes, is placed in parallel with the exciter and serves both to equalize the lighting and to give a momentary current for starting the petrol motor by means of the dynamo, the armature of which is fixed to the same shaft, and which for the moment acts as motor. When the speed has run up to 420 or 480 revolutions per minute (according to the quickness of start wanted) the current is made to pass to the motors, placed either in series or in parallel. In addition, the exciting current of the dynamo can be varied by the rheostat according to the load. Thus a range of tractive effort and of speed up to 36 miles per hour on the flat is available.

When the handle of the controller has been moved back, it can be moved in the opposite direction, in order to produce electric braking by means of the magnetic brakes, the motors then acting as generators.

The motorman, moreover, for more complete power of regulation, has at each end compartment a rod available, which controls the throttle of the petrol motor.

The following are the chief particulars: Length of car, 52 feet; width, seven feet 11 inches; length of compartment containing the engines, three feet three inches; total weight in running order, 35 tons; there are turnover seats in two rows for 52 passengers; the petrol motor gives 80 useful horsepower. There are four horizontal cylinders 8½ inches in diameter and with a stroke of 11 inches. They are arranged in pairs, opposite to each other, and act on a double-crank shaft. The generating dynamo can give 55 kilowatts. On the same shaft is fixed a well-balanced flywheel three feet in diameter. It drives a 3.75-kilowatt exciting dynamo by means of a belt. On the shaft on the latter there is a second pulley taking the belt which drives a fan intended to cool the cooling water of the petrol motor. The electric motor is the Westinghouse make, of 55 horsepower, the gearing being in the ratio of 18 to 64. The lighting is effected by 24 lamps of 16 candlepower. A small air compressor operated by a one-horsepower electric motor, automatically regulated, supplies the reservoir for the whistle. During the trials the engines and the controlling gear gave every satisfaction.

### Automobile Cars in Belgium.

A commencement was made in 1893 by a six-wheeled carriage with two motors without gearing, with the armature fixed to a sleeve on the axle and connected to the wheels by means of helical springs. With this object, a starwheel was fixed to the sleeve carrying the armature; the four points of this starwheel were connected by eight springs with links fixed to the spokes of the wheels. The field magnets were partly supported by plate springs having small travel, resting on the axle boxes and held against the twisting moment by horizontal rods. The car weighed 25 tons (24.6 English tons), 10 tons (9.84 English tons) of which were the battery.

We may recollect that in these first trials the motors were shunt-wound to facilitate recharging the accumulators when running downhill; but it was found that the amount of advantage derived was extremely small, taking into consideration the disadvantage which results from slow starting.

Five new cars were built in 1896-97 and fitted with compound motors, in order to make it possible both to recharge the batteries by means of the shunt winding and to accelerate the starting by means of the series winding. This was a very difficult problem, but several firms succeeded in solving it, in spite of the additional requirement that if it was found that the shunt was not required, it must be possible to do away with it ultimately and to provide for excitation in series.

In order, moreover, to compare the effect of the different methods of springing the motors, some of the motors were specified to have the armature fixed direct to the axle, and others were specified to have it fixed to a sleeve, allowing play for the axle, the selection of the kind of elastic coupling between the sleeve and the axle being left to the discretion of the contractor.

In spite of all the ingenuity displayed in the different solutions which have been described elsewhere, but would require too much room here, we hasten to state that the dead weight of the accumulators and the limited amount of energy stored in them are but little compatible with the use of such cars on steep gradients, and it is only on steep gradients than any appreciable amount of recharging takes place. Moreover, the two windings lead to complication in controlling the currents for the purpose of regulating the speed, and extreme care is required in constructing the appliances, in managing them and in maintaining them. This was the first lesson drawn from this new series of experiments on the winding of the motors and the regulation of the speed.

The car was used for investigations which gave valuable results. The body has a central gangway with the entrances at the ends, and is carried on bogies; it contains several compartments for second and third-class passengers, with 36 and 40 seats, respectively. In addition, there is standing room for eight passengers in each of the end compartments, so that the car takes altogether 92 passengers. Each of the end compartments is divided into two parts, one of which forms the cab of the motorman. The entrance to the carriage is between this compartment and the central gangway.

In so far as it is a question of trains at rare intervals, on sections where there is no advantage in increasing the number of trains, automobile cars make it possible to realize some economy as compared with trains hauled by steam locomotives. Electric automobile cars have the advantage that the speed can be easily and readily controlled with

great simplicity and certainty from either end of the car without any necessity for turning the car around. Experience will show whether accumulators or dynamos driven by petrol motors give the better results.

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## Report on Present Methods of Protection from Lightning and Other Static Disturbances.[1]

By Alex Dow and R. S. Stewart

Transmission lines are occasionally subjected to excessive high-potential strains that would be injurious to generators, transformers or motors, and it is the function of a lightning arrester to protect the apparatus from such strains. These excessive strains are due to the following:

First—Lightning. Lines are seldom struck by a direct stroke of lightning, and when struck the damage is not necessarily serious, if the line is struck some distance from the station, for the line chokes back the discharge. Poles are split by the lightning traveling down them, instead of following the line into the station.

A good example of the action of a direct stroke was observed in Detroit some years ago. One of the street-lighting towers was struck in the daytime, when no current was on the lines, the lines being thoroughly grounded at the station a mile away. As the tower was of iron, the main portion of the discharge evidently traveled down this to earth. Two of the switches at the top of the tower were burned out, the current jumping from the tower to the line, the auxiliary cut-out in one of the lamps was raised and the contacts welded together, showing that a very large current had flowed through this contact. This current then traveled down the line wires to the base of the tower and jumped to the case of the switch at the bottom and from thence to earth. Current also traveled down all four guy lines, splintering all the guy stubs. To one of these stubs a guy line to a telephone pole was fastened. A portion of the current jumped to this line and from there to a trolley wire, puncturing the insulator on the hanger. Nowhere else on the line was there any evidence of damage.

The damage sequent to a lightning discharge is in most instances the work of the induced currents set up in surrounding or adjacent conductors. The potential strain is usually from the line to earth, but may be (and frequently is) between the several wires of a circuit. This latter is more likely to be the case on lines in which the wires are strung some distance apart.

Second—High-frequency waves set up by sudden changes of load or by resonance. These waves are similar to the induced currents from lightning, but the frequency is not so high nor is the potential difference as great. The maximum strain is almost always between the several wires of the circuit.

Third—Static charges. A line insulated from the earth may become charged to a high potential if the climatic conditions are favorable. A very dry atmosphere, hot-wind storms, sand storms and great variation in the altitude of the pole lines are some of the causes of static charges. During severe sand storms the arresters may not be able to keep down the potential of the line, although they may be discharging almost continuously.

The best methods of protection are: Non-inductive high resistances connected from the circuit to the earth; lightning arresters with enough resistance in series with them to prevent the discharges from becoming oscillatory, and overhead ground wires.

Essential features of protective apparatus: They should discharge at a potential slightly higher than that of the system; the ordinary working of the system should not be affected by the discharge; the electric energy of the static disturbance should be dissipated as rapidly as possible; the static waves should be prevented from developing high-potential difference in generators, transformers and other apparatus.

An ordinary spark-gap from the line to earth fulfills the first condition perfectly. The gap can be set to break down at any voltage desired. A spark-gap is dispensed with altogether in some arresters, the line being connected to earth through a non-inductive resistance which is high as compared with the resistance of the rest of the circuit. Water-jet and tank arresters are examples of this.

The gap once broken down, the line current will follow unless some means is adopted for preventing this. Inserting resistance in series with the gap, subdividing the gap into several smaller ones, making the metal cylinders between the gaps of some non-arcing material, increasing the size of these cylinders so as to present a large cooling surface for the arc, and blowing out the arc by a magnet are the methods adopted at present.

The third condition is very hard to comply with, as static disturbances differ so much from one another. To protect from a direct stroke of lightning as little resistance as possible should be in circuit. If, however, the [illegible] the arrester [illegible] resistance [illegible] in the [illegible]

The fourth condition requires the use of choke coils [illegible] and [illegible] due to short circuit [illegible] load.

[illegible]

*General Electric Arrester* [illegible] one-thirty-second-inch air gaps are connected from line to earth in series with a non-inductive high resistance. Cylinders are large to give a large cooling surface for the arc. The current is kept low by the high resistance used. For protection from stresses between the separate wires of line, half of the gaps are cut out by a bridge connecting the two cylinders which are midway between the line and earth. The arrester thus connected will have the same number of gaps between the lines as from the line to earth. For very high-voltage systems several arresters are connected in series. This arrester should protect very well from ordinary disturbances, but the high resistance does not permit

VARIOUS FORMS OF LIGHTNING ARRESTERS.

of rapidly dissipating the large amount of energy in a lightning flash.

*Westinghouse Arrester for 2,000 Volts.*—Six one-thirty-second-inch air gaps are in series from line to earth. Cylinders are made of non-arcing metal. No resistance is used with this when connected to lines fed by 2,200-volt generators of moderate size. When a higher potential than 2,200 volts is used more gaps are used, and a resistance in connected in series with the arrester to prevent an excessive current from the generator flowing through the arrester. This arrester protects from severe flashes very well, but as the length of air-gap is longer than in the General Electric arrester, a higher difference of potential is required to break down the gap. On discharging a line that has a static charge, oscillating waves may be set up in the circuit, since no resistance is used.

*Westinghouse Low-equivalent Arrester.*—This was designed some five years ago in order to cut down the number of gaps required in the standard arrester when used on very high-voltage circuits. It consists of a small number of gaps which should break down at a little above the line voltage. In series with these is a high resistance, and shunted across this resistance is a second set of gaps equal in number to the first set. In series with the whole arrester is a small non-inductive resistance to keep down the main current. Non-arcing metal is used for the cylinders. The operation is as follows: If the potential of the circuit increases the series gaps break down immediately. As the resistance of these gaps when broken down is small compared with the high resistance in series with them, practically full-potential strain is put on the gaps shunted across this resistance and they will break down. After the static discharge the arc immediately dies out in the shunted gaps if the arrester is properly designed, and the high resistance cuts the current so low in the series gaps that the arc in these is next extinguished. This arrester combines the good qualities of both those already described, for it furnishes a high-resistance path for small static discharges and a low resistance for violent discharges.

[illegible] the iron pole pieces. This field draws up the arc [illegible] furnish high non-inductive resistance paths from the line to earth for any static waves.

DIRECT-CURRENT ARRESTERS

In direct-current service the arc formed by a discharge is much harder to extinguish than in alternating-current service. Fortunately, however, direct-current voltages are usually small.

[illegible] the single air-gap is between two metallic horns. [illegible] the lower extremity of the gap. This magnet is excited either by the discharge current or by the main-line current. The magnetic field set up blows out the arc immediately. The operation of this arrester is very satisfactory.

*Westinghouse Direct-current Arrester.*—This is built in accordance with the principle that if the voltage across a gap is very low no arc will be maintained in the gap. A large number of minute gaps are connected in series. Carbon particles are used to form the sides of these gaps. It is necessary in this arrester to keep the lines of carbon particles protected from the air, or an arc will be carried across the air above the carbon and will burn up the arrester.

*Garton Arrester.*—Two gaps are connected in series with a non-inductive resistance. Shunted across part of this resistance is a small coil. On discharge the current in the coil lifts an iron armature and increases the length of one of the gaps so much that the arc is immediately extinguished. The most serious objection to this arrester is that it contains moving parts.

*Westinghouse Tank Arrester.*—This was designed many years ago for the protection of large railway stations. Instead of air-gaps, a tank of running water is connected directly from the line to ground. The current taken will be small in comparison with the load. The arrester is disconnected from the circuit, except during thunder storms.

*Choke Coils.*—With all arresters choke coils are placed between the arrester and the apparatus to be protected. A coil of wire offers opposition to the passage of an electric discharge through it. The more sudden the discharge the greater will be the opposition. The opposing electromotive force in the choke coil may be so high that the path across the air-gap of an arrester will be easier than through the coil.

*Distribution of Arresters.*—In long-distance transmission the lines need no protection and the arresters are grouped at the two ends of the line. Several choke coils are used and the arresters are connected to the line at several places between the coils so as to be sure that some of the arresters will be at a maximum point of a static wave.

In distribution networks arresters should be scattered all over the network. There is no general rule as to the number necessary, except that the more arresters installed the better the protection.

In low-voltage networks that are tied together in many places, if one branch extends some distance from the network, weak spots near the end of the branch are punctured by discharges during thunder storms. Experiments with static machines and small networks of conductors showed the same phenomenon many years ago. A static wave traveling down the conductor is reflected back at the end of the conductor. The resultant of the advancing and reflected waves gives at the end of the line a potential strain that is double that of the advancing wave.

The remedy is to put choke coils in the branch at the point where it is connected to the network. The wave in the network will then be divided at the coil, part being reflected at this point and only a small part advancing along the branch.

*Overhead Ground Wires.*—In many long-distance transmission systems the lines are protected by ground wires strung above the lines. These ground wires are connected to earth every thousand feet. The theory is: If lightning strikes the line the ground wire would be struck directly instead of the line wires that are insulated from ground. As the earth's potential is above and also below the line wires these cannot be charged with static to a high potential. The inductive action of lightning on the line is much reduced, as the

1. Abstract of a paper read before the Denver-Colorado Springs convention of the National Electric Light Association on June 7, 1905. Mr. Dow is manager of the Edison Illuminating Company in Detroit.

ground wire is much nearer the line than the earth.

Discussion (in Abstract.)

E. P. Dillon, Colorado Springs, Colo.: Those of us who are operating in Colorado have our troubles, especially in the zone in front of the foothills, and we feel that lighting is probably more severe in this particular section than in any other part of the state, and we venture to say more severe than we have heard of in other sections of the country. It has required a good deal of attention and study of the peculiar conditions of each system. In Colorado Springs we have a fair amount of protection now, although it is not absolute. We have liberally distributed lightning arresters at various plants and sub-stations, but we have nothing on the line. We do not feel that the placing of lightning arresters on the line is warranted, the risk of having lightning arresters on the line more than offsetting their advantage. We have no ground wire, but I think perhaps a well constructed ground wire would probably obviate some of the difficulties which we have had. Our triangle is not very large, 16-inch centers, no double circuits on the pole line. At three different times in the last two years we have had lines burn down directly in the middle of the span. It seems that the arc starts in some way between the wires, resulting from some sort of a short circuit, and runs along the line until it finds a weak point and burns the copper. Our copper is No. 1, with large engines behind it, with heavy fly-wheel capacity, tending to hold the arc long enough to burn the lines down. This has never occurred on junction poles where you would think the lighting would jump around, but invariably happens on the straight line.

George R. Stetson, New Bedford, Mass.: In the station I had the care of in last December, and after having run direct current for a good many years, and an underground system of transmission for four or five years, an epidemic broke out among our motors that raged for several weeks and in two weeks destroyed more motors than had been destroyed in all the 14 previous years in the operation of our plant. This was an unexpected epidemic with us, and we went to work and treated it as fast as possible, but have not got over it yet. It was a static manifestation. Previous to this we had never found it necessary to make any particular provision for the care of our motors, but at this time the motors were punctured within a radius of three to five miles, one after the other, some being served by the underground system and some being served by the overhead system. The puncture was very much in the nature of a lighting puncture, generally on the armature. At first we were able to repair the armatures within a reasonable time and without much inconvenience to our customers, but it finally went beyond the motors outside, and came into the generators inside, and that was more serious. The singular feature of the matter is the manifestation at this particular time. We immediately went to work to take care of the motors as far as possible by putting up lightning arresters and kicking coils, and seemed to have conquered the trouble to quite an extent, but occasionally we have a manifestation now, particularly if we have not taken proper care of the motors.

I think the Pikes Peak scheme of the tank or water jet resistance in series with the gaps will do the business. I believe we will have some interesting data on that point later.

W. B. Jackson, Madison, Wis.: Regarding the static conditions on transmission lines, some three or four years ago I made a somewhat complete examination of the line in northern Italy, and at that time they had the jet static arresters in use. They were very much troubled by the attacks of static disturbances on their 20,000-volt generators, and they were frequently shut down, as I was informed, not on account of the lightning particularly, but on account of the static going through the insulation of the 20,000-volt machines. They then installed jet static arresters, and I think the arresters had been in about six months. I was informed at that time that since the installation of the water jet arresters, they had no trouble from static effects.

Mr. Dow: Water jets are still satisfactory. Your reporters believe that the water jets are the most comprehensively reliable arrangement that we have just now for protection against either lightning or static discharges when installed in connection with choke coils. The function of the choke coil is to locate the point of discharge for any excessive voltage. The objections to the jets are, first of all, the things are sloppy; and, next, that they take energy. Because of this taking of energy, we make the recommendation that they be held as emergency devices where possible, and upon the appearance of symptoms of static charge on the line the water jets be turned on.

Mr. Stetson's experience with punctures causes me to expect that he had re-action from his machines. I fancy when the short circuit occured that the machines went over, or there was a short circuit of some device on the line, and a quick breaking of a short circuit puts the worst stresses on the line. Mr. Stewart calculated at my request the effect of a short circuit on a certain transmission line we are now building in Michigan. The voltage between the wires on the short circuit will, by calculation, be in that case over 80,000 volts. We are, therefore, not at all anxious to start short circuits, nor break them too rapidly.

## Patent Litigation.

In the case of the General Electric Company, complainant, vs. the Allis-Chalmers Company and the Bullock Electric Manufacturing Company, defendants, alleging infringement of United States patent No. 726,391, Judge Cross in the United States Circuit Court, district of New Jersey, has overruled two demurrers, filed by the defendants, to the bill of complaint. The patent on which the suit is based is known as the Armstrong and Woodbridge patent and involves delta-connected voltage regulation.

To a bill alleging infringement of United States patents Nos. 625,806, 671,287 and 661,049, in which case the General Electric Company is complainant and the Bullock Electric Manufacturing Company is defendant, the defendant filed a plea setting up among other things that since March 1, 1904, it has not made, used or sold any devices of the character alleged by the bill of complaint to be infringements, having on that date leased and surrendered its plants, good-will, etc., to another. Judge Cross of the United States Circuit Court, district of New Jersey, overrules the plea.

The Anderson patent, No. 412,155, covering a trolley contact spring, has been held valid in two cases in which the General Electric Company was complainant and the Garrett Coal Company and the Morgan-Gardner Electric Company, respectively, defendants. Injunctions restraining infringement by the defendants were granted the complainant in both cases, which were heard in the United States Circuit Court, one for the western district of Pennsylvania and the other for the northern district of Illinois.

## Electrical Enterprises in Egypt.

According to a report from the German consul at Alexandria, Egypt presents an excellent field for electrical enterprises, not alone in the cities and towns, but for furnishing motive power for pumping water in the agricultural districts. Egypt imported electric materials to the value of $467,760 in 1904, drawn from the following countries: England, $222,485; Germany, $81,655; France, $41,265; Sweden, $25,960; United States, $25,855, and Italy, Switzerland, Belgium and Austria smaller amounts. The following towns have electric lighting systems, conducted by the companies named: Ismailia, the Société Electrique d'Ismailia; Mansoura, the Mansoura Electric Supply Company; Suez, the Société Electrique d'Ismailia; Tanta, Eugene Nahman & Co.; Port Said, Compagnie Centrale du gaz; Alexandria and Cairo, Compagnie Centrale d'Eclairage par le gaz. Electric-railway lines are operated in Cairo by a Belgian company, the Société Anonyme des Tramways du Cairo, whose share capital is $1,200,000, and in Alexandria by a Belgian company also, the Société Anonyme des Tramways d'Alexandrio, having a working capital of $1,600,000. The Alexandria and Ramleh Railway Company operates the electric railways running from Alexandria to suburban places.

## Foreign Trade Possibilities.

The building of a tramway line in Nankin, China, is projected.

The city of Nachod, Bohemia, Austria, plans the erection of an electric-light plant.

A German national automobile exposition is projected, to be held at Frankfort the coming autumn.

The Italian ministry of public works has granted a concession to construct a tramway line from Rome to Civita-Castellana.

A project has been presented by a member of the municipality of Mainz, Germany, to introduce electric lighting in the principal streets of that city.

The electric central power station in Podgorze, Austria, near Krakow, is to be enlarged and will receive additional motors, steam engines, boilers and electric fittings. Further information may be had from K. K. Staatsbahn-Direction, Krakow.

A new company, Le Central Electrique du Nord, with a capital of $1,200,000, has been formed in Brussels for the purpose of building an electric tramway between the cities of Lille, Roubaix and Tourcoing, France, and branch lines running a total length of 37½ miles.

The Austrian consul at St. Gall calls the attention of Austrian manufacturers to the increased use of electrical contrivances in the hotels of Switzerland, in laundries and elevators, and for ventilating, cleaning floors, beating carpets, etc. Switzerland has many hotels, and offers a big market for the sale of electric machines for such purposes.

The following cities are now issuing bonds to pay for contemplated public improvements, among which are sewerage works, electric plants, etc.; Belgrade, Servia, $2,000,000; Baden-Baden, Germany, $933,000; Giessen, Germany, $814,000; Mülhausen, Germany, $814,000; Regensburg, Germany, $476,000; Offenbach, Germany, $1,190,000; The Hague, Netherlands, $1,200,000.

# CORRESPONDENCE.

## Great Britain.

London, June 7.—The telephone agreement is now being seriously considered by the select committee of the House of Commons appointed for the purpose. The committee is in a different position to the ordinary committee of Parliament, inasmuch as it has no power to make modifications in the agreement, but is only able to make recommendations to the House as to what alterations should, in its opinion, after careful consideration, be made. Up to the present, witnesses from the postoffice have been heard in favor of the agreement, the general opinion being that whereas competition in London did not mean duplication of plant, competition in the provinces would be an unwarranted waste of capital and a duplication of plant, owing to the vastly different circumstances. So far as the proceedings have gone, it is clear that some members of the committee are in favor of an extension of municipal telephony, in preference to a state-controlled system. The officers of the postoffice, however, have put forward some very strong reasons why the municipal systems should be purchased at the same time as the company. Witnesses from the municipalities will be heard later.

Having been constituted by special act the sole tramway authority for London, the London County Council is gradually extinguishing all the remaining small interests of the companies. Up to last year all the companies on the south side of the Thames had been bought up with the exception of two, whose lines were in a more or less derelict condition. Having missed the statutory period at which the lines could be purchased, the council last year was confronted by one of the companies going to Parliament and asking for a revival and an extension of its powers, and also authority to work them electrically. The County Council quite naturally opposed the proposition most strenuously, its attitude being that the lines were not worth purchasing. In the end the committee ordered the council to pay the company a small sum for its rights. This year a similar application was made to Parliament by the remaining company in the south, with somewhat similar results. Taking the above in conjunction with the agreement just entered into with the one company in the north of London the County Council is now in sole possession of all the tramways in the County of London, a fact which should lead to a continuity and uniformity of policy which should augur well for the future.

With the mixed system of steam and electric traction which now exists upon the Metropolitan railway, it was obvious that some method would have to be adopted for hauling the ordinary trains over the electrified portion of the track. Consequently a number of electric locomotives have been ordered, each having four 300-horsepower motors, for hauling the main line ordinary trains over the portion of the track fitted with the third and fourth rails. The locomotives are also to be used for hauling goods trains in a similar manner. Altogether there will be 10 of these locomotives.

The inconsistency of opinion on questions relating to municipal trading between the general body of the members of the House of Commons and those of the House of Lords was well shown a few days ago. A certain provincial local authority obtained sanction from a committee of the House of Commons to supply electrical energy in districts contiguous to its boundaries, albeit there had been no demand for current from any of such districts. In due course the bill came before a committee of the House of Lords, but it was pretty quickly rejected. On the broad principle I think the latter decision is one which ought not to be quarreled with, for the primary functions of a local authority is to supply the needs of its own districts and not to speculate in districts where it has no power to raise rates.

The session of the Institution of Electrical Engineers has now closed and the report of the council has been published. The total membership of all classes is now 5,410, which it is anticipated will be increased to 5,677 by the end of this year. The council has this session elected Prof. Elihu Thomson an honorary member. Among the matters now in hand by the Institution, mention may be made of a sub-committee which has recently been formed for the purpose of entering into correspondence with foreign countries with a view to ascertain their attitude toward the question of international electrical standardization, and, if favorable to the idea—to procure their support in the proposal to form an international standardization.

Gradually all the large electric power companies are getting into working order. The latest company to commence the erection of permanent generating works is the Cleveland and Durham County Power Company, and the first installment of the plant will be 6,000 horsepower. Turbo-generators, of course, will be installed, the voltage being 11,000 and the frequency 25 cycles per second.

An association has been formed called the Incorporated Association of Electric Power Companies, having for its objects the encouragement, expedition and facilitation of the development of the industry of supplying electrical energy for

power and other purposes. [illegible] of gentlemen interested [illegible] pany. [illegible]

## New York.

New York, June 17.—Aldermen [illegible] and [illegible] have obtained [illegible] the Board of Estimate from acting upon the [illegible] route approved by the Rapid Transit [illegible]. This is part of the attempt of the Board of Aldermen to [illegible] the [illegible] law which takes away [illegible] power from the aldermen. The alleged motive of the application is to allow the matter to be [illegible] public vote.

Nearly all the arrears of the franchise tax have been paid this week and the city has not had to proceed to offer any of the franchises at auction to pay the taxes. Yesterday nearly $3,000,000 was paid over. The Manhattan Railway Company paid $1,888,305, and the Metropolitan Street Railway Company, $774,325. Some of the corporations are trying to offset rentals against the franchise taxes.

The Fourth, or Park Avenue Tunnel, through which the surface cars travel is now in course of renovation. An air-blasting apparatus worked by a motor is taken along the tunnel from point to point, the current being supplied from the trolley conduit circuits. Owing to the limited space for operation, the apparatus has been specially designed not to occupy more than about 15 inches in width, so that it can stand between the car tracks.

The Brooklyn Rapid Transit Company has opened its new line on Wyckoff Avenue, on which there will be ultimately 20 cars running.

Sanderson & Porter, electrical contractors of 52 William Street, have purchased for $1,500,000 the New York and Long Island Traction Company. The road is about 33 miles long and runs from Mineola to Freeport, via Hempstead, passing the new race course at Belmont Park.

The new electropneumatic signalling plant at the Long Island Railroad depot at Long Island City has been put into operation this week after exasperating delays. The plant controls 250 switches and 100 signals, and when first put in some months ago was found to be unworkable. The experience of the last few days seems to promise entire success this time.

The list of the newly elected officers of the New York Electrical Society is as follows: President, W. S. Barstow; vice-presidents, H. G. Stott, P. A. Bates, Max Loenthal, A. F. Ganz, L. B. Marks, W. S. Rugg; secretary, George B. Guy; treasurer, H. A. Sinclair.

The New York Edison Company announces, as from July 1st, a reduction in the price for current to 10 cents a kilowatt-hour. The old pro rata discount on the number of lamps is abolished.

Charles A. Thompson, with several associates, has incorporated as an electrical machinery concern bearing his name, with a capital of $25,000. His associates are James Shaw of Brooklyn and Rudolph Mieling of New York.

The Hallmund-Collbohm Electric Company of this city has been incorporated with a capital of $10,000. The directors are G. B. Rossman and M. H. Collbohm of this city, and H. Dinderichs of Ithaca, N. Y.

The village trustees at Freeport, L. I., have decided to purchase another (making the third) 100-kilowatt generator for the village electric-light plant, the present machines being insufficient for growing local business. D. W. W.

## Southeastern States.

Charlotte, N. C., June 17.—The electric railway from Atlanta, Ga., to Marietta, in course of construction for two years, has just been completed and opened for travel.

The Belton (S. C.) Power Company is progressing rapidly with the new dam over Saluda River and expects to have power in Belton by September, when the town will be lighted by electricity.

E. H. Trafford has submitted a report to the aldermanic committee on finance and electricity of Richmond, Va., in which it is contended that a municipal plant would net the city a revenue of over $78,000 above expenses, the sum of $16,000 to be deducted, however, for interest on $400,000 bonds for construction.

The Salisbury-Spencer (N. C.) Railway Company has been reorganized and elected E. M. Deane of Grand Rapids, Mich., president, and Harry B. Wales of Michigan general manager. It is expected that the line to Spencer will be in operation by July 10th. Extensions in other directions are contemplated.

Immediately after the defeat of a measure put to popular vote to establish a $35,000 lighting plant in the city of Thomasville, Ga., F. D. Dismuke, R. H. Neel and others, composing the light committee, made a present of $3,000 to the city for a lighting plant on condition that the lighting plant should be secured.

The town of Petersburg, Va., is considering the question of municipal ownership of lighting facilities. J. M. Quick is chairman of the light committee.

The Southern Electric Company of Nashville, [illegible]

[illegible]

## Ohio.

Cleveland, June 17.—The Cleveland, [illegible] and Mansfield Traction Company [illegible] with a nominal capital of $1,000,000, which will later be increased, it is said. W. H. Abbott, A. J. Halle, C. W. Collister, Frank Butler and H. B. Cavanaugh are the incorporators. It is supposed that the interests of the Cleveland and Southwestern and the Ohio Central [illegible] plan contemplates the use of power from the Elyria power house of the Cleveland and Southwestern.

Surveys are being planned for an extension of the Cincinnati, Georgetown and Portsmouth from West Union to Portsmouth and West Union to Manchester, the latter being a branch seven miles long. J. N. Gardner of New York and Portsmouth and West Union people are at work on the proposition. The line from Cincinnati to Portsmouth will be 95 miles long in comparison with 117 miles for the Chesapeake and Ohio and 107 miles for the Norfolk and Western. Another proposition backed by the same people is the Cincinnati, Toledo and Detroit Short Line Railway Company. It will be 220 miles long and there will be ten county seats on the line besides a large number of small towns. According to an interview, F. E. Seagrave of Toledo will be chief manager of construction, and T. Rhys Smith of New York and Major Walter A. Calhoun will be in charge of the engineering work.

City Solicitor Charles Murphy of Circleville has filed suit to prevent the Scioto Valley Traction Company from laying a third-rail system within the city limits. It is said that the franchise stipulates that the third rail shall not be used in the city.

The public subscription to the stock of the Ohio Northern Traction Company has been closed, the amount for that purpose having been taken is $1,938,000. The stock, which bears five per cent. interest, is said to have been purchased mainly for investment purposes. This is the company that will take over the Cincinnati Traction Company and allied interests.

A franchise for the construction of twenty miles of extensions in Hamilton has been granted the Ohio Northern Traction Company, lessee of the Cincinnati, Dayton and Toledo and the Hamilton lines. At Hamilton $550,000 will be put into a power house, $350,000 on tracks and road construction and $150,000 on rolling stock. The new route in Hamilton eliminates 21 steam-railroad crossings.

City Solicitor Baker of Cleveland has issued an opinion that the council may pass an ordinance regulating lighting rates. There is no law governing this matter, while there is a statute prescribing methods by which franchises shall be granted telephone companies. O. M. C.

## Indiana.

Indianapolis, June 17.—Harry L. Webber, city engineer of Richmond, Ind., has resigned from that position to accept the position of chief engineer for the Fort Wayne and Wabash Traction Company.

The two per cent subsidy tax voted by the property holders in Harrison County to aid in the construction of the extension of the Louisville and Southern Indiana Traction Company's line from New Albany to Corydon, has been placed on the tax duplicate. The work in Corydon was begun last week. The right-of-way extends through the range of hills west of New Albany. An extension is also contemplated to French Lick and West Baden.

The Indiana Railway Company, which largely controls Northern Indiana and Southern Michigan interurban and city traction lines, has let the contract for the construction of a new branch of the system from South Bend to Laporte to George Townsend of Indianapolis. The length of the new line is 29 miles. Mr. Townsend is also building an extension of the Indiana railway system from Niles to Benton Harbor and St. Joseph, Mich.

A meeting of the representatives of the traction lines in Ohio and Indiana, and a committee from the Travelers' Protective Association, is being held in this city to-day to talk over the question of an interchangeable mileage book on interurban lines. It was the Travelers' Protective Association that obtained from the steam railroads the mileage books now in use, and they think a similar book in use on the traction lines would be a great help to the travelers. Several plans are suggested, and the Travelers' Association committee is hopeful of being able to adjust the difficulty now existing between the Indiana and Ohio lines. The present rate of fare on interurban lines is 1¼ cents a mile. It is

[illegible]

light plant, and bids will soon be asked for [illegible]

[illegible]

on electricity by Mr. [illegible] short time until electr[illegible] second lecture will [illegible]

[illegible]

## Michigan.

Detroit, June 17.—[illegible] Commonwealth Power [illegible] under [illegible] in the state. It will furnish power for the new electric lines to be built from that city to Adrian and to Lansing. It is a steam plant and it will supplant the company's plants operated by water-power and also be used to provide power for various manufacturing institutions in Jackson. This company is also constructing an office building on West Main Street.

The village of Trenton has made arrangements with the Peninsular Electric Lighting Company of Detroit for lighting the streets. The company will give free service on 20 street lights and connect with private consumers.

The Detroit United Railway of Detroit has been making a good showing and it is said that its dividends are to be placed on a five-per cent. basis at the next meeting of the board of directors.

It is again rumored that a movement is under way looking to the consolidation of all of Detroit's electric suburban lines. They are now all controlled by the Detroit United Railway except the Monroe and Toledo Short Line and the Detroit, Ypsilanti, Ann Arbor and Jackson. The Everett-Moore syndicate, now controlling the Detroit United, it is understood, would like to get hold of these two separate lines, but they are good properties and will consider a cash deal only. The Hawks-Angus syndicate, it is understood, had about sold the Detroit, Ypsilanti, Ann Arbor and Jackson line to the Everett-Moore people in 1901 just before the financial difficulties of the latter and for a good price, too. Now the road is making money, and if sold it will command a good price. H. A. Everett has always wished to see the Cleveland lines connected with those of Detroit and had, before the trouble mentioned, made an arrangement to lease, with option of purchase, the Detroit and Toledo Shore Line (since sold to the Grand Trunk railroad). Since then the Detroit, Monroe and Toledo Line has been built.

The street-railway strike at Saginaw and Bay City still continues and without prospect of settlement. The cars are being operated by strike-breakers under police protection and are very poorly patronized. The sympathy of the people is still with the men. The police were withdrawn for one day to rest up and the strike-breakers refused to take out cars without protection. Owing to the strike the Bay City Street Railway Company has decided to close its summer resort, Wenona Beach, for the season. In Bay City the municipal-ownership idea is gaining ground on account of the strike. An effort is being made to have the city withdraw police protection, without which the company would be unable to operate.

The Jackson Traction Company and its employes have signed an agreement to settle all differences between them by arbitration. C. G. W.

## Northwestern States.

Minneapolis, June 17.—Work is under way on the transforming stations which will form a part of the Twin City Rapid Transit Company's Lake Minnetonka extension. There are to be two stations, one at Hopkins and one at Excelsior. Power is to be transmitted to them at 12,000 volts pressure and distributed over the line at 600 volts. The two buildings will be fitted out with the most modern equipment.

An [illegible] has been granted at Yankton, S. D., to S. G. Donaldson. A plant will be in operation within 30 days.

A company has been formed to utilize the water power of the Root River at Rushford, Minn., and will construct an electric plant shortly.

It is reported [illegible] the Chicago Great Western

Railway Company contemplates operating its trains on the Fort Dodge, Boone (Iowa) extension by electrical power.

The Creston (Iowa) Mutual Electric Light, Heat and Power Company has been formed with J. C. Sullivan as president and J. W. Reynolds as secretary. It will be capitalized at $50,000.

L. L. Stewart of Omaha will install an electric-lighting system at Sumner, Ia.

The Great Northern Power Company of Duluth has recorded a mortgage for $10,000,000 in favor of the Knickerbocker Trust Company of New York. Of this amount $4,000,000 is to be spent in completing the power system.

McArthur Bros. have begun work on the dam for the new power plant at Sault Ste Marie, Mich., for the Edison-Sault plant.

A. G. Moser has resigned as general manager of the Winona (Minn.) Railway and Light Company.

R.

## PERSONAL.

Henry P. Hetherington of Detroit, Mich., has been elected president of the Detroit Public Lighting Commission.

Friends of Arthur S. Ives, civil engineer, in the West and also in Philadelphia, his recent residence, will be interested to know that he has recently accepted the appointment of assistant general manager of the Glamorgan Type and Foundry Company of Lynchburg, Va. Mr. Ives now makes the last-named place his permanent residence.

Announcement is made that deLancey Rankine has been appointed third vice-president of the Niagara Falls Power Company and its allied companies, including the Canadian Niagara Power Company. Mr. Rankine is a brother of William B. Rankine. He is now secretary-treasurer of the Cataract Power and Conduit Company of Buffalo; secretary, treasurer and general manager of the Tonawanda Power Company and the Suburban Power Company. The appointment is made to fill the vacancy caused by the death of the late George W. Davenport.

Frank C. Randall has resigned the position of vice-president and general manager of the National Electric Company which he has held since the early part of 1904, and joined the Allis-Chalmers Company as district manager for the district of New York with headquarters in New York city. Mr. Randall has been closely identified for years with the street-railway supply interests. He belongs in Boston, where he began his business career in the office of his father, who was an importer of special grades of iron and steel. After gaining a couple of years' experience under his father's eye he took up railroading, becoming first the "performance of engines" clerk and later chief clerk of the motive department for all divisions west of Willimantic of the New York and New England railroad. He was afterwards chief clerk of the motive department of the Boston and Lowell road and held this position until the consolidation of the road with the Boston and Maine Railroad. He then entered the shops of the Tripp Manufacturing Company, became expert in the manufacture of electric railway car trucks and rose first to the place of foreman and later to that of superintendent of the works. He left this position to become eastern sales agent for the J. G. Brill Company and was later transferred to the West with headquarters in Chicago. Six years later he accepted the position of eastern sales agent for the Christensen Engineering Company and later became general sales agent for that company and its successor, the National Electric Company, finally becoming vice-president and general manager of that concern. Mr. Randall brings to the Allis-Chalmers Company a valuable knowledge of how to secure business, and of the organization of a selling force. His special acquaintance in the electric-railway field will prove of great value in advancing the interests of the electrical branch of his company.

FRANK C. RANDALL.

## ELECTRIC LIGHTING.

A franchise has been granted to T. R. Osmond for the construction of an electric-light plant in Jacksonville, Fla.

The plant of the Oregon City (Mo.) Light and Water Company has been damaged by fire to the extent of $1,500.

The Prospect Electric Light and Power Company of Columbus, Ohio, has increased its capital from $10,000 to $20,000.

The electric-lighting company of Rio, Wis., is having plans prepared for one 60-inch turbine and one 75-kilowatt alternating-current generator with step-up and step-down transformers. The Milwaukee Engineering Company is the consulting engineer.

The Frisco Ice and Light Company of Granberry, Tex., has been chartered to operate an electric-light and power plant. J. W. Day heads the incorporators.

The Columbia Light and Power Company of Columbia, S. C., has been incorporated with a capital of $10,000 by C. D. A. Spivey, J. C. Spivey and others.

George S. Carson of Iowa City, Iowa, and T. B. Carson of Davenport have purchased the gas and electric plant of the Washington (Iowa) Illuminating Company. The purchase is for $36,500.

The City Council of Aledo, Ill., granted a 20-year franchise to Bollon Bros. on June 14th, and they will begin at once the installation of a $16,000 electric-light plant. W. D. Emerson is the city clerk.

The Algiers Railway and Lighting Company has incorporated at New Orleans, La., with $360,000 capital stock to construct and operate electric-light and power plants, etc. Leigh Carroll is president and L. H. Marrero vice-president.

The city of Cockeville, Tenn., is completing arrangements for the installation of waterworks and an electric-light plant for which bonds were recently voted. Granberry Jackson of Nashville, Tenn., is engineer in charge.

The Campbellsville (Ky.) Electric Light Company has been organized with Dr. J. L. Atkinson, president; J. R. Davis, secretary-treasurer, and B. S. Kincart, superintendent and general manager. The company will operate an electric-light plant.

It is reported that the Southwest Missouri Light Company will make improvements to plant, including one 30-kilowatt 60-volt exciter, one 11 by 11 high-speed automatic self-oiling engine, complete switchboard for sub-station and considerable other machinery. Mr. A. M. Barron is general manager of the company.

## ELECTRIC RAILWAYS.

Hamilton Browne, president of the Newton (Iowa) Northwestern electric railway, has tendered his resignation. Mr. Browne has been for some time engaged in the construction of the Elgin and Belvidere railway in Illinois and will become president of the road.

A new private car for President Huntington and an electric freight locomotive have been turned out by the mechanical and electrical department of the Pacific Electric Railway Company of Los Angeles, Cal. Each has a motive power of 800 horse-power, but the one is geared for high speed and the other for tractive power.

At the last meeting of the stockholders of the York (Pa.) Street Railway Company it was decided to make an extension of the company's line, which will connect the Highland Park division with the South George Street line. The proposed addition will make a complete belt line around the southwestern section of the city.

An electric railway is to be built up Lookout Mountain by S. W. Divine and associates of Chattanooga, Tenn., who have secured the right-of-way along the line of the old "broad-gauge" road which was in operation several years ago. Engineers are now engaged in making preliminary surveys. It is proposed to connect with the interurban line out of Chattanooga, which is to be built via Chickamauga Park to Ducktown.

The Des Moines (Iowa) News says that it is semi-officially announced that the Chicago Great Western railroad is planning the building of short electric feeders along its line, and that it has started this policy by making a proposal for either the purchase or the leasing of the Waterloo and Cedar Valley electric line, operating about 50 miles of electric road. It is stated that the Great Western will electrify its Sycamore branch, a new branch it proposes to build into Creston, and its Zumbrota division between Winona and Minneapolis and St. Paul. Other lines are in contemplation, but have not been decided on as yet.

The Westinghouse Electric and Manufacturing Company has just closed a contract for the equipment of the main generating station and four rotary-converter sub-stations of the Cincinnati Northern Traction Company. The power house will be located at Hamilton, Ohio, and the original installation will be of 5,000-kilowatt capacity, with provisions for ultimately increasing it to 10,000 kilowatts. In the generating station will be located three 1,500-kilowatt and one 500-kilowatt, three-phase, rotating-field, enclosed turbo-type generators and three 300-kilowatt rotary converters. Current will be generated at 375 volts, thus avoiding the necessity of lowering transformers for the main station rotaries. The outgoing lines will then be equipped with raising transformers having a ratio of 375-33,000 volts. Each generator will be driven by a Westinghouse-Parsons steam turbine and excited by a direct-current generator attached to the end of the turbine shaft, from which its power will be derived. Each sub-station will contain a 300-kilowatt rotary converter supplied by 33,000-375-volt step-down transformers. All transformers are of the oil-insulated self-cooling type. Besides the above, the contract includes all necessary switchboards and protective devices for the control and protection of apparatus in the power house and rotary stations.

## TELEGRAPH.

It is reported that the Postal Telegraph-cable Company will begin at once the construction of the telegraph line from Jasper, Ala., to Amory, Miss.

The cable steamer Stephan of the North German cable works of Nordenham is said to have successfully completed the laying of a cable between Menado-Yap and Guam for the German-Holland Telegraph Company of Cologne. The length of this cable is nearly 2,000 miles, and the greatest depth attained 2,300 feet. By this cable the Dutch-India colonies and the German Carolines are placed in communication with the American Pacific cable. The Stephan next proceeded to Shanghai to lay a cable 130 miles in length along the coast, which will form a part of the Shanghai-Yap cable, of which the main line is now being constructed by the North German Cable Works, and which will be laid next winter.

## SOCIETIES AND SCHOOLS.

The National Electric Light Association has received invitations to hold the annual convention of 1906 from Buffalo and New York, but the executive committee has taken no action as to the place of next meeting, and probably will not do so until October of this year.

The University of West Virginia at Morgantown, W. Va., has appropriated $3,000 for new electrical equipment in the engineering department. Mr. William E. Dickinson of New York city, who has recently been elected to be an assistant in the department of mechanical engineering, will install the new equipment.

Prof. F. R. Hutton, secretary of the American Society of Mechanical Engineers, announces that a large number of bids have been received for the construction of the new united engineering building which is to be built in New York city as a result of the contribution of Andrew Carnegie for the housing of the engineering societies. The contract will probably be awarded before this issue of the Western Electrician is printed.

A giant magnet, lifting tons of dead weight, will be one of the things to be seen next month in Mechanics Building at the International Electrical Exposition at Boston. Another interesting and notable feature will be an elaborate X-ray exhibit; also a complete exhibit of medical and surgical electric apparatus. Among the quarry machinery will be seen a model of the great five-motor, electric traveling crane which has recently displaced 10 of the old steam-power derricks in a Vermont marble quarry. The traveling public will be interested in a new electric annunciator for special use at elevated stations, notifying passengers, in advance, of the route, destination and stops that the approaching car or train will make after leaving a station. Then, too, there will be the operation of the new wireless trolley, the invention of a young Philadelphia electrical engineer, which entirely does away with all overhead structures as well as the third rail. Manager Chester I. Campbell reports that space is being rapidly taken, and that the exposition will be an elaborate and successful one.

## PUBLICATIONS.

An original piece of advertising literature is that just issued by the Consolidated Engine Stop Company of New York city. It is in the form of a small booklet setting forth extracts from the opinion of Justice Douglas in the Supreme Court of Rhode Island, relative to a personal injury case in which the Monarch engine-stop system made by the company played a prominent part in decision of the judge. The back cover of the booklet extends above the front cover, the extended portion representing the head and shoulders of a judge, giving a striking appearance to the booklet.

The "Transactions of the International Electrical Congress," held in St. Louis at the World's Fair, have been issued in three volumes. Collectively these three volumes contain 2,843 pages—every page full of the best and latest things in the modern development of electrical science, prepared by world renowned authorities on their several subjects. The transactions take up in alphabetical order the proceedings of the various sections. The books are well printed on a good quality of paper and contain all the diagrams and pictures which went with the original papers, and also several fine half-tones of group pictures taken at the congress. The work is published under the care of the general secretary and treasurer, Dr. A. E. Kennelly, to whom much credit is due for the arrangement of the work.

## POWER TRANSMISSION.

The Orange County Power Company, with headquarters at Port Jervis, N. Y., has been incorporated with a capital of $50,000. The directorate includes W. W. Handy and L. L. Marks of New York and Henry Troy of East Orange, N. J.

The city of Ozark, Ala., is contemplating the construction of a 300-horsepower dam across Choctawhatchie River seven miles from the city and the erection of power plant for the transmission of electricity. Plans and specifications are being prepared by Marvin McDonald, city engineer, who will also supervise the construction.

The York Haven Water and Power Company has decided to make an addition to its plant at York Haven, Pa. Four additional units will be installed in consequence of the demand for more current. The expenditure at this time will be about $100,000. The entire plant will be completed some time next year, when all of the units, which were intended for installation according to the original plans, will be put in.

## MISCELLANEOUS.

At the [illegible] the Schichau Works [illegible] fitted with turbine engines [illegible] hour for three hours. The [illegible] 29½ knots per hour [illegible] piston engines averaged [illegible] than the S 125.

It is said that experiments go to show that the temperature of the atmosphere in [illegible] Subway is from three to six degrees higher than on the surface, and from four to [illegible] than in the elevated trains. The observations were taken only at the subway stations, and Chief Engineer W. B. Parsons thinks that the higher temperature is due to the radiant heat from the crowds and from the sunlight through the glass roofs.

Although mica has been found in commercial sizes in about one-third of the United States, it has been mined during the last year only in North Carolina, New Hampshire, Colorado, New Mexico, California, Georgia, South Daketa and Idaho, which are named in the order of their importance as mica

[illegible] logical [illegible]

## TRADE NEWS.

[illegible] building [illegible] will deal in electrical [illegible] tracting business. [illegible] H. C. Hare.

# ILLUSTRATED ELECTRICAL PATENT RECORD.

*Issued (United States Patent Office) June 13, 1905.*

791,998. Resistance for Rheostats and Electric Heaters. Henry P. Ball, New York, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 23, 1904.

A metallic electrical conductor having the form of a ribbon ribbed longitudinally, to increase its sustaining power, is wound edgewise into a coil to form a rheostat resistance.

792,014. Transmitting Apparatus for Wireless Telegraphy. John A. Fleming University College, London, England, assignor to the Marconi Wireless Telegraph Company of America. Application filed September 7, 1904.

In a producer of electromagnetic waves are a pair of conducting bodies, separated by a spark-gap, and a motor and connections for rotating one of the bodies, and for causing sparking at successive portions of the body.

792,015. Telegraphic Signaling Key. John A. Fleming, University College, London, England, assignor to the Marconi Wireless Telegraph Company of America. Application filed September 7, 1904.

A movable circuit closer and breaker comprises a lever mounted to oscillate. A continuously-operating motor is provided with means comprising a flexible connecting member for connecting the motor to the lever. A transmitting instrument controls the coupling action.

792,016. Transformer Lead. John J. Frank, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 16, 1904.

An insulating bushing is formed of annular members of insulating material, each comprising an inner flanged portion and an outer flanged portion, the inner and outer portions of adjacent members overlapping. A washer is secured between an adjacent pair of the annular members.

792,020. Circuit Breaker and Closer for Alternating Currents. Andrew Gray, London, England, assignor to the Marconi Wireless Telegraph Company of America. Application filed September 7, 1904.

Details are described.

792,022. Electric Furnace. Ernst Haagn, Hanau, Germany, assignor to the firm of W. C. Heraeus, Hanau, Germany. Application filed March 8, 1905.

In an electric furnace is a recess in the wall reaching to near the heating or melting chamber. A conductor piece leads to the heating chamber and engages in the recess near its end face. A conductor also engages in the recess. A metal indicator connects the ends of the conductor piece and the conductor in the recess and is so disposed that it can be watched from without and indicate by its commencing red heat the correct strength of the current.

792,025. Means for Protecting Electric Circuits. John Hamilton, Jr., Boston, Mass. Application filed October 16, 1903.

Combined with an electric circuit is a relay circuit including a visual signal having a circuit closer controlling a second circuit which includes an audible alarm. Means for closing the relay circuit when the difference of potential between two points of the electric circuit exceeds a predetermined quantity, the circuit-closing means including a solenoid device normally cut out from the first-mentioned circuit, are provided.

792,035. Synchronizing Device. John D. Hilliard, Jr., Glens Falls, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed November 23, 1904.

Connected with an alternating-current dynamo-electric machine are a switch adapted to connect the machine to a source of alternating current, a relay comprising two magnet coils energized from corresponding phases of the machine and of the source, a second relay comprising a magnet coil energized with current of a different phase from the current in the other two coils and an electro-responsive device operative upon the simultaneous operation of the relays to close the switch. (See cut.)

792,043. Breaking Device for Electric Motors. Arthur Hultqvist, Göteborg, Sweden. Application filed March 30, 1904.

In an electric-motor circuit are a switching device adapted to change the motor into a generator, a safety circuit adapted to release the switching device, a local circuit and a relay in the latter adapted to close the safety circuit.

792,052. Electric Telegraphy. Isidor Kitsee, Philadelphia, Pa. Application filed March 16, 1905.

Attached to a recording siphon is a paper adapted to have recorded thereon through the movement of the siphon characters designating the letters of a telegraphic alphabet. An intermediate device is adapted to prevent the depositing of the recording fluid on the paper during the movement of the siphon with the exception of a predetermined period or part of the movement.

792,066. Electrical Harness. William D. McGregor, Slocan, Canada. Application filed December 5, 1904.

An arrangement for a horse's harness is provided with electrode terminals whereby a shock may be communicated to the horse.

792,076. Electric Arc Lamp. Robert H. Read, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed October 10, 1902.

An electric-arc lamp having a lifting magnet and armature for the movable carbon is provided also with means responsive to the lamp current for regulating the arc length. The means are movable independently of the position of the armature and the lifting magnet.

NO. 792,035.—SYNCHRONIZING DEVICE.

792,091. Constant-current System. Matthew O. Troy, Schenectady, N. Y., assignor to the General Electric Company, Schenectady, N. Y. Application filed December 12, 1903.

A constant-current device having relatively movable coils has means external to the device for limiting the flow of current thereto when the device is first put in circuit. Automatically operated means eliminate the effect of the current-limiting means.

792,101. Means for Protection Against Reversal of Energy. Leonard Wilson, Pittsfield, Mass., assignor to the Stanley Electric Manufacturing Company, Pittsfield, Mass. Application filed November 3, 1904.

A series transformer in the circuit to be protected has a core adapted to be saturated by a fraction of the full-load current. A potential transformer, a poly phase torque-producing device connected to the secondaries of the transformers, a switch in the circuit and operative connections between the device and the switch are the other features.

792,102. Alternating-current Motor. Gabriel Winter, Vienna, Austria-Hungary, and Friedrich Eichberg, Berlin, Germany, assignors to the General Electric Company, Schenectady, N. Y. Application filed November 14, 1904.

In an alternating-current motor are a rotor winding provided with a commutator, commutator brushes and connections short circuiting the winding on a number of angularly displaced lines. Means vary the relative resistance of the short circuits.

792,104. Alternating-current [illegible] Winter, Vienna, Austria-Hungary, and Friedrich Eichberg, Berlin, Germany, assignors to the General Electric Company, Schenectady, N. Y. Application filed November [illegible]

[illegible] short circuited [illegible] thereby. [illegible] and short circuit the [illegible]

792,105. Remote Control of D[illegible] Machines. Jonathan E. Woodbridge, England, and John B. Taylor, Schenectady, N. Y., assignors to the General Electric Company, Schenectady, N. Y. Application filed November 21, 1904.

Combined with a rotary converter [illegible] circuit supplied from the [illegible] means for connecting the [illegible] sumption circuit in proper [illegible] regardless of the polarity at the [illegible] converter.

792,110. Circuit Controller. John M. B[illegible], New York, N. Y., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed March 7, 1904.

Associated with an electric motor [illegible] controllably supplying energy [illegible] tor automatically inserting [illegible] with the motor when changing from a higher to a lower supply voltage. The resistance is [illegible] while the motor generates a voltage [illegible] lower supply voltage.

792,120. Constant-current Regulator. Frank Conrad, Edgewood Park, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed January 20, 1904.

Combined with an iron core are a primary [illegible] and movable secondary windings. [illegible] Means for overbalancing the weight [illegible] winding and means for partially [illegible] weight of the other are provided.

792,122. System for Transmitting Electric Currents to Cars. John J. Eagan, San Francisco, Cal. Application filed February 2, 1905.

In a railway current transmission system are [illegible] on one side of the road, which have a channel for wires. Perpendicular rods are affixed to the [illegible] for connection with the wires. Trolleys, pivotally connected to the ends of the car are provided with springs at their outer ends for grasping wire. A wire [illegible] the ends of the trolleys.

792,162. Electric Osteophone. La Forest Potter, New York, N. Y. Application filed June 15, 1904.

An electric osteophone consists of a source of electrical energy, an electromagnetic vibrator in circuit therewith, head contacts electrically connected with the make-and-break members of the vibrator, and means for [illegible] the contacts in position for directing the electric current through the head.

792,174. Electric-railway Switch-operating Device. Charles W. Squires, Springfield, Mass. Application filed May 10, 1904.

A track solenoid and a switch [illegible] are connected to a normally [illegible] solenoid. A pair of normally [illegible] the power circuit, a primary solenoid [illegible] core and a pair of electrically connected resilient members carried by the core for engaging and electrically connecting the terminals are the [illegible] features.

792,178. Electrically Propelled Carrier. William J. Sumner, Holyoke, Mass., assignor to the Coburn Trolley Track Manufacturing Company, Willimansett, Mass. Application filed November 14, 1904.

Combined with an overhead trolley track are one or more trolley heads bearing thereon, traction devices on one of the heads to impart movement to the latter in either direction, a platform suspended from the head arranged to swing transversely of the track, a motor on the platform and driving connection extending from the motor to the traction devices.

792,191. Galvanic Battery. Benjamin J. Blameuser, Chicago, Ill. Application filed August 1, 1902.

A galvanic battery comprises elements, one of which is provided with a shell and a rod axial in the shell

but spaced from it. The other element is a cylinder inclosing the rod within the space between the rod and shell. A porous cup having inner and outer walls spaced apart produces a chamber within which the cylindrical element is held.

792,196. Rotary Mercury Circuit Breaker. Adolph F. Christmas, Pittsburg, Pa., assignor of two-thirds to Frank R. McFeatters, Wilkinsburg, Pa. Application filed September 23, 1904.

A circuit interrupter comprising a rotatable body provided with two or more chambers insulated from each other carries a body of mercury in each of the chambers but only partially filling them. Annular conducting faces are exposed in at least two of the chambers, the wall or partition between the chambers being provided with an opening or openings through which the mercury in the two chambers will come into contact at intervals in the rotation of the body.

792,225. Wall Plug for Incandescent Electric Lamps. Charles J. Malish, Toledo, Ohio, assignor of one-half to Louis Bergman, Toledo, Ohio. Application filed October 31, 1904.

A two-part body portion composed of suitable insulating material has corresponding recesses in the meeting faces of the two portions. Detachable axially disposed pivotal connections are placed between the two parts of the body portion, also a pair of contacting metal rings in the meeting faces of the two parts of the body portion.

792,248. Induction Coil. George A. Campbell, Newton, Mass., assignor to the American Telephone and Telegraph Company. Application filed October 8, 1904.

A repeating induction coil composed of two insulated conductors wound over an iron core contains a conducting shield for each winding. An outside conducting shield surrounds both windings and their associated shields.

792,255. Electric Furnace. Francis A. J. Fitz Gerald and Peter M. Bennie, Niagara Falls, N. Y. Application filed December 3, 1904.

An electric furnace comprises independent consecutively disposed compartments and resistors, arranged to heat the compartments, electrically connected in series.

792,257. Low-water Alarm. Addison E. Gardner, Milan, Mich., assignor to George W. Kennedy, Jackson, Mich. Application filed March 17, 1905.

An electric alarm, the circuit of which is controlled by contacts which are closed by the movement of a tubular expansible member, is the feature of novelty in the invention.

792,258. Valve Apparatus. Frederick Grinnell, New Bedford, Mass., assignor to the General Fire Extinguisher Company, New York, N. Y. Application filed July 11, 1899.

Combined with a manually operated valve through which fluid is supplied are an electrically operated indicator, an electric circuit therefor, a switch in the circuit and means operated by the valve-actuating mechanism for operating the switch when the valve is moved from the open position.

792,264. Telegraph Apparatus. Paul E. Heina, Paris, France. Application filed September 12, 1903.

A telegraph apparatus for simultaneous transmission, on a single line, of alternating currents whose respective frequencies are different is the basis of the patent.

792,279. Electric Block-signaling System for Railways. Claud D. McPhee, Arnprior, Canada, assignor of one-half to John Carling Kelly, Ottawa, Canada. Application filed July 1, 1904.

In a signaling system are combined with the block of track in front of a station two adjacent blocks on each side. Electric circuits at the near end of the adjacent sections are closed by the axles and wheels of the locomotive in the section.

792,307. Process of Electrodepositing Antimony. Anson G. Betts, Troy, N. Y. Application filed May 20, 1904.

The process of electrodepositing antimony consists in electrolyzing a solution containing antimony trifluorid with a suitable cathode.

792,315. Self-soldering Heat Coil. Frank B. Cook, Chicago, Ill. Application filed April 13, 1905.

A metal tube carries a pin secured within the tube by heat-susceptible material. Insulating washers are suitably secured upon the tube. Heat-producing means are placed upon the tube between the washers and a corrugated sheet-metal shell is mounted upon the washers and incloses the heat-producing means.

792,404. System for Unlocking Safes or the Like. William W. Dean, Chicago, Ill., assignor to the Consolidated Fire Alarm Company, New York, N. Y. Application filed August 10, 1903.

Electromagnetic unlocking mechanism is attached to a safe, it being responsive only to currents of a distinctive character. Means for applying the currents to the mechanism are provided.

792,425. Electric Cut-out Box. Anton T. Kliegl and John H. Kliegl, New York, N. Y. Application filed August 4, 1904.

Combined with a casing having an inclined wall are one or more sockets supported in an inclined position on the wall, contacts in the inside of the sockets and a plug having contacts arranged to engage those in the socket.

792,435. Lightning Arrester. Charles T. Mason, Sumter, S. C., assignor to the Sumter Telephone Manufacturing Company, Sumter, S. C. Application filed November 23, 1904.

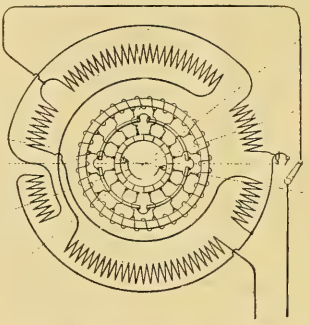
A lightning arrester comprises a sinuous conductor, a grounding shell of conducting material surrounding the conductor and isolated sections of insulation separating the conductor and shell.

792,466. Alternating-current Motor. Leo Schüler, St. Louis, Mo. Application filed June 17, 1904.

In an electric motor is a member provided with a circuit producing definite poles therein. A second member, a conductor on the second member forming poles for producing torque in a given direction and means for excluding a portion of the conductor from effective operation to shift the poles of the second member to a position producing torque in the same direction are the other features. (See cut.)

792,467. Method of Operating Alternating-current Motors. Leo Schüler, St. Louis, Mo. Application filed July 5, 1904.

Operating alternating-current motors is accomplished by producing a given angular displacement between the poles of the respective members to produce torque in one direction, shifting the poles of one of the members to a second position producing torque in the same direction and changing the circuits of the other of the members before synchronous speed is exceeded.



NO. 792,466.—ALTERNATING-CURRENT MOTOR.

792,489. Street Indicator. Carl H. Bailey, Leavenworth, Kan. Application filed December 17, 1904.

The rachet mechanism which moves the register is controlled by a pawl which is operated by a solenoid.

792,528. Wireless Telegraphy. Guglielmo Marconi, London, England, assignor to the Marconi Wireless Telegraph Company of America. Original application filed October 13, 1903. Divided and this application filed January 27, 1904.

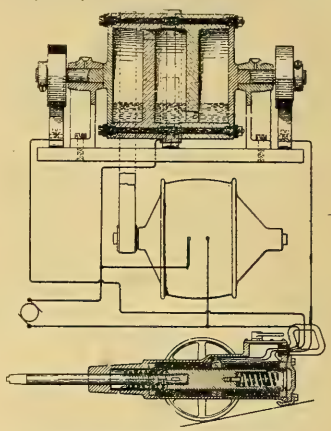
A method of selectively detaching electromagnetic waves consists in associating an open circuit and a resonant circuit and simultaneously altering the inductance of both circuits without altering the sum of the inductances of the two circuits.

792,530. Electric Fuse. Norman Marshall, Newton, Mass. Application filed June 27, 1903. Renewed May 20, 1905.

An electric fuse or cut-out contains a main fuse wire, an inclosing casing having an opening through its wall, a cup extending through the opening and an auxiliary fuse wire within the casing and passing through the cup.

792,569. Electric Railway. William Chapman and Percy W. Davies, Pittsburg, Pa., assignor to the Westinghouse Electric and Manufacturing Company, Pittsburg, Pa. Application filed November 23, 1897. Renewed April 12, 1905.

The electric railway system comprises track rails, a feeder, conducting sections and electromagnetically operated switches for making connections between the conductor sections and the feeder. Each of the switches comprises a magnet having one or more shunt pick-up coils and one or more series holding coils. An auxiliary solenoid has a core to open the pick-up circuit when the main circuit is closed and a valve that is automatically closed when the core is electromagnetically actuated and is opened by the reverse movement.



NO. 792,571.—ELECTRIC MOTOR SYSTEM.

792,571. Electric Motor System. Adolph F. Christmas, Pittsburg, Pa., assignor of two-thirds to Frank R. McFeatters, Wilkinsburg, Pa. Application filed September 23, 1904.

A reciprocating motor is provided with one coil for giving the working stroke and another coil for giving the return stroke. A circuit interrupter and changer are arranged to break the circuits and make them alternately through the coils, the circuit interrupter and changer being provided with adjustable means to vary the time at which one or both of the coils is energized. (See cut.)

REISSUE.

12,356. Reciprocating Electric Engine. Bruno O. Wagner, El Paso, Texas. Application filed April 20, 1905. Original No. 783,001, dated February 21, 1905.

In a reciprocating electric engine are a metallically inclosed magazine of iron rings and interposed solenoids forming periodically and in sequence actuated electromagnets. A rotary controller opens and closes progressively circuits through the electromagnets and reverses the direction of the oscillating field when the armature is to reverse its stroke.

## EXPIRING PATENTS.

Following is a list of electrical patents (issued by the United States Patent Office) that expired on June 19, 1905:

384,638. Dynamo-electric Machine. R. Oliver, Alpena, Mich.

384,644. Multiple Switchboard Testing Apparatus. C. E. Scribner, Chicago, Ill.

384,662. Magneto Electric Fuse. E. L. Zalinski, U. S. Army.

384,663. Projectile. E. L. Zalinski, U. S. Army.

384,676. Automatic Electric Gas Cut-off for Railroad Cars. F. C. Brower, Syracuse, N. Y.

384,685. Electric Railway. S. D. Field, Yonkers, N. Y.

384,775. Electromagnetic Parcel Carrier. M. C. Mengis, York, N. Y.

384,810. Automatic Electric Block Signal System. T. D. Williams, Alleghany City, and J. S. Lucock, Bellevue, Pa.

384,676. Apparatus for Operating Automatic Block Signals. T. D. Williams, Alleghany City, and J. S. Lucock, Bellevue, Pa.

384,815. Incandescent lamp socket and switch. J. J. Wood, Brooklyn, N. Y.

384,816. Commutator for Dynamo-electric Machine. J. J. Wood, Brooklyn, N. Y.

384,817. Electric Arc Lamp. J. J. Wood, Brooklyn, N. Y.

384,830. Railway Signaling. T. A. Edison, Llewellyn Park, N. Y.

384,856. Electromagnetic Time Lock. C. J. Kintner, New York, N. Y.

384,875. Electric Fire-alarm Apparatus. G. M. Stevens, Cambridge, Mass.

384,901. Guard Rail and Insulator for Electric Railways. H. A. Foster, Boston, Mass.

384,908, 384,909, 384,910, 384,911 and 384,912. Electric Railway. R. M. Hunter, Philadelphia, Pa.

## SPECIAL MENTION.

"Where Health and Pleasure Wait" sounds inviting as vacation days approach and the feeling is strengthened by reading about and studying the beautiful pictures of mountain, lake and stream which are reproduced in the handsome new folder issued under the above title by the New York Central lines, being No. 2 of the Four-track Series. The folder is prepared in a breezy, agreeable style and describes the resorts of New England, the Berkshire Hills and Canada, which are reached by the New York Central lines, and which offer the finest opportunity for recreation during the summer months. The public, by this number of the Four-track Series, is given an idea of a lot of places that are easily reached, and which will suit a variety of tastes.

Many interesting things are to be learned about ropes, their manufacture and uses, from the new catalogue of the C. W. Hunt Company of New York, entitled, "Manila Rope Transmission and Hoisting." The catalogue contains a treatise for engineers upon ropes used for transmission of power, together with formulas, data and tables useful in mill engineering. The catalogue is well illustrated and the information which it contains will be found of much value.

The New York Central and Hudson River railroad, under date of June 13th, announces important changes in time for the summer schedule which took effect June 18th. Train No. 11, Southwestern Limited, will leave New York at 2:04 p. m. and arrive at Buffalo 11:37 p. m., Cincinnati 10:30 a. m., and St. Louis 5 p. m. Train No. 25, the Twentieth Century Limited, 18 hours from New York to Chicago, will leave New York daily at 3:30 p. m. and arrive at Chicago 8:30 a. m. Train No. 26, the Twentieth Century Limited, 18 hours Chicago to New York, will leave Chicago, via Lake Shore and Michigan Southern railway daily at 2:30 p. m., and arrive at Grand Central Station, New York, at 9:30 a. m. Several other changes have been made, but the notable ones are those cutting two hours from the time between New York and Chicago, by which the distance is now covered in 18 hours.

The Couple Gear Freight Wheel Company of Grand Rapids, Mich., has been incorporated and filed articles of association with capital at $500,000. The company will manufacture as licensees the gyroscope type of wheels (see Western Electrician of February 20, 1904) for electric trucks and delivery wagons under the Holson Motor Patents Company of the same city. About $80,000 will be invested in buildings and equipment. The president of the company is M. B. Church.

# Western Electrician

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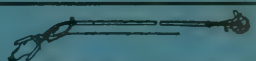

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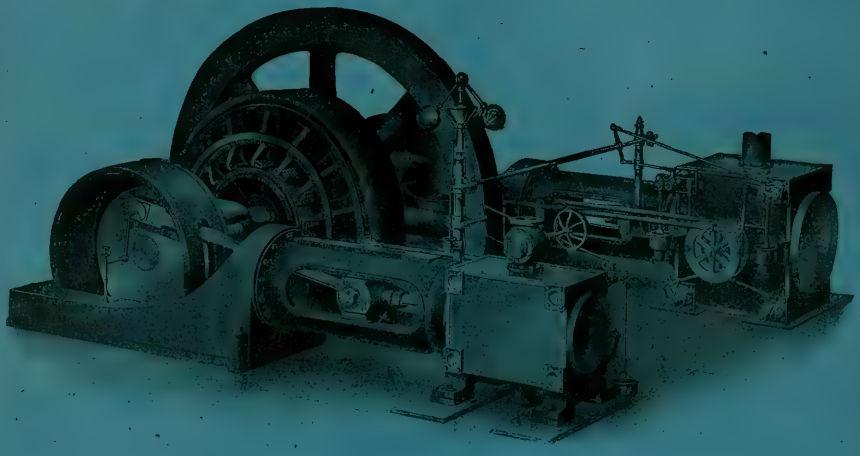

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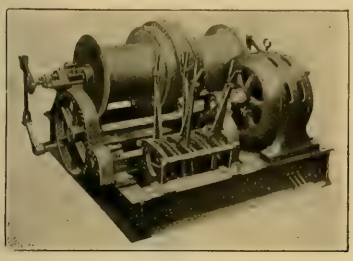

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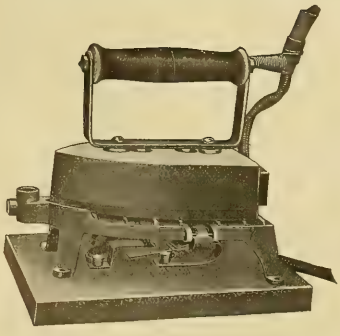

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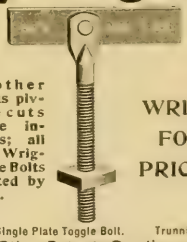

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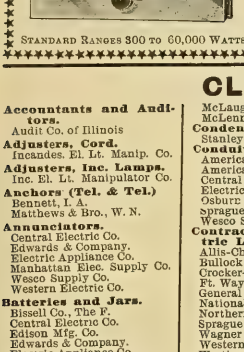

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**Letters, Sign.**
Colonial Sign & Insulator Co.

**Lightning Arresters.**
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Manhattan Elec. Supply Co.
Stanley Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.

**Linemen's Climbers.**
Klein & Sons, Mathias.

**Lubricating, Oil, Grease.**
Richardson Lubricating Co.

**Machinery, Hoisting.**
Contractors Plant Mfg. Co.

**Magnet Wires.**
(See Wires and Cables.)

**Mechanical Draft.**
Green Fuel Economizer Co.
Sturtevant Co., B. F.

**Mica.**
Chicago Mica Co.
Mica Insulator Co.
Munsell & Co., Eugene.

**Mining Apparatus, Elec.**
Allis-Chalmers Company.
Crocker-Wheeler Company.
General Electric Co.
Jeffrey Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Motors.** (See Dynamos and Motors.)

**Nippers and Pliers.**
Klein & Sons, Mathias.

**Novelties, Lighting.**
Letheule, Paul

**Nozzles.**
Faries Mfg. Co.

**Overalls.**
Carnarti & Co., Hamilton.

**Patent Attorneys.**
Bain, Foree.

**Phosphor Bronze.**
Phosphor Bronze Sm. Co. Ltd.

**Platinum, Wire and Sheet.**
American Platinum Works.
Baker & Company Inc.

**Poles and Ties.**
Berthold & Jennings.
Brooks, Hall L.
Columbia Mfg. Co.
Fowler, John H.
Fowler-Jacobs Company.
Kellogg Switch. & Sup. Co.
Lindsley Bros. Co.
Loud's Sons Co., H. M.
Maltby Cedar Co.
Morrison Lbr. Co., J. W.
Mueller Company, William.
Pacific Coast Pole Co.
Phelan, D. W.
Pittsburg & L. S. Iron Co.
Porter Cedar Company.
Sterling & Son, W. C.
Torrey Cedar Co.
Valentine-Clark Co., The.
Worcester Co., C. H.

**Polish (Metal).**
Allen Co., Inc., L. B.
Hoffman, Geo. W.

**Portables.**
Faries Mfg. Co.

**Power Transmission Machinery.**
Jeffrey Mfg. Co.

**Rail Joints.**
Continuous Rail Joint Company of America.

**Railway Supplies.**
Wesco Supply Co.

**Re-Winding—Repairs.**
Chicago Edison Co.
Gregory Electric Co.

**Rheostats.**
Amer. Electric Fuse Co.
Cutler-Hammer Mfg. Co.
General Electric Co.
Gen'l Inc. Arc Lt. Co.
Union Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Rods, Conduit.**
Cope, T. J.

**Schools and Colleges.**
Electrical Engineer Inst.
Highland Park College

**Second-Hand Mach'y.**
Bissell Co., The F.
Cent. Sta. Improvement Co.
Gregory Electric Co.
Matthews & Bro., W. N.
Walsh's Sons & Co.

**Shades, Lamp.**
Faries Mfg. Co.

**Sheet Brass & Copper.**
Plume & Atwood Mfg. Co.

**Signs, Electric.**
Elec. Motor & Equip. Co.
Zero Marx Sign Works.

**Silks, Insulating and Braiding.**
Sauquoit Silk Mfg. Co.

**Sockets & Receptacles.**
Pass & Seymour.
Yost Elec. Mfg. Co.

**Soldering Sticks, Salts and Paste.**
Butler Chemical Works.
Crollus & Son, E. R.
Kester Elec. Mfg. Co.
Standard Appliance Co.
Western Electric Co.

**Speaking Tubes.**
Central Electric Co.
Edwards & Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.

**Speed Indicators.**
Weston Electrical Inst. Co.

**Storage Batteries.**
American Battery Co.
Electric Storage Battery Co.
Gould Storage Battery Co.

**Supplies, General Elec.**
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Chicago Edison Co.
Electric Appliance Co.
General Electric Co.
Manhattan Elect'l Supply Co
Wesco Supply Co.
Western Electric Co.

**Switchboards.**
Bissell Co., The F.
Gen. Incan. Arc Light Co.

**Telephones, Telephone Material and Switchboards.**
American El. Telephone Co
Automatic Electric Co.
Bissell Co., The F.
Central Electric Co.
Central Tel. & El. Co.
Electric Appliance Co.
International Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co.
Manhattan Elec. Supply Co.
Stromberg-Carlson Tel. M.Co
Vought-Berger Co.
Wesco Supply Co.
Western Electric Co.

**Time Switches.**
Amer. El. Sign Co.
Bissell Co., The F.

**Tools.**
Klein & Sons, Mathias.
Standard Tool Co.
Western Electric Co.

**Transformers.**
Central Electric Co.
Crawfordsville Electric Co.
Crocker-Wheeler Co.
Electric Appliance Co.
Ft. Wayne Elec. Works, Inc.
General Electric Co.
Gregory Electric Co.
Kuhlman Electric Co.
Manhattan Elec. Supply Co.
National Electric Co.
Stanley Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Trucks, Electric Car.**
General Electric Co.
Westinghouse El. & Mfg. Co.

**Turbines, Steam.**
Allis-Chalmers Co.
General Electric Co.
Westinghouse El. & Mfg. Co

**Turbine Water Wheels**
Jeffrey Mfg. Co., Jas.

**Varnishes.**
Sterling Varnish Co.

**Vulcanized Fibre.**
Vulcanized Fibre Co.

**Whistles, Electric.**
Electrical Appliance Co.

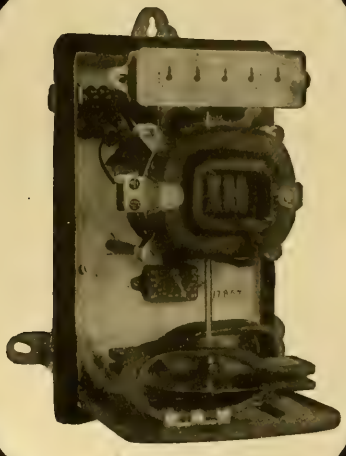
**Wires & Cables—Magnet Wires.**
American Electrical Works.
Bissell Co., The F.
Central Electric Co.
Chicago Insulated Wire Co.
Crescent Ins. Wire & Cble. Co
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
Indiana Rub. & Ins. Wire Co
India Rubber & Gutta Percha Insulating Co.
Kellogg Switch. & Sup. Co.
Manhattan Elec. Supply Co.
National India Rubber Co
New York Insulated Wire Co.
Northern Wire & Cable Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co
Roebling's Sons Co., J. A.
Runzel-Lenz Elec. Mfg Co.
Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Standard Underground C. Co
Wesco Supply Co.
Western Electric Company.


**For Alphabetical Index of Advertisements See Page 3.**

# DUNCAN WATTMETERS

## 5346

SOLD DURING OCTOBER & NOVEMBER



AMERICA'S STANDARD

AND THE METER THAT
LEADS IN THE ART

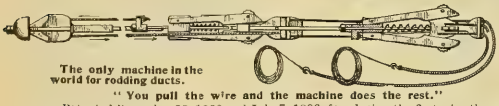
DUNCAN ELECTRIC MFG. CO.

LA FAYETTE, IND.

# COPE'S UNDERGROUND ELECTRICAL SPECIALTIES

## THIS IS WHAT WE HAVE

### PATENT CONDUIT THREADING MACHINE



**The only machine in the world for rodding ducts.**

**"You pull the wire and the machine does the rest."**

Patented December 30, 1890 and July 7, 1896, for placing the first wire through electrical or other underground conduits. These machines have been successfully used several years, but the improvements of 1896 make it much easier working and simplify its whole construction. This device threads conduits of any material such as iron, wood, cement or terra-cotta, of any shape or size from 1 to 20 inches in diameter. Can be worked from surface of street, thus avoiding the gases, or within the manholes.

Is pliable and can be bent to enter or to be withdrawn from manholes or hand-holes 15 inches in diameter. Have run "ducts" 1,300 feet between man-holes. Will pass through mud in "ducts" 100 feet from entrance, that cannot be penetrated any other way.

### PATENT QUICK COUPLING CONDUIT ROD

Made of Steel in the BEST POSSIBLE MANNER

Made in 3 ft. and 4 ft. lengths of carefully selected hickory and are passed through three processes of toughening before being used.

These rods should not be compared with inferior ones thrown on the market by parties unfamiliar with the requirements of rods. A good rod is worth ten inferior ones. Our 16 years' experience guarantees these to be the best.

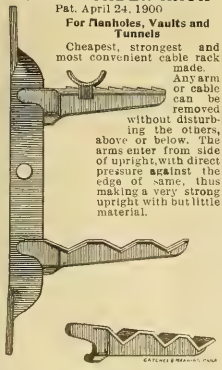
**WRITE FOR LIST OF PERSONS USING THESE RODS**

## THIS IS WHAT WE DO

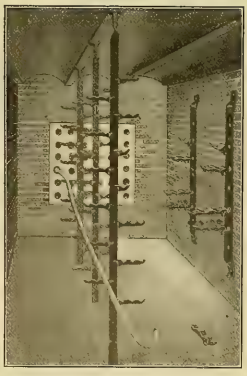
### PATENT CABLE RACK

Pat. April 24, 1900

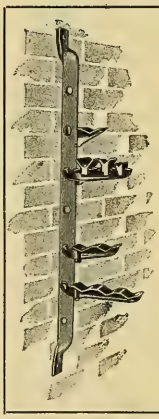
**For Manholes, Vaults and Tunnels**



Cheapest, strongest and most convenient cable rack made. Any arm or cable can be removed without disturbing the others, above or below. The arms enter from side of upright, with direct pressure against the edge of same, thus making a very strong upright with but little material.



Cable rack in vault or tunnel with arms on either side and cable entering from street. Wall rack on the side.



### CABLE RACK

**Wall Style**

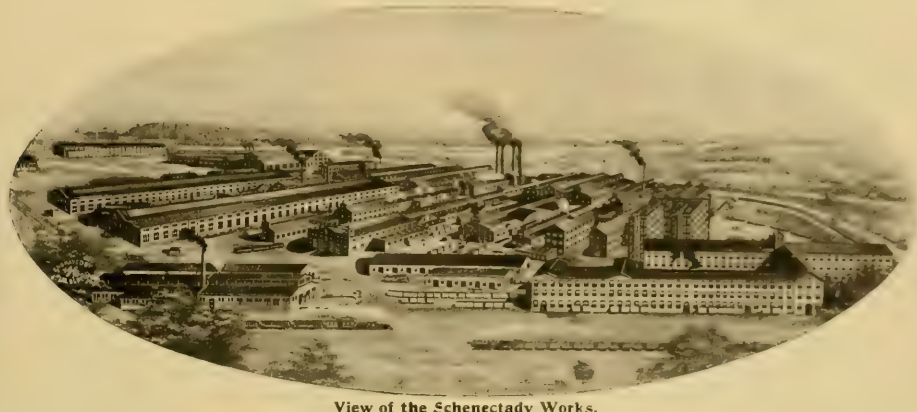
Illustrating—No. 1 arm for 1 cable.
" No. 2 arm for 2 cables.
" No. 3 arm for 3 cables.
" No. 4 or ratchet arm for from 1 to 7 small cables.

# T. J. COPE

## 3244 N. 15TH. ST., PHILADELPHIA, PA. U.S.A.

# General Electric Company

## OF NEW YORK, U. S. A.



View of the Schenectady Works.

## PRINCIPAL OFFICES: SCHENECTADY, N. Y.

## SALES OFFICES:

Boston, Mass., 84 State Street.
Philadelphia, Pa., 218 South Eleventh Street.
Cincinnati, O., Perin Bldg.
Denver, Colo., Kittredge Bldg.
Syracuse, N. Y., Sedgwick, Andrews and Kennedy Bldg.
Baltimore, Md., Mt. Royal Apartment House.
New Orleans, La., Hennen Bldg.
Columbus, O., Hayden Bldg.
Detroit, Mich., Majestic Bldg.
St. Louis, Mo., Wainwright Bldg.
Dallas, Texas, Scollard Bldg.
Minneapolis, Minn., Phoenix Bldg.
Salt Lake City, Utah, 25 East First South Street.
Portland, Ore., Worcester Bldg.
New York, N. Y., 44 Broad Street.
Atlanta, Ga., Empire Bldg.
Chicago, Ill., Monadnock Block.
San Francisco, Cal., Crossley Bldg.
Buffalo, N. Y., Ellicott Sq. Bldg.
Pittsburg, Pa., Park Bldg.
Cleveland, O., Citizen's Bldg.
Nashville, Tenn., Cole Bldg.
Oklahoma City, Okla., Culbertson Bldg.
Helena, Mont, Power Block.
Los Angeles, Cal., Douglas Bldg.

### FOR FOREIGN BUSINESS.

Foreign Department, Schenectady, N. Y. and 44 Broad Street, New York, N. Y.

### FOR GREAT BRITAIN AND IRELAND.

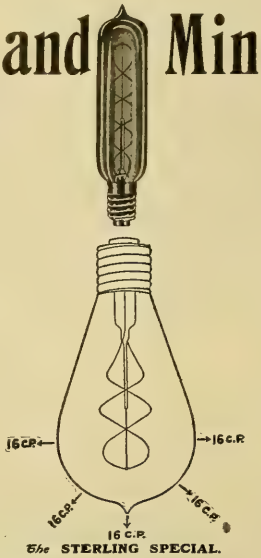
The British Thomson-Houston Co., Ltd., Rugby and 83 Cannon Street, London, E. C.

For all CANADIAN Business, Canadian General Electric Company, Ltd., Toronto, Ontario.

# Sterling Special and Miniature Lamps.

## Sterling Special

Gives full rated candlepower at all light-giving points of the bulb. The filament being mounted in double spiral form, the radiation of light is equal in all directions. Manufactured in all candlepowers and voltages. We guarantee that in ordering candlepower from us in our "STERLING SPECIAL" lamp the purchaser cannot find a light-giving point that will not give him exactly what he has ordered.




The STERLING SPECIAL.

| | | |
|---|---|---|
| Side | . . . | 16 Candlepower |
| Angle | . . . | 16 " |
| Tip | . . . | 16 " |
| Average | . . | 16 " |

## Sterling Miniature

We also manufacture a complete line of Miniature Battery and Candelabra Lamps for Signs and Decorative purposes, Show Windows, Show Cases, etc., ½ to 8 c. p.,—½ to 125 volts,—plain, frosted, dipped or natural colored bulbs.

Note:—These Miniature Lamps have the same spiral filament so successfully adopted in the "Sterling Special." Write for circular and prices.

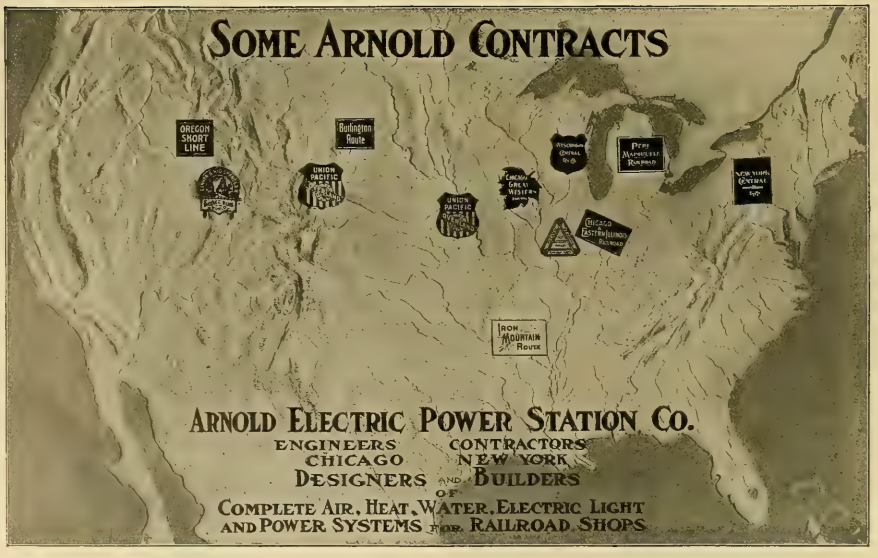
## Sterling Electrical Mfg. Company

WARREN, OHIO, U. S. A.

NEW YORK, 100 William Street.

SAN FRANCISCO, Crossley Building.

CHICAGO, 1610 Masonic Temple.



That Central Station Managers are finding

# The Nernst Lamp

to be a valuable ally in getting business, is evidenced by the Central Station Companies in the following cities who, during the past year, have supplied Nernst Lamps on their circuits:

Quincy, Ill.
Paxton, Ill.
Montgomery, Ala.
Denver, Colo.
Hartford, Conn.
Unionville, Conn.
Lafayette, Ind.
Elkhart, Ind.
Hammond, Ind.
Laporte, Ind.
Alexandria, Ind.
Cedar Rapids, Iowa.
Eagle Grove, Iowa.
Waterloo, Iowa.
Grinnell, Iowa.
Cresco, Iowa.
Urbana, Ill.
Hoopeston, Ill.
Dekalb, Ill.
Elgin, Ill.
Freeport, Ill.
Springfield, Ill.
Waterville, Me.
St. Paul, Minn.
Little Falls, Minn.
St. Louis, Mo.
Springfield, Mo.
Detroit, Mich.
Lapeer, Mich.
Constantine, Mich.
Mason, Mich.
Mt. Vernon, Ohio.
Columbus, Ga.
Dallas, Tex.
Brockton, Mass.

Lansing, Mich.
Ann Arbor, Mich.
Ishpeming, Mich.
Boyne City, Mich.
Charlotte, Mich.
Waverly, N. Y.
Liberty, N. Y.
Avon, N. Y.
East Aurora, N. Y.
Auburn, N. Y.
Despatch, N. Y.
Albion, N. Y.
Buffalo, N. Y.
Cattaraugus, N. Y.
Medina, N. Y.
Binghamton, N. Y.
Lincoln, Neb.
Alliance, Neb.
Nebraska City, Neb.
Winston-Salem, N. C.
Durham, N. C.
Raleigh, N. C.
Tarboro, N. C.
Van Wert, Ohio.
Elyria, Ohio.
Fremont, Ohio.
Lima, Ohio.
Ashtabula, Ohio.
Sewickley, Pa.
Union City, Pa.
Harrisburg, Pa.
Coudersport, Pa.
El Paso, Tex.
Houghton, Mich.
Jacksonville, Fla.

Chambersburg, Pa.
Warren, Pa.
Scranton, Pa.
Altoona, Pa.
Conshohocken, Pa.
Scranton, Pa.
Bloomsburg, Pa.
Waynesboro, Pa.
Pittston, Pa.
Carbondale, Pa.
Erie, Pa.
Plymouth, Pa.
Allentown, Pa.
Deadwood, S. D.
Wheeling, W. Va.
Washington, D. C.
Sparta, Wis.
Madison, Wis.
Milwaukee, Wis.
Sheboygan Falls, Wis.
Grand Rapids, Wis.
Beloit, Wis.
Pine Bluff, Ark.
Cannon City, Colo.
Florence, Colo.
Fort Collins, Colo.
Peru, Ind.
Cherokee, Iowa.
Seymour, Iowa.
Shreveport, La.
Aurora, Mo.
Minneapolis, Minn.
Savannah, Ga.
Tampa, Fla.
Bellingham, Wash.

Adrian, Mich.
Salem, Mass.
Plymouth, Mass.
Williamstown, N. J.
Gloversville, N. Y.
Wilmington, N. C.
Port Clinton, Ohio.
Allegheny, Pa.
Morrisville, Vermont.
North Yakima, Wash.
Yonkers, N. Y.
New York City.
Brooklyn, N. Y.
Pittsburg, Pa.
Seattle, Wash.
Fairbury, Ill.
Jackson, Mich.
Lambertville, N. J.
Newburgh, N. Y.
Reidsville, N. C.
El Reno, Okla.
Canton, Ohio.
Warren, Ohio.
Easton, Pa.
Blairsville, Pa.
Wilmerding, Pa.
San Antonio, Tex.
Ft. Worth, Tex.
Ft. Worth, Tex.
Logan City, Utah.
Madison, Wis.
Appleton, Wis.
Delavan, Wis.
Terre Haute, Ind.

If you want to be up to date, get on the list

Address Nearest Sales Office

# Nernst Lamp Co.

Boston, New York, Philadelphia, Pittsburg, Buffalo, Cleveland,
Detroit, Chicago, St. Louis, Denver, San Francisco, Seattle.

## Preeminently the Storage Battery

It costs no more than the Cell Type.

It has comparatively, considerably more active material and occupies less space (about half that required by Cell Type).

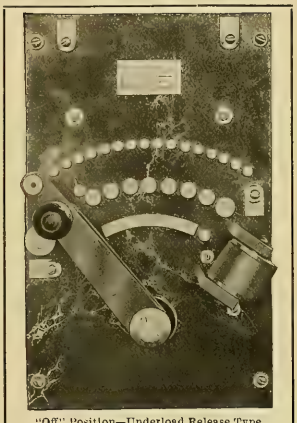
It is far more durable—is cleaner and more economical in operation and much less expensive in cost of maintenance.

Besides, this important fact must not be overlooked: There are no annoying and destructive fumes as with the Cell Type. The gas does not escape, therefore no corrosion of adjacent pipe or iron work or even the tarnishing of bright metal work.

**TRAY PLATE BATTERY CO.**

Successors Smith Storage Battery Co.

5-11 FREDERICK ST., BINGHAMTON, N. Y.



"Off" Position—Underload Release Type

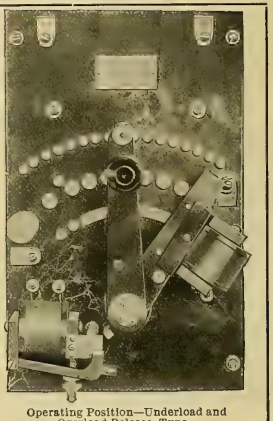
ANOTHER NEW

# C-H Controller

AND ANOTHER GOOD ONE

The controller herewith shown is intended for machine tools and similar apparatus.

*A SINGLE LEVER DOES BOTH STARTING AND REGULATING IN AN EASY AND SIMPLE MANNER*



Operating Position—Underload and Overload Release Type.

### How Simply it Operates

The motor is started and brought to speed by moving the handle to the right, this handle being attached to the field regulator lever which is mechanically connected to the starter lever so as to move them as one piece in starting the motor. During this operation of starting, the field resistance is short-circuited by an auxiliary contact mounted on the starter lever and a curved sector located just below the armature contacts. When the two levers have been moved to the position in which all resistance is cut out of the armature circuit, a keeper on the starter lever is attracted by the retaining magnet, and the starter lever is held in this position. At this time also the auxiliary contact above referred to has left the curved sector, thus removing the short-circuit from the field resistance. The field lever is now free for movement over the field rheostat buttons at the will of the operator, and may be left at any desired point, thus regulating the speed of the motor as desired. :: :: :: ::

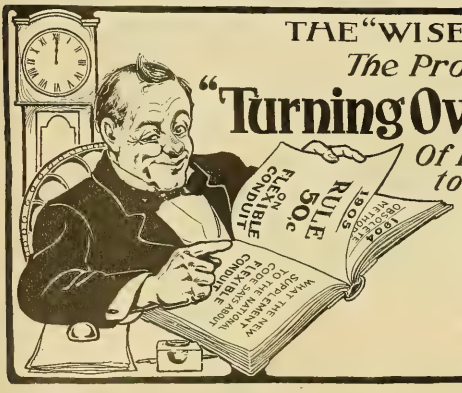
It gives a wide range of speed through shunt field control.
The motor cannot be started on a weakened field.
Release magnets automatically return all parts to "off" position when required.
If you have not received bulletins describing it let us know.

## THE CUTLER-HAMMER MFG. CO.

*Electric Controller Manufacturers and Electrical Engineers*

MILWAUKEE, WIS.

NEW YORK BOSTON CHICAGO PITTSBURG

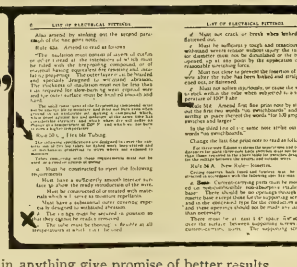


THE "WISE ONE" IS ON

*The Proverbial*

## "Turning Over a New Leaf"

*Of Particular Significance to the Wise Buyer*



**New Year--New Standard.**

We all at least have a fleeting thought of the next year being a better year. How to get it? Is it not by higher standards? Higher standards in anything give promise of better results.

"Flexduct" is the higher standard Flexible conduit. The new standards just adopted by those who know mean endurance, safety, less labor and surer results.

Where is this new standard more faithfully interpreted than in "Flexduct." No questions asked if you use "Flexduct", the known standard.

**OSBURN FLEXIBLE CONDUIT CO.,** New York, Chicago, San Francisco.

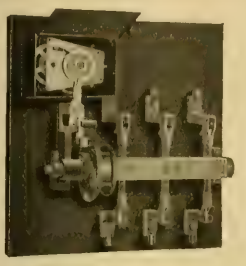
# GRAND PRIZE

**The Highest Possible Award**

**Has Been Given to**

## HIGHEST GRADE NUERNBERG CARBONS

**By the International Jury of Awards, of the Louisiana Purchase Exposition, St. Louis, 1904.** **HUGO REISINGER,** Sole Importer, 11 BROADWAY, NEW YORK



**YOU** all ask for a RELIABLE TIME SWITCH to run 8 days with one winding and turn your Electric Signs or Window Lights on and off at any time you set it.

**WE MANUFACTURE the SWITCH and GUARANTEE IT.**

Our Guarantee is good, and so is the Switch.

**Standard Sizes 35-50-75-100 Amperes 2 or 3 Wire Systems**

We manufacture Signs, all-porcelain Letters. Write for prices.

**American Electric Sign Co.**

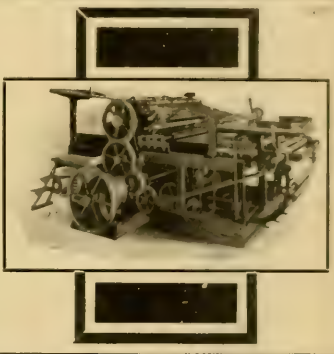
New York Office, 1265 Broadway 133 Summer St., BOSTON, MASS.

**NORTHERN MOTORS CUT PRINT SHOP COSTS**

DO BETTER THAN OTHER MOTORS

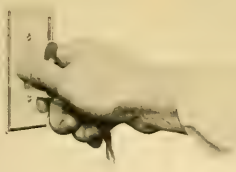
The reason is best told by correspondence—Send for leaflet No. 25141.

We show a Northern Motor operating a Cottrell Two-Revolution Press.



**NORTHERN ELECTRICAL MFG. CO.**
ENGINEERS, MANUFACTURERS
MADISON, WIS., U. S. A.

# "DIAMOND H"



This Trademark on a Switch means "Perfection."

## Automatic Flush Receptacles and Plugs Switches and Wall Appliances

Type "A" Rotary Plate.

**Are the ones to use if you want the best.**

**Remember the name and write for Catalogue "B."**

Type "A" Plate.

*THE HART MANUFACTURING CO., = HARTFORD, CONN.*

**Manufacturers of "Diamond H" Switches**

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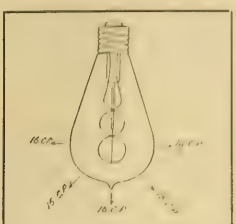

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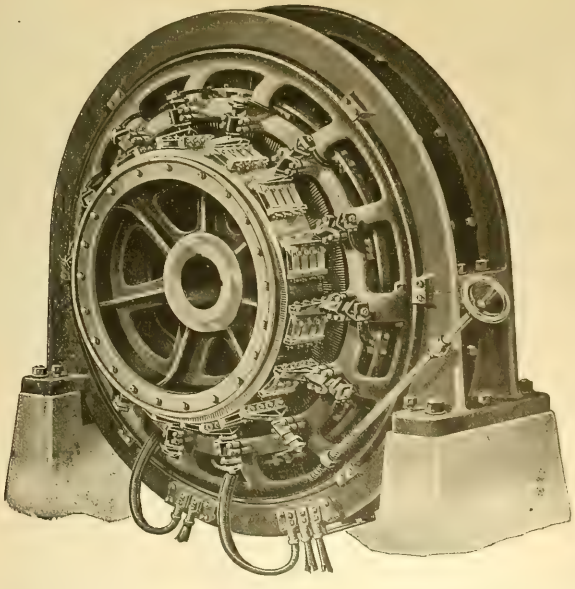

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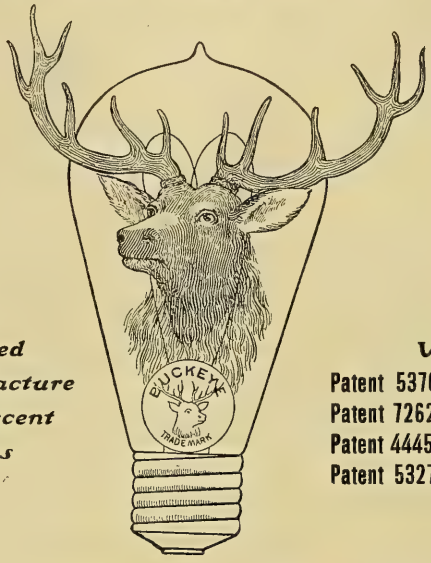


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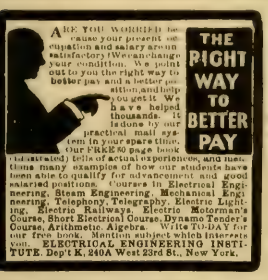

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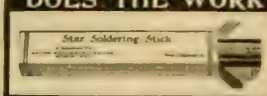


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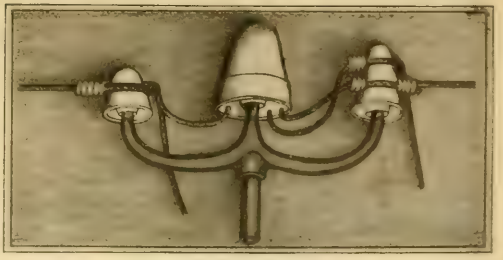

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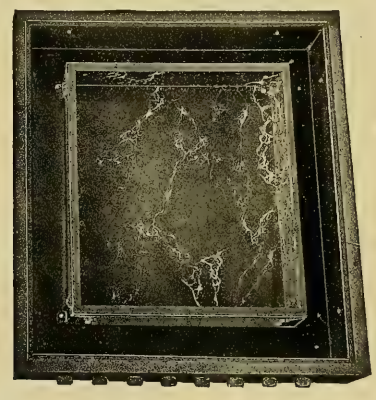

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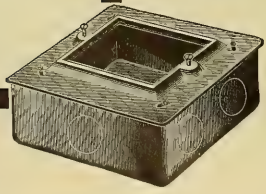

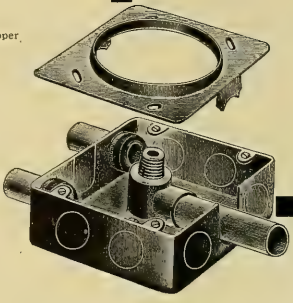

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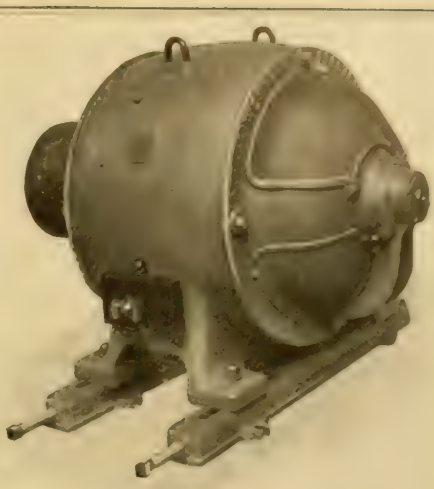

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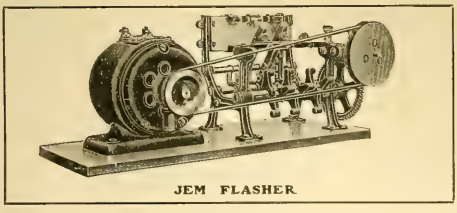

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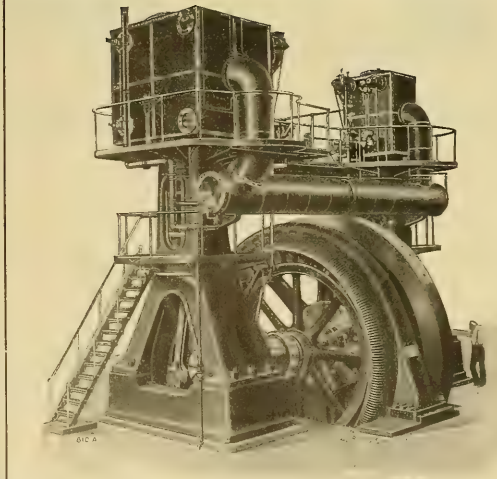

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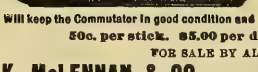


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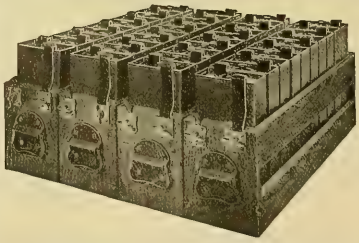

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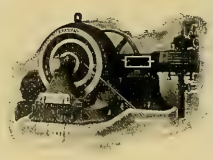

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CABLES FOR AERIAL AND UNDERGROUND USE.

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Montreal Branch, Eugene F. Phillips Electrical Works.
MAIN OFFICES AND FACTORIES, PHILLIPSDALE, R. I.

# Stombaugh Guy Anchors

WILL HOLD HEAVY STRAINS — IF YOU DOUBT ORDER ONE AND TEST IT

## STOMBAUGH GUY ANCHOR

Test it your way. If you are not satisfied after you have tested it, return it at our expense. We pay the freight on it all ways.

HOLDING STRAINS OF ANCHORS WHEN BURIED IN 5 FEET

| 8 inch | 10 inch | 12 inch |
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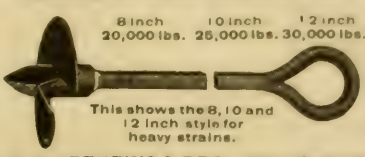
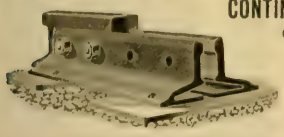
| 20,000 lbs. | 25,000 lbs. | 30,000 lbs. |



This shows the 8, 10 and 12 inch style for heavy strains.

W. N. MATTHEWS & BRO, Manufacturers
603 Carleton Building — ST. LOUIS



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GENL. OFFICES: CENTURY BLDG., NEWARK, N. J.

## OVER 20,000 MILES IN USE

See our exhibit, World's Fair, St. Louis, Mo., Transportation Bldg., Aisle "G," Posts 7 and 8

# EXPERT IN ELECTRICITY MECHANICS PATENT CAUSES

SOLICITOR OF U. S. & FOREIGN **PATENTS**

FOREE BAIN, 1652-3 Monadnock Blk., CHICAGO

# NOXALL DYNAMO OILS. GIVES THE BEST SERVICE. HIGH QUALITY, LOW PRICE.

RICHARDSON LUBRICATING CO., - Quincy, Ill.

# OTTO BUNGE

MANUFACTURER OF

LEATHER NAIL HEADS, BELTS, SAFETY AND CLIMBER STRAPS

1130 ST. PETER STREET,

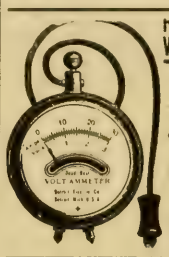
INDIANAPOLIS, - - INDIANA.

# YOST SPECIALTIES.

***Sookets, Wall Sockets, Weatherproof Sockets, Rosettes, Receptacles, Cord Adjusters.***

*Catalogue for the asking.*

THE YOST ELECTRIC MFG. CO.
TOLEDO, OHIO.



## Robert Volt-Ammeter

Dead Beat
Accurate, Durable
Guaranteed

List Price $6.00 including leather case.

Sample instrument forwarded prepaid on receipt of $5.00.

Discount to Dealers

THE ROBERT INSTRUMENT CO.
56 Shelby Street, DETROIT

## Water-Wheel Governors

Our new mechanical governors co-operate with the inertia effect of the water and the momentum of the plant.
They have cut the cost of good government in two. Guaranteed in every particular.

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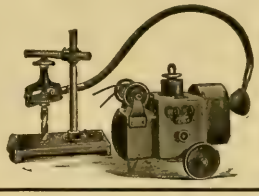
AKRON, OHIO.
WRITE FOR DESCRIPTIVE MATTER W.

# "STAR" INCANDESCENT LAMPS

LONG LIFE
GUARANTEED CANDLEPOWER,
HIGHEST EFFICIENCY.

MADE BY THE MOST SKILLED WORKMEN.

STANDARD ELECTRICAL MFG. COMPANY, : Niles, Ohio.



ESTABLISHED 1876.
COMBINATION OF

# Stow Flexible Shaft

—AND—

## MULTI-SPEED MOTOR

Practically dust and water proof. For Portable Drilling, Tapping, Reaming, Emery Grinding, etc. Write for Catalogue and Prices.

STOW MFG. CO., Binghamton, N. Y.

Gen'l European Agents, Selig, Sonnenthal & Co., 85 Queen Victoria Street, London, England

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Raven White Core

Raven Black Core

ALL OUR WIRES pass inspection and carry the above TRADE-MARKS on our tags. We also manufacture Crimshaw and Competition Tapes and Splicing Compounds.

# NEW YORK INSULATED WIRE COMPANY,

MAIN OFFICE: 114, 116 & 118 Liberty St., New York.
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# NATIONAL CODE STANDARD

WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

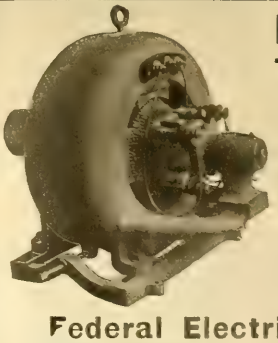
## "O. K." Weatherproof Wire.

## Slow-Burning Weatherproof and Ideal Wire.

Prices and Samples on Application.

# Phillips Insulated Wire Co.

Office and Factory: PAWTUCKET, R. I.



# FEDERAL

## Type B Motors

are the noiseless, sparkless, efficient kind. They deliver their full rated horsepower at slow speed, necessitating a solid, massive construction. They will stand up under the severest service, and are unequaled for general power purposes.

We make another type especially for elevator service, using with it our Automatic Controller. This combination cannot be excelled.

Federal Electric Company,
DIRECT CURRENT ELECTRICAL MACHINERY. Girard, Penn'a.

**WANTED, FOR SALE** *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 3c each.* **POSITION WANTED** *advertisements (50 words or less), $1.00 an insertion; additional words 2c each.*

## POSITION WANTED.

By thorough telephone man. Have had years of successful experience, first as repairman and afterwards as manager. Can furnish fine references from company by whom at present employed. Address BOX 431, care Western Electrician, 510 Marquette Building, Chicago.

## WANTED.

Practical electrician with at least two years' experience in electrical work in and about coal mines, to take charge of electric plant at coal mine, must thoroughly understand electric mining machines. Permanent position to right man. Reference required. State salary expected. Address BOX 432, care Western Electrician, 510 Marquette Building, Chicago.

## WANTED.

Location for an electric-light plant in a growing village or city that will grant a franchise, also contract for street lighting. I have a complete plant ready to install and would like to hear from some towns who are desirous of securing the location of an electric-light plant. Address BOX 430, care Western Electrician, 510 Marquette Building, Chicago.

## FOR SALE
### A MONEY MAKER.

Electric-light and steam-heating plant in thriving Illinois manufacturing town of 2,500. Income over $7,000 per year. Seventy new patrons added in past six months. Equipment all in first-class condition. City revenue $185.00 per month. A. C. system, meter customers, 15c base. Excellent opportunity for party with money to develop the field. Address, BOX 429, care Western Electrician, 510 Marquette Building, Chicago.

ANADARKO, OKLAHOMA, December 21st, 1904.

## NOTICE TO CONTRACTORS.

Sealed bids addressed to the City Clerk of Anadarico, Oklahoma, will be received by the City Council of Anadarko, Oklahoma, up to eight o'clock p. m. January 9th, 1905, for the construction of an electric lighting plant for said city, according to plans and specifications on file in the office of the City Clerk.

Bids must be accompanied by a certified check for 5 per cent of the amount bid, made payable to the City of Anadarko, Oklahoma, as a guarantee that the successful bidder will enter into a contract and furnish an acceptable bond without delay.

The Council reserves the right to reject any and all bids.

B. E. BEEBE, City Clerk.

## FOR SALE

| | | | | |
|---|---|---|---|---|
| 1-360 K. W. | General Electric | Alternator, | Three | Phase |
| 1-240 " | Westinghouse | " | Single | " |
| 2-150 " | Warren | " | " | " |
| 1-150 " | Westinghouse | " | " | " |
| 1-150 " | Wood | " | " | " |
| 1-150 " | Stanley | " | " | " |
| 1-120 " | General Electric | " | Three | " |
| 1-120 " | General Electric | " | Single | " |
| 1 120 " | Westinghouse | " | " | " |
| 1- 90 " | General Electric | " | " | " |
| 1- 75 " | Westinghouse | " | Two | " |
| 1- 75 " | Westinghouse | " | Single | " |
| 1- 75 " | Westinghouse | " | Two | " |

Direct connected to Gates' Engine.

Send for our **Monthly Bargain Sheet** with complete list and net prices.

**GREGORY ELECTRIC CO.**
**54-62 S. Clinton St., Chicago, Ill.**

**Western Electrician**
# WANT ADS
**Bring Results.**

# SPECIAL BARGAINS

### ENGINES

One 650-H. P. 14¾, 21 9-16, and 33½x30 Williams Triple.
One 350-H. P. 11⅞, 18 5-16, and 28 7-16x22 Williams Triple.
Two 400-H. P. 17 and 30x30 Noye Tandem Compound.
One 280-H. P. 18x36 Cummer Automatic.
One 160-H. P. 13 and 20x12 Ball Cross Compound Automatic.
Five 160-H. P. 15½x15 Armington & Sims Automatic.
One 160-H. P. 12 and 24x15 Armington & Sims Tandem Compound.
One 70-H. P. 10x12 Ball Automatic.
One 100-H. P. 13x12 Ball Automatic.

### BOILERS

Two 323-H. P. Heine Water Tube, 160 pounds pressure.
Four 125-H. P. Root Water Tube, 125 pounds pressure.
Five 100-H. P. 60x18 Return Tubular, 105 pounds pressure.

### CONDENSERS

One Taunton Surface Condenser, 3,000 square feet cooling surface.
12x15x15 Worthington Duplex Air Pump.
12x15x15 Worthington Duplex Circulating Pump.
One Worthington Surface Condenser, 1,800 square feet cooling surface.
Duplex Air and Circulating Pump, 14x14x14x10.
One Dean Jet Condenser, Single Cylinder Air Pump, 10x14x18.
One Dean Jet Condenser, Single Cylinder Air Pump, 10x12x12.

### DIRECT CURRENT GENERATORS

One 200-K. W. General Electric, 275 volts.
Four 150-K. W. Edison Bi-polar, 140 volts.
Fourteen 50-K. W. Edison Bi-polar, 125 volts.

### ALTERNATING CURRENT GENERATORS

Two 300-K. W. 60-cycle three-phase General Electric, direct connected to two 16 and 32x30 McIntosh & Seymour Engines.
Three 120-K. W. 60-cycle single-phase General Electric.
One 75-K. W. 133-cycle single-phase Westinghouse.

### FEED WATER HEATERS

One 300-H. P. Kensington Engine Works Closed Feed Water Heater.
One 1,250-H. P. Cochrane Open Feed Water Heater.
One 1,500 H. P. Warren-Webster Open Feed Water Heater.
One 500-H. P. Otis Closed Feed Water Heater.

### BOILER FEED PUMPS

One 10x7x12 Smith & Valle Duplex.
Two 10x6x10 Smith & Valle Duplex.
Two 7½x4½x10 Worthington Duplex.
One 12x7x10 Smith & Valle Duplex.
One 6x4x6 Smith & Valle Duplex.
One receiving tank and float controlling a 5½x4½x5 Worthington Duplex.

### BELTS

12 inches to 28 inches wide.
One Self-supporting Steel Stack, 75 feet high, 9 feet in diameter.

**THE EDISON ILLUMINATING COMPANY**
**DETROIT, MICHIGAN**

WORKS QUICK AND EASY. KEEPS ITS LUSTER. HOLDS OLD TRADE AND MAKES NEW. DOES NOT DETERIORATE. ESTABLISHED 16 YEARS. SOLD BY AGENTS AND DEALERS ALL OVER THE WORLD
3 OUNCE BOX 10 CENTS
SAMPLES SENT FREE
**U.S. METAL POLISH** GEO. W. HOFFMAN
POLISHES ALL METALS. BRANCHES: NEW YORK, CHICAGO, SAN FRANCISCO. 295 E. WASHINGTON ST. INDIANAPOLIS, IND.
HIGHEST AWARD, CHICAGO WORLD'S FAIR, 1893. LOUISIANA PURCHASE EXPOSITION 1904.

## Special Bargains for Spring—Immediate Delivery.

| 500-VOLT MOTORS. | | | 220-VOLT MOTORS. | |
|---|---|---|---|---|
| 1—20 H. P. C. & C. | 1—18 H.P., C&C. | 4—15 H. P. | 1—30 H. P. | 3—15 H. P. |
| 6—10 H. P. | 8—7½ H. P. | 17—5 H. P. | 5—10 H. P. | 6—7½ H. P. |
| 6—3 H. P. | 16—2 H. P. | 7—1 H. P. | 6—5 H. P. | 4—3 H. P. |
| | | | 11—2 H. P. | 4—1 H. P. |

**Above Motors are Complete and of Standard Make.**
**Special Bargains in Engines up to 600 H. P. Also A. C. & D. C. Dynamos, Boilers, Pumps, Etc.**
**Write requirements. Send for Catalogue.**
**CENTRAL STATION IMPROVEMENT COMPANY, 938 Monadnock Block, CHICAGO.**

## THE ONLY TOOL REQUIRED

Next time you hammer, ream and file a cast-iron junction box, wasting time, breaking boxes, and finally fail to produce a round hole, think of

**BOSSERT DRAWN STEEL JUNCTION BOXES.**

They are punched out of one piece of steel and have holes closed with hermetically sealed plugs which can be removed with one blow of a hammer. No time wasted. No broken boxes. No filing or reaming. A clear round hole every time. Write for particulars.

**BOSSERT ELECTRIC CONSTRUCTION CO.,** Office and Works, **Utica, N.Y.**

**Our Compound Stops Sparking and Saves Commutators.**
**14 Years' Use on Street Ry., Light and Power Commutators Has Proven its Worth. WE GUARANTEE RESULTS.**
**Send Your Address for FREE SAMPLE THAT CONVINCES.**
**JAS. McLAUGHLIN & CO.,** ELECTRICAL ENGINEERS
**586 Fulton Street, - - Chicago, Ill.**

## PRESERVE YOUR COPIES
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**BINDERS $1.00 EACH.**
**ELECTRICIAN PUBLISHING CO.,**
**Suite 510 Marquette Building, - - - CHICAGO.**

## EDWARDS AND CO

**Lock Gravity Drop Annunciator.**

Extra heavy, well finished case of ornamental design.
The drops being fastened to the back-board, the case may be removed without disconnecting wires.

**WESTERN ELECTRIC CO.,**
**Selling Agents.**

NEW YORK N.Y.

## *Locations for Industries*
### *Erie Railroad*
### *Chicago to New York*

The Erie Railroad Company's Industrial Department has all the territory traversed by the railroad districted in relation to resources, adaptability, markets and advantages for manufacturing, and can advise with manufacturers in relation to the most suitable locations. For full information address

**LUIS JACKSON**
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# Mechanical Engineers

who are interested in electricity should write for our catalogue of . . . . . .

# ELECTRICAL BOOKS.

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## CHICAGO EDISON COMPANY REPAIR SHOPS
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**FIRST-CLASS EQUIPMENT THROUGHOUT.**
Machine and Carpenter Work of All Kinds Correspondence Solicited.
Dynamos Armatures, Motors, Arc Lamps, Fans, Instruments.

# PHŒNIX QUALITY

PHŒNIX GLOBES POSSESS ALL THE POINTS OF MERIT NECESSARY IN THEIR USE. WE SPEND INFINITE CARE IN THE DESIGNING AND MAKING OF THESE GLOBES AND GUARANTEE THEM TO BE OF THE HIGHEST STANDARD OF EXCELLENCE AND SUPERIORITY.

# INNER GLOBES

LICENSED UNDER PATENT 745,677

YEARS OF EXPERIENCE, CAREFUL AND INTELLIGENT ATTENTION TO EVERY DETAIL IN THEIR MANUFACTURE HAS RESULTED IN OUR PRODUCING

## INNER AND OUTER GLOBES

FOR ALL ENCLOSED ARC SYSTEMS THAT ARE PERFECT IN EVERY RESPECT.

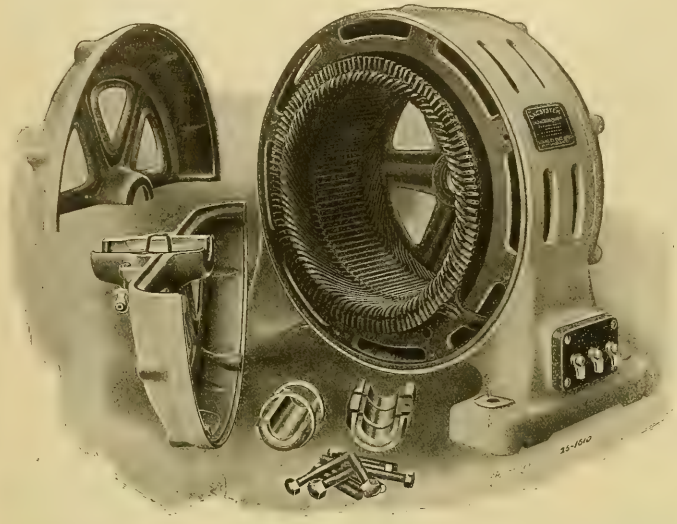
CATALOGUE OF INNER GLOBES SENT ON REQUEST.

***SEND FOR CATALOGUE NO. 16, ILLUSTRATING NEW DESIGNS IN ELECTRIC INCANDESCENT GLOBES AND SHADES.***

# THE PHŒNIX GLASS COMPANY

NEW YORK PITTSBURG CHICAGO

# The SKC System



## Induction Motors

are of superior design and the result of the best engineering ability extant.
They operate satisfactorily at high efficiency and high power factor, at full load, light load, and overload.

Speed Drop at Full Load is Slight.
Overload Capacity is Large.

Descriptive Matter Free Upon Request.

**Stanley Electric Mfg. Company,**
PITTSFIELD, MASS.
Chicago Office, Monadnock Block.

WE handle everything in the paper line used by Printers and Publishers.

Special attention given to weekly and monthly publications.

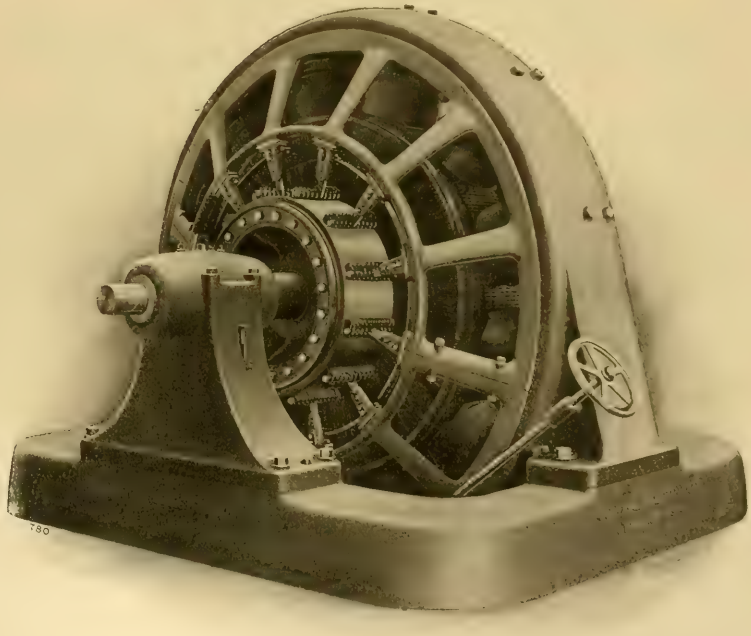
## Dwight Bros. Paper Co.

61-63 Plymouth Place - - - CHICAGO.

Trade National Mark

# Electrical Machinery

**Built in All Capacities and Types**



1,000 K. W. ROTARY CONVERTER

## National Electric Company

**General Sales Office and Works**

**Milwaukee**

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PHILADELPHIA: 1509 Land Title Building
PITTSBURG: A. W. Wyckoff Co.
CHICAGO: Old Colony Building
BOSTON and CINCINNATI

**SALES OFFICES:**
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CLEVELAND: Barton, Stevenson & Co.
DETROIT: Miller Seldon Electric Co.
DENVER: Hendrie & Bolthoff Mfg. & Supply Co.
SEATTLE and SAN FRANCISCO: Kilbourne & Clark Co.

# GOLD MEDAL

SINGLE-PHASE ALTERNATING-CURRENT MOTORS

# GOLD MEDAL

STATIC TRANSFORMERS

# SILVER MEDAL

SWITCHBOARD INSTRUMENTS

The apparatus built by this Company received unusual recognition by the International Jury of the Louisiana Purchase Exposition, as above list of awards indicates. These awards were made after a comprehensive series of tests which enabled the performance of the apparatus to be gauged as well as its appearance and mechanical construction. By confining our attention to a limited line of products, we are able to maintain a high degree of perfection, this fact being amply evidenced by the constantly widenng sphere of our influence. We seek—

TO SUPPLY FIRST-CLASS APPARATUS
TO HAVE ITS PERFORMANCE ENTIRELY SATISFACTORY TO THE CUSTOMER AND TO EMPLOY METHODS OF DOING BUSINESS WHICH WILL MERIT THE CONFIDENCE OF OUR FRIENDS

Have you received our latest publication ?

"ANSWERS TO SOME CENTRAL-STATION QUESTIONS ABOUT SINGLE-PHASE MOTORS"

A paper read before the October meeting of the Kansas Electric Light Association by G. PERCY COLE

Bulletin No. 68—Single-Phase Motors
Bulletin No. 69—Motor-Generator Sets
Bulletin No. 65—Static Transformers
Bulletin No. 64—Power Transmission Transformers
Bulletin No. 67—Instruments

## Wagner Electric Manufacturing Company

ST. LOUIS, U. S. A.

THIS "AD" appeared in the daily papers of Lincoln, Nebraska.

It refers to the AUTOMATIC TELEPHONE SERVICE of the Lincoln Telephone Company, who have been using our AUTOMATIC TELEPHONE SYSTEM since last March.

The "ad" contains within itself so many potent arguments in favor of AUTOMATIC TELEPHONE SERVICE that comment upon it is hardly necessary.

It shows, more plainly than anything else, that in Lincoln, as in every other city where our AUTOMATIC SYSTEM is in use, the people are quick to appreciate the superiority of AUTOMATIC TELEPHONE SERVICE and to vigorously support the company using it.

THE LINCOLN DAILY STAR, MONDAY EVENING, NOVEMBER 14, 1904

## ...NOTICE...

WE desire to notify our patrons and friends that we have discontinued the use of the Bell Telephone at our Wholesale Saddlery House, 808-814 P St., for the reason that we believe that the Bell service should be furnished at no higher price than the Automatic, and further, we find that most of our patrons have the Automatic service so that we found it unnecessary to have both. Our Automatic store number is 2324; J. C. Harpham residence 3546; C. F. Harpham residence 2404.

**HARPHAM BROS.**

Among the cities in which it has been adopted are:

| | | | | | |
|---|---|---|---|---|---|
| Chicago, Ill. | Auburn, N. Y. | San Diego, Cal. | Medford, Wis. | Albuquerque, N. M. | Wilmington, Del. |
| Grand Rapids, Mich. | Lewiston, Me. | Hopkinsville, Ky. | St. Mary's, Ohio. | Van Wert, Ohio. | Riverside, Cal. |
| Columbus, Ohio. | Auburn, Me. | Sioux City, Iowa. | Woodstock, N. B. | Battle Creek, Mich. | Traverse City, Mich. |
| Dayton, Ohio. | Fall River, Mass. | Cleburne, Tex. | Westerly, R. I. | Clayton, Mo. | and |
| Lincoln, Neb. | New Bedford, Mass. | Columbus, Ga. | Manchester, Iowa. | Pentwater, Mich. | Berlin, Germany. |
| Portland, Me. | Los Angeles, Cal. | Augusta, Ga. | Princeton, N. J. | Toronto Junction, Can. | |

# Automatic Electric Company

**Van Buren and Morgan Streets, CHICAGO, U. S. A.**

## INTERNATIONAL

### Mechanical Self-Restoring Drop Switchboard.

**A PERFECT APPARATUS.**

*Made in any desired capacity.*
*Sample parts and quotations on request.*

**INTERNATIONAL TELEPHONE MANUFACTURING CO.**

**CHICAGO, U. S. A.**

## AMERICAN ELECTRIC TELEPHONE CO.

**LARGEST MANUFACTURERS**

**This Company Sends Prepaid upon request any of the following bulletins:**

| | |
|---|---|
| Bulletin No. 7—Combined Telephone and Switchboard | Bulletin No. 18 Magneto Telephones of All Kinds |
| " " 8—Wall Switchboard | " " 19 Central Energy Switchboards |
| " " 9—Samson Telephone | " " 20—Central Energy Telephones |
| " " 10—American Express Switchboards | " " 21—Protective Apparatus and Terminal Equipment |
| " " 11—Desks—Toll and Private Branch | " " 22—Construction of Country Telephone Lines |
| " " 12—Visual Signal and Bell Style Switchboards | " " 23—Eight-Party Selective Ringing Telephones |
| " " 13—Intercommunicating Systems | " " 24—Composite Telephone and Telegraph Lines |
| " " 14—Line Material and Supplies | |
| " " 15—Bell Express Self-Restoring Switchboards | " " 25—Four-Party "Leich" Selective Telephone System |
| " " 16—Operator's Set and Accessories | " " 26—Telephone Power and Ringing Equipment |
| " " 17—Parts of Apparatus | |

**CHICAGO, ILL., U. S. A.**

## EDISON PRIMARY BATTERIES

FORMERLY EDISON-LALANDE

The name of Edison attached to an article is in itself a guarantee of excellence, for the electrical profession and trade know that Mr. Edison takes great pride in the quality of everything bearing his name, especially goods made at his own factories in Orange, as is the case with Edison Primary Cells.

Send for Catalogue No. 7

TRADE Thomas A. Edison PARIS

**EDISON MFG. CO.**

Factory, ORANGE, N. J.

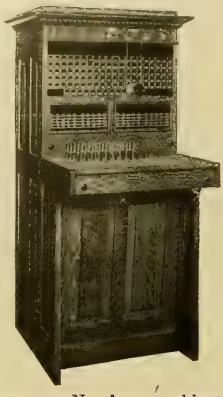
NEW YORK: 83 Chambers Street
CHICAGO: 304 Wabash Avenue

# STROMBERG-CARLSON

**GENERATOR-CALL**

## VISUAL SIGNAL SWITCHBOARDS

are inexpensive to maintain and nearly as rapid as a lamp signal switchboard.



**SIGNALS SELF-CONTAINED**

**NO WORKING PARTS EXPOSED**

This illustrates our No. A-1249 cabinet equipped with 100 line signals and 10 clearing-out signals. Our standard cabinets have a capacity for 50, 60, 70, 100, 140, 180 and 200 line signals of the above type.

***Bulletins No. 6 and 7-E describe these boards very thoroughly. Mailed free upon request.***

**STROMBERG-CARLSON TELEPHONE MFG. CO.,**

GENERAL OFFICES, ROCHESTER, N. Y.

WESTERN SALES OFFICE, CHICAGO, ILL.



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**FOR UNDERGROUND CONSTRUCTION**

The demands made upon conduits by electric-light and power service are much more severe than in the case of telephone service. Since Bituminized Fiber Conduit has shown itself to be so satisfactory for lighting and power service, it is unquestionably a very superior conduit for telephone work.

**American Conduit Co.**

**Main Offices: 1005-6 Manhattan Building, Chicago**

**Other Offices:**

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# THE TELEPHONE HAND-BOOK

**NEW AND REVISED EDITION, WITH A NEW CHAPTER ON "RECENT PROGRESS," BRINGING THE BOOK UP TO DATE.**

**BY HERBERT LAWS WEBB.**

*Member of the American Institute of Electrical Engineers, and of the Institution of Electrical Engineers, London. Author of "A Practical Guide to the Testing of Insulated Wires and Cables." Joint Author of "Electricity in Daily Life."*

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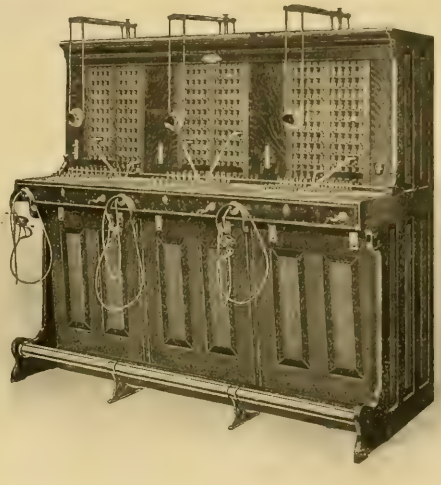

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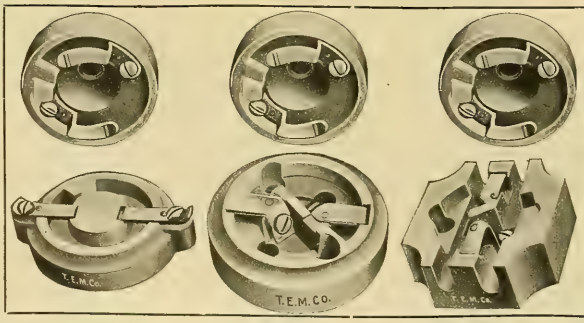


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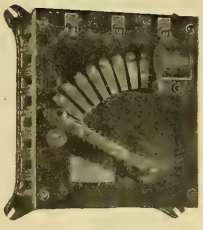

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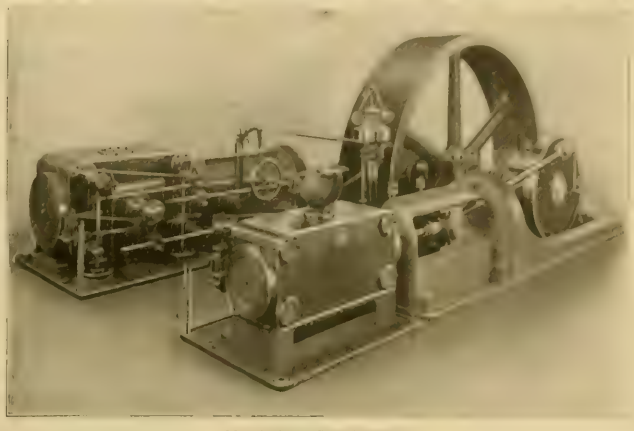

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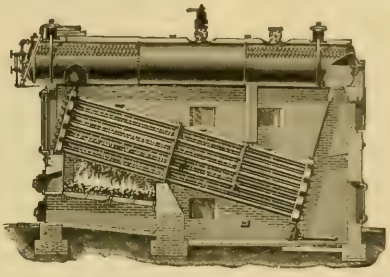

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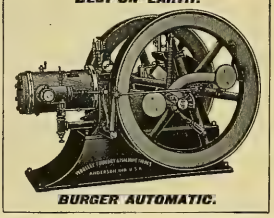

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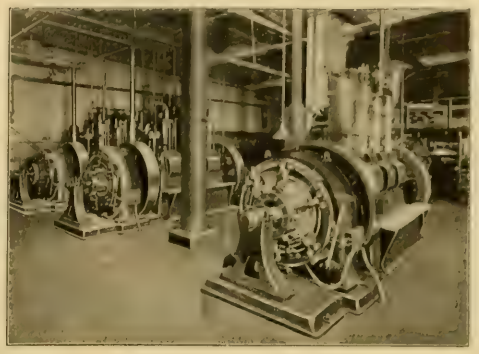

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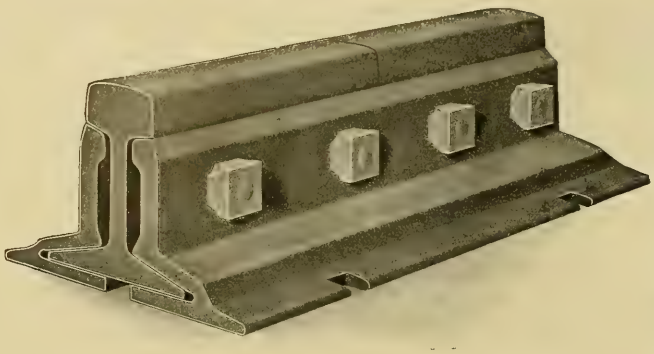

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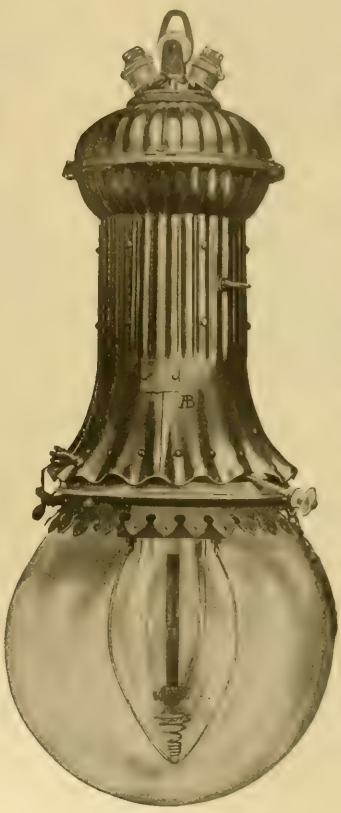

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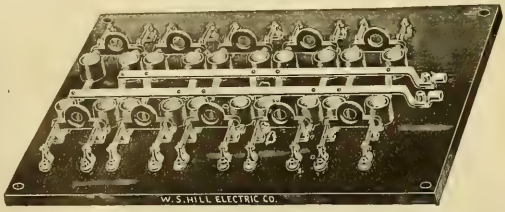


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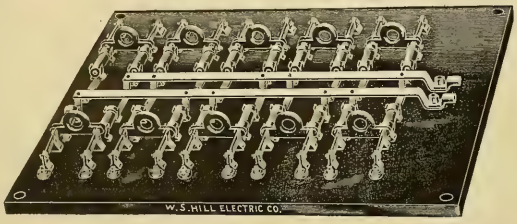


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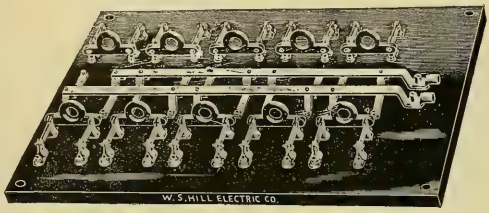


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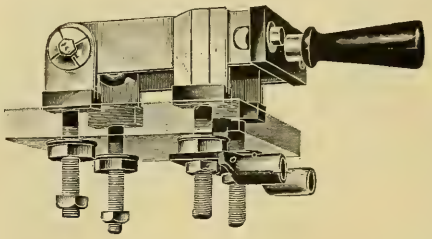

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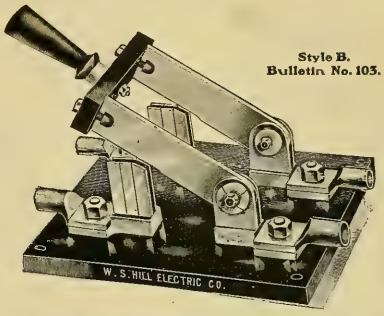


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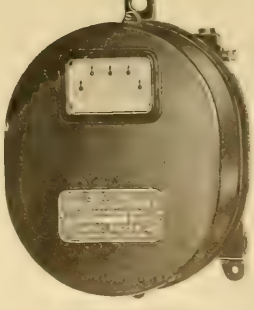
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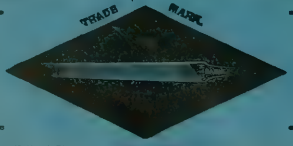


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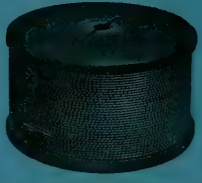

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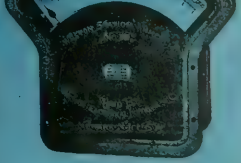
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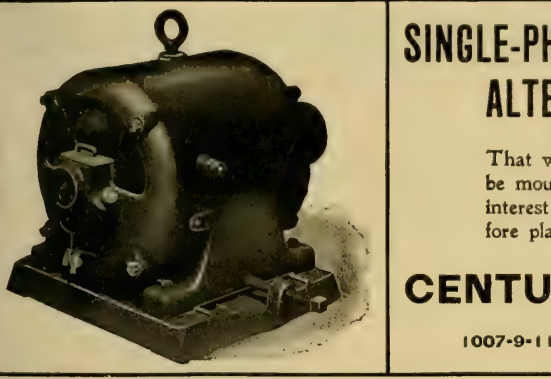

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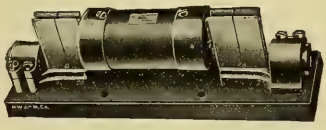

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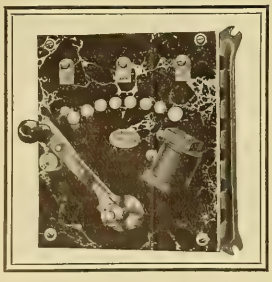

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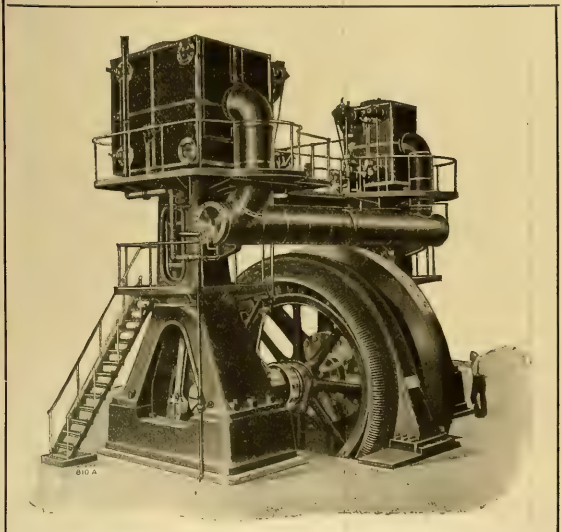

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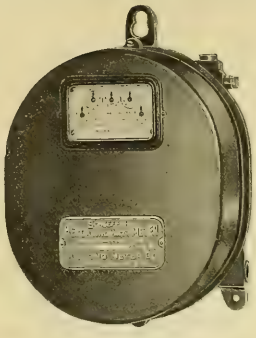

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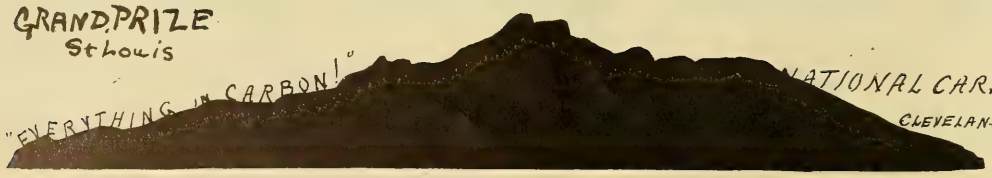

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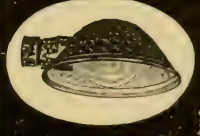

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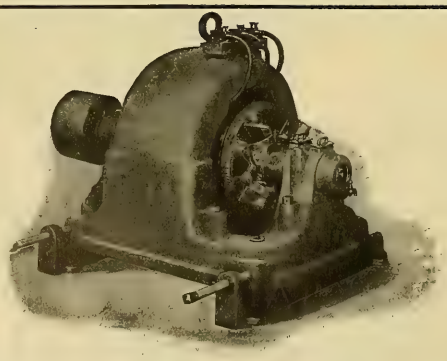

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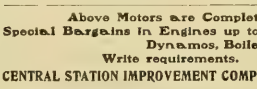


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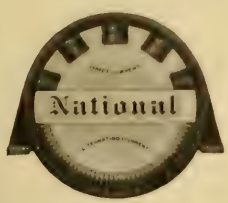


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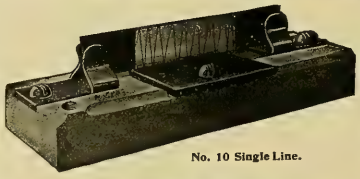

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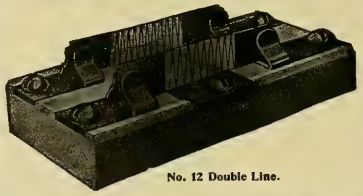

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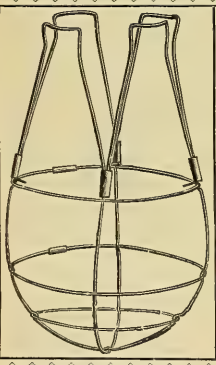

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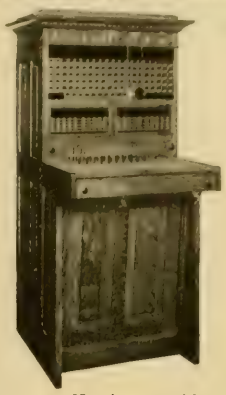

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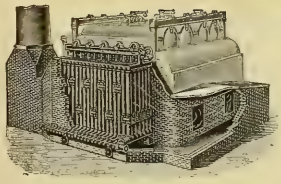

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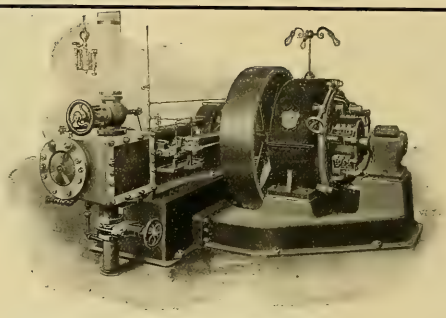

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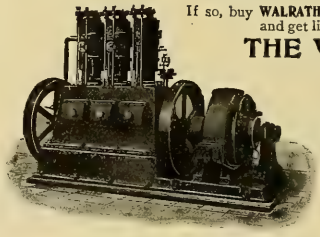

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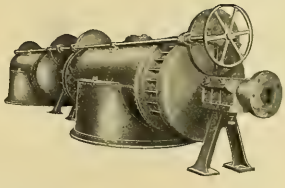

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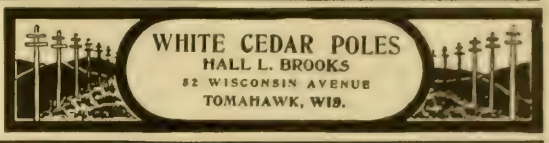


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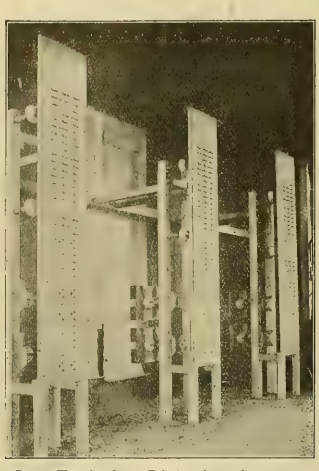

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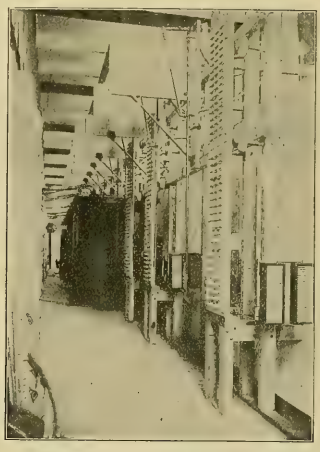

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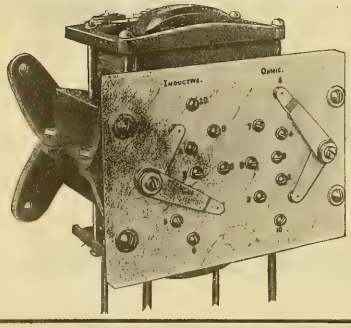

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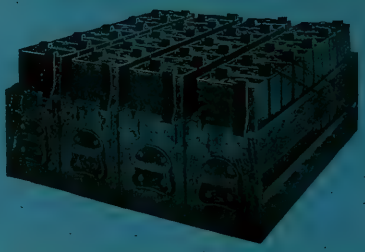

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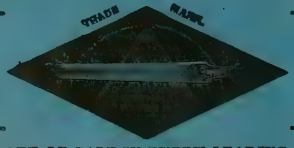


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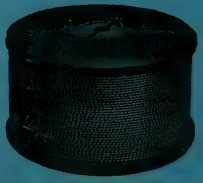

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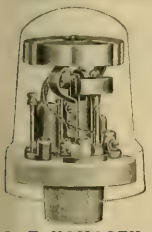

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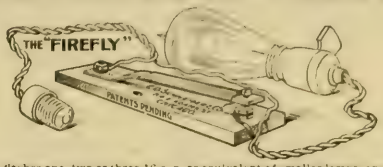


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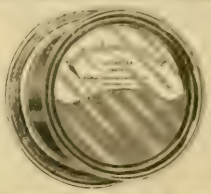

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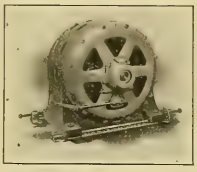

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**Single Phase and Polyphase**

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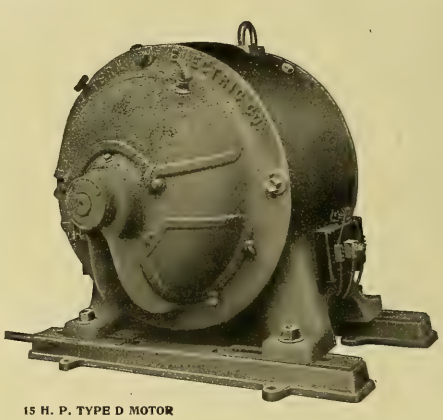

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CHICAGO NEW YORK

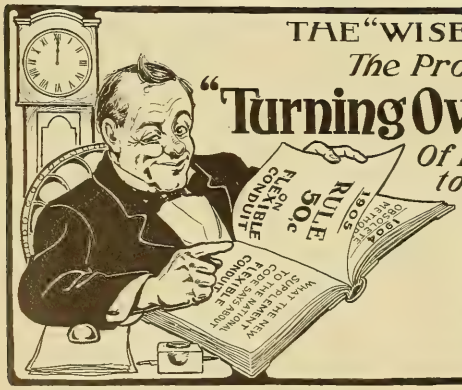
And Other Large Cities

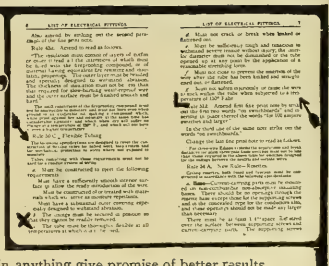
THE "WISE ONE" IS ON

*The Proverbial*

**"Turning Over a New Leaf"**

*Of Particular Significance to the Wise Buyer*



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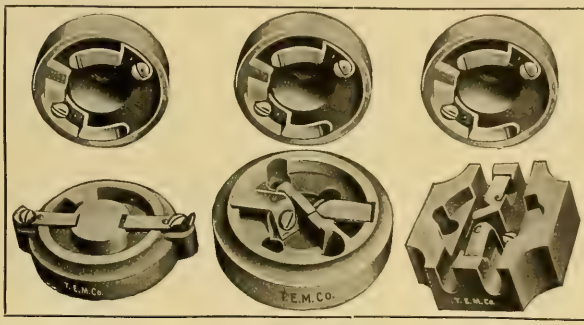


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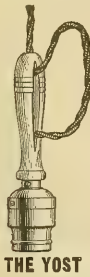

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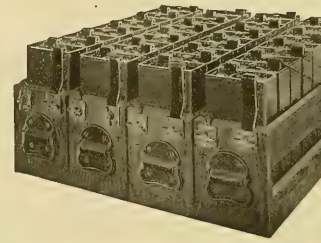

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Special switches made to order.

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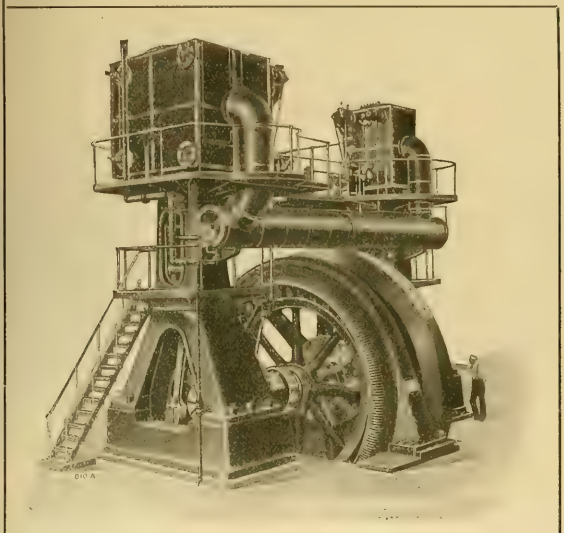

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Released at close of St. Louis Exposition.

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is not the least of this 476-foot sky-scraper's wonders. Lighting the huge presses, 55 feet below ground, was a serious problem solved by using

## Cooper Hewitt Mercury Vapor Lamps

In the press and stereotype rooms, 26 Cooper Hewitt lamps take the place of 132 incandescent lamps with separate outlets and 14 arc lamps, besides saving two-thirds of the current and obviating the need of drilling 1,600 holes for incandescent lamps in the press frames.

They light thoroughly all the machines and 17,000 square feet of floor space with a ceiling 21 feet high.

The composing room is lighted by 12 Cooper Hewitt lamps. Those who have worked under these for six months consider the light the nearest approach to daylight yet developed. The light is soft and cool to the eyes. Casting no shadows, it makes type legible in any position. Eliminating reflections from bright surfaces, it renders new type easy to read.

In the mailing room, there are 4 Cooper Hewitt lamps, making 42 in all—two in series of 118 volts direct current, each consuming 3.5 amperes.

THE LIGHT TO WORK BY.

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FOR ELECTRICIANS
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The Turner 4B Gasoline Brazing Torch is used by all mechanics for light work in brazing, annealing, tempering and drawing temper of small tools, etc. This torch produces an intensely hot, pointed flame of over 3,000° Fahr. Burns 4 hours from one filling.

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They are punched out of one piece of steel and have holes closed with hermetically sealed plugs which can be removed with one blow of a hammer. No time wasted. No broken boxes. No filing or reaming. A clear round hole every time. Write for particulars.

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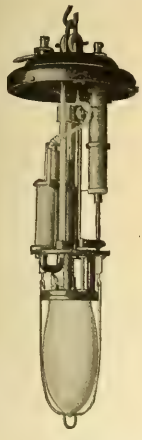
NORTHERN BOOKLET NO. 2538.

# General Electric Company



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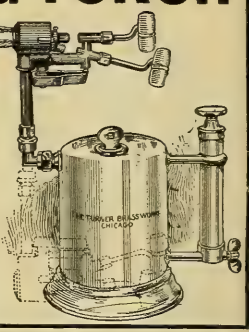

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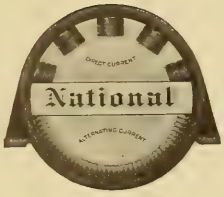


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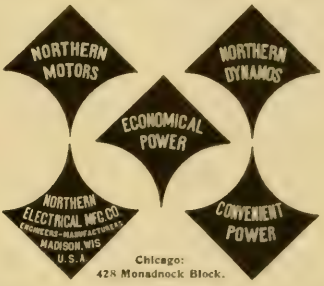


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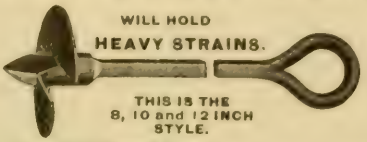


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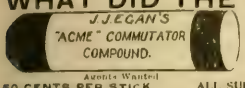


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Summitville Ind. Nov 23 1903

Western Electrician
Chicago Ill.

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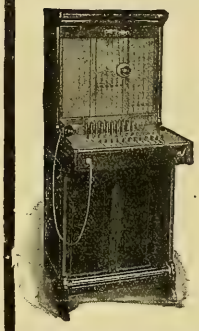

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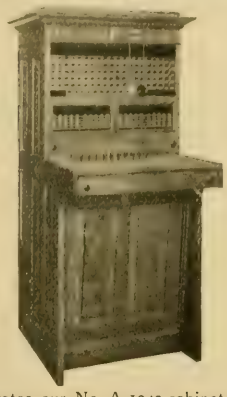

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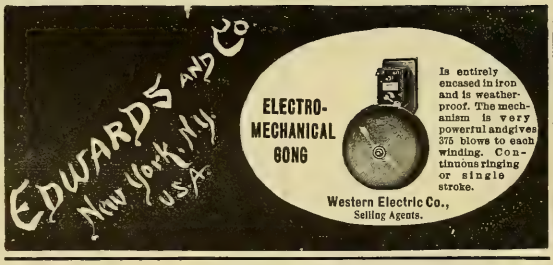

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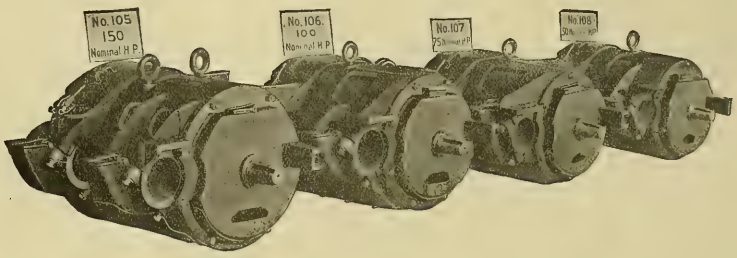


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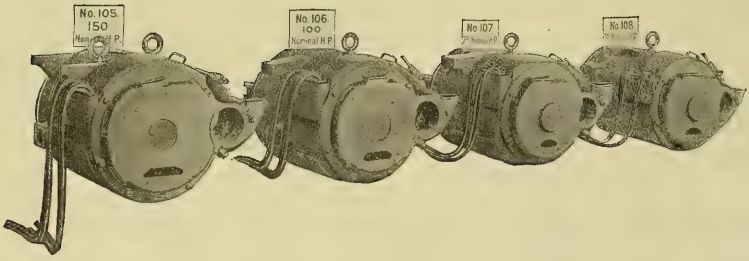


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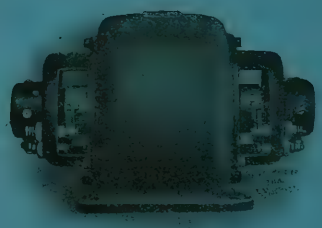

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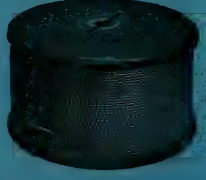

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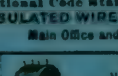

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After that there were rumors of buying up, "amalgamating," and the rest of it,—rumors without a fraction of foundation in fact.

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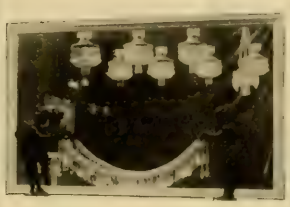

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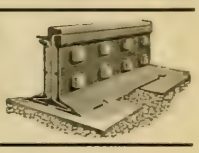

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GRAND PRIZE UNIVERSAL EXPOSITION ST. LOUIS, 1904


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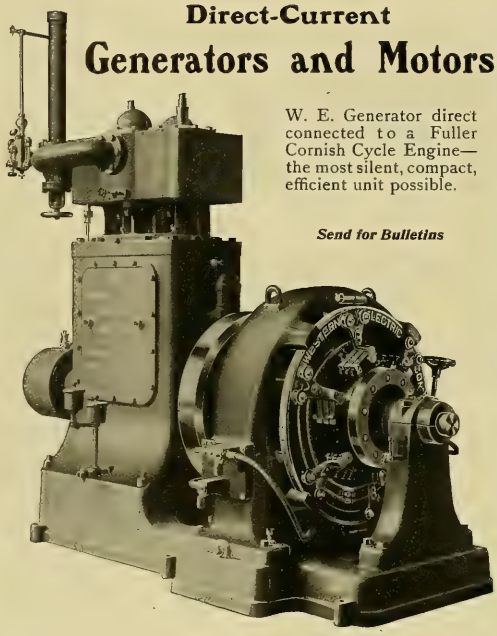

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TYPE E (Knife Blade Contact).
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201-400 Amps., 1 Pole, Main Line.
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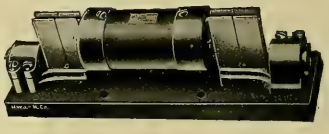

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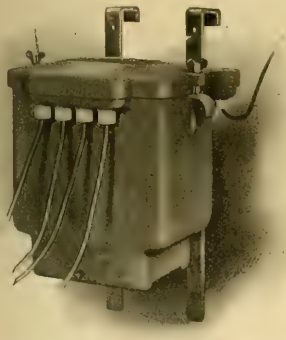

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**Polyphase and Single-Phase.** Superior in points of engineering and manufacture over ordinary induction motors.

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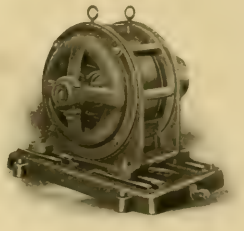

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Trumbull Elec. Co.
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Hobart Elec. Mfg. Co.
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Northern Electrical Mfg. Co.
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Wagner Electric Mfg. Co.
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Green Fuel Economizer Co.

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Electric Appliance Co.
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General Electric Co.
Westinghouse El. & Mfg. Co.

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Kemp, R. W.
Kohler Brothers.
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Newgard & Co., Henry.
Northern Electrical Mfg. Co.
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Sargent & Lundy.
Schoti, W. H.
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Stanton, LeRoy W.

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Bissell Co., The F.
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General Inc. Arc Light Co.
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**Electro-Plating Mach'y**
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General Electric Co.

**Elevators-Conveyors.**
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Allis-Chalmers Company.
Marinette Gas Engine Co.
Woolley Pump & Mach. Wks.

**Engines, Oil.**
American Diesel Engine Co.

**Engines, Steam.**
Allis-Chalmers Company.
Brownell Co., The

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Century Electric Co
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Vulcanized Fibre Co.

**Files.**
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Haller Machine Co.
Reynolds El. Flasher Mfg.Co
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Central Tel. & El. Co
Chicago Die & Electric Co.
Chicago Fuse Wire & Mfg.Co.
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D. & W. Fuse Company.
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Westinghouse El. & Mfg. Co.

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Westinghouse El. & Mfg. Co.

**Lamp, Coloring.**
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Klein & Sons, Mathias.

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Richardson Lubricating Co.

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(See Wires and Cables.)

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Mica Insulator Co.
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Letheule, Paul

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Hoffman, Geo. W.

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Union Electric Mfg. Co.
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Westinghouse El. & Mfg. Co.

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Highland Park College

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Kester Elec. Mfg. Co.
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General Electric Co.
Manhattan Elect'l Supply Co
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Gen. Incan. Arc Light Co.

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Automatic Electric Co.
Bissell Co., The F.
Central Electric Co.
Central Tel. & El. Co.
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Roebling's Sons Co., J. A.
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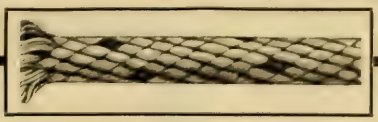

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***If used for hanging Arc Lamps, saves heads, lamps and expensive renewals; BECAUSE:***

FIRST—The stitches double on each other, giving freedom of play and distributing the strain equally over all the strands.

SECOND—It is made of extra quality stock, warranted free from waste.

THIRD—Being warranted free from bad splices and rough braiding, the smooth surface causes minimum abrasion and maximum wear.

For the same reasons this cord is much the most durable for Trolley Cord and Bell Cord.

We gladly send tests and samples, with full information, to all interested.

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# WHY

NOT LET US SHOW YOU HOW TO EFFECT A MUCH GREATER SAVING BY INSTALLING AN UNDERGROUND **EXHAUST STEAM HEATING SYSTEM?**

WRITE FOR THE "STORY" OF
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is not the least of this 476-foot sky-scraper's wonders. Lighting the huge presses, 55 feet below ground, was a serious problem solved by using

## Cooper Hewitt Mercury Vapor Lamps

In the press and stereotype rooms, 26 Cooper Hewitt lamps take the place of 132 incandescent lamps with separate outlets and 14 arc lamps, besides saving two-thirds of the current and obviating the need of drilling 1,600 holes for incandescent lamps in the press frames.

They light thoroughly all the machines and 17,000 square feet of floor space with a ceiling 21 feet high.

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THE LIGHT TO WORK BY.

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Gold Medal **Single-Phase A. C. Motors**
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**To supply first-class apparatus. To have its performance entirely satisfactory to the customer. And to employ methods of doing business which will merit the confidence of our friends.**

Have you received our latest Publication—

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A paper read before the October Meeting of the Kansas Electric Light Association by G. Percy Cole.

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" " 69. Motor Generator Sets
Bulletin No. 65. Static Transformers
" " 64. Power Transmission Trans.
Bulletin No. 67. Instruments

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ST. LOUIS, U. S. A.

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## Edgewise Wound Enclosed Arc Lamps

FOR 110-VOLT DIRECT CURRENT SERVICE

Embody the Latest Features of Arc Lamp Manufacture.

INDESTRUCTIBLE.
PERFECT REGULATION.
PERMANENT ADJUSTMENT.
COMPOSED OF FEW PARTS.
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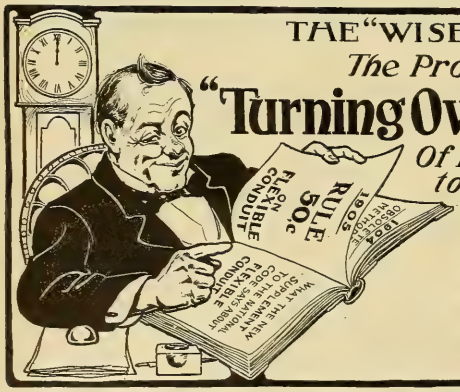


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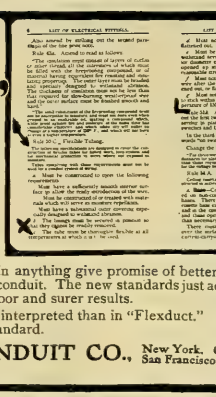

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"Flexduct" is the higher standard Flexible conduit. The new standards just adopted by those who know mean endurance, safety, less labor and surer results.

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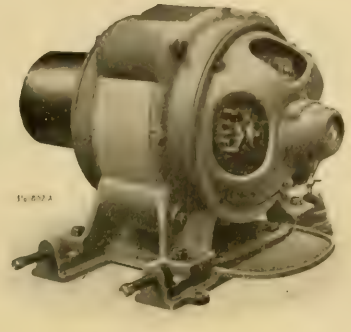

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600 to 800 hours guaranteed life
Economy of Operation.

**Packard Lamps Are a Good Investment. Begin the New Year by Installing Them on Your Circuit.**

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PRICED RIGHT
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WESCO
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"EVERYTHING ELECTRICAL"

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The Only Article That Will Prevent Sparking.
Will keep the Commutator in good condition and prevent cutting. Absolutely will not gum the brushes.
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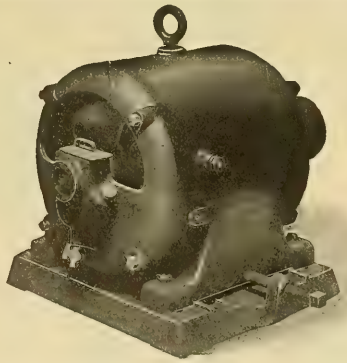

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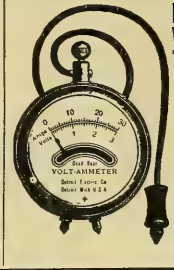


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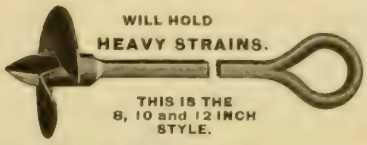

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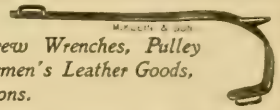

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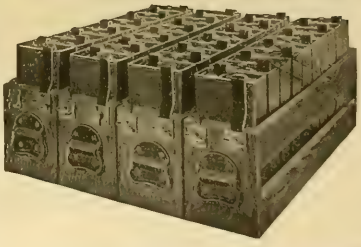

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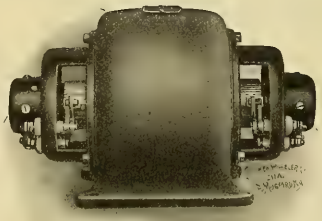

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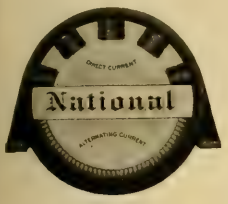


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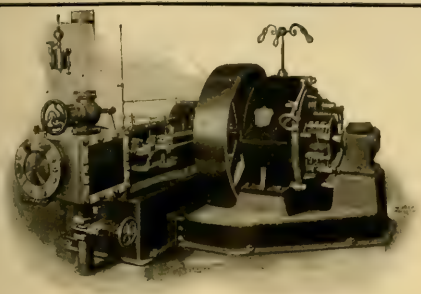

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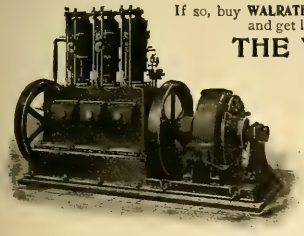

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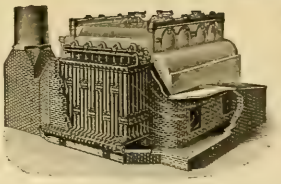

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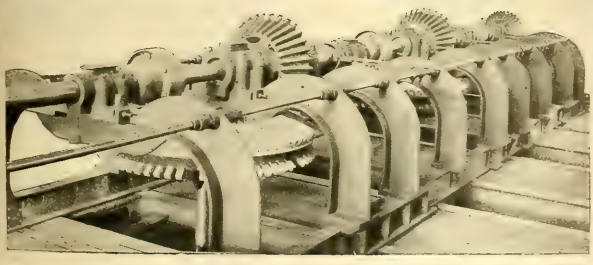

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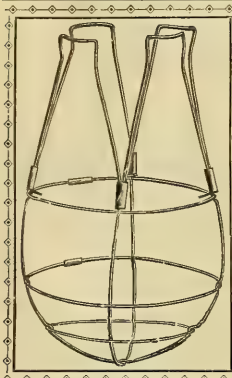

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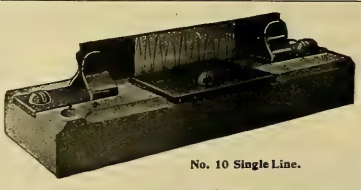

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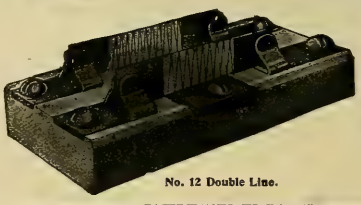

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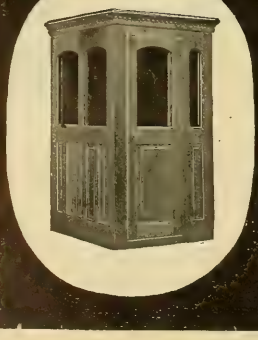

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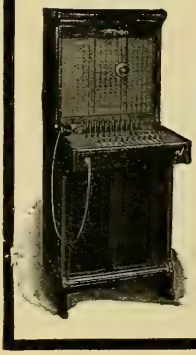

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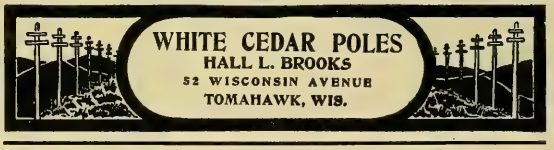


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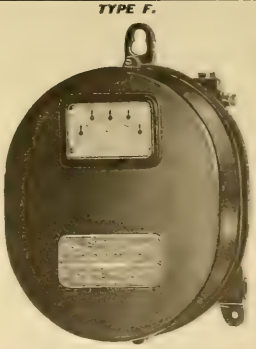
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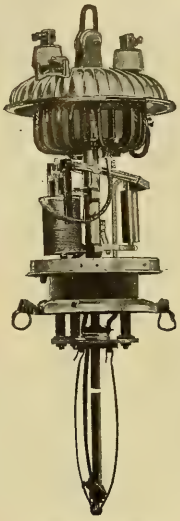

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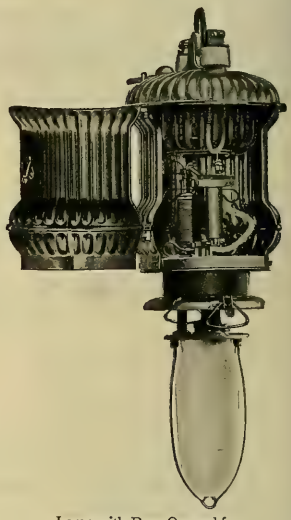

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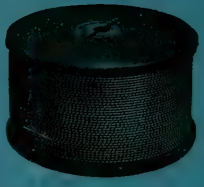

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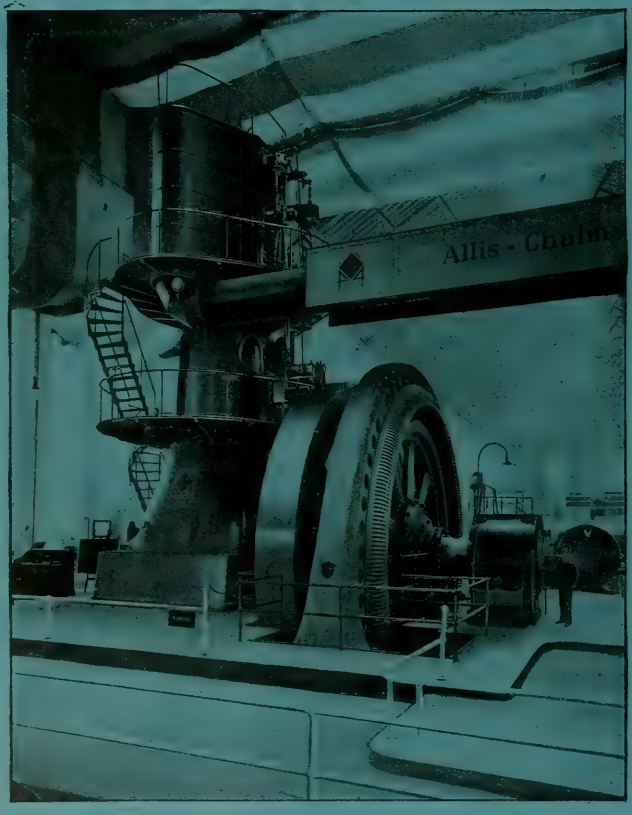


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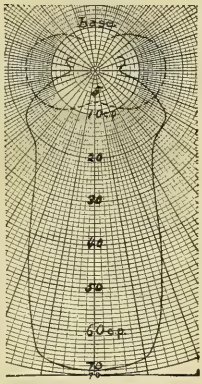


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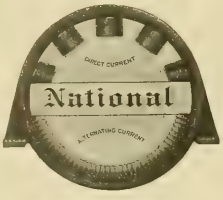


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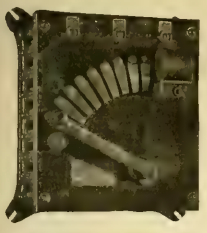

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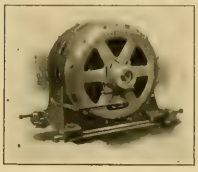

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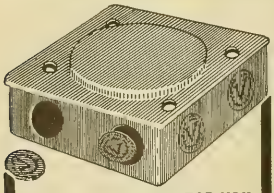

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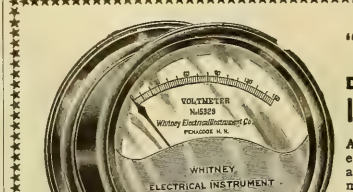


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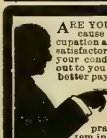

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Phillips, Eugene F.
Phillips Insulated Wire Co
Roebling's Sons Co., J. A.
Runzel-Lenz Elec. Mfg Co.
Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Standard Underground C. Co
Wesco Supply Co.
Western Electric Company.

For Alphabetical Index of Advertisements See Page 3.

# STANLEY
# INSTRUMENT CO.

**GREAT BARRINGTON, MASS., U.S.A.**

Present their new

## Rotary Jewel Bearing

Wattmeters for Alternating Current-Service

by which

**Permanent Accuracy at all loads**

is obtained.

**Jewel Bearing** is continuously

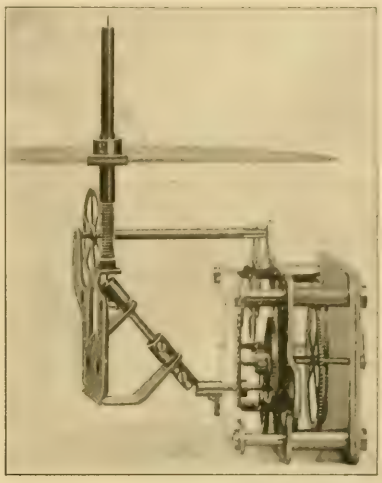
**Rotated by Train.**

**A New Jewel** surface is continuously automatically placed under disc staff pivot. Pivot cannot touch same spot on Jewel more than once in 1,000 kilowatt-hours.

Disc Staff Pivot is Spring Supported.
No increase of bearing friction can occur.
No change in Accuracy can occur.

**Such Result is Self Evident.**

The disc staff pivot in a meter of this construction (10-ampere capacity) has rotated on the Jewel bearing upwards of 150,000,000 times; the equivalent of more than 120,000 kilowatt-hours; equal at 10 cents per kilowatt-hour to a revenue of $12,000.00 from a 10-ampere meter, and no change of accuracy is perceptible at any load from 25 watts to 50% overload.



**JEWEL SURFACE**

**ALWAYS NEW**

ACCURACY PERMANENT

NEW PRINCIPLES

NEW IDEAS

NEW METHODS

PERFECTION PROVED

# ROTATED

JEWEL

# BEARING

PATENTED

# WATTMETERS

# Kohler Bros. Asked The Cutler-Hammer Mfg. Co.

**What they thought about the Cooper Hewitt Mercury Vapor Lamp and this is what they said:**

Milwaukee, Wis., Jan. 13, 1905

KOHLER BROS., Contracting Engineers, Chicago, Ill.
Gentlemen :— Re Cooper Hewitt Lamps.

We are in receipt of yours of the 12th inst., regarding Cooper Hewitt Lamps. At present we have our Draughting Room, Cost Department and one Department of our shop equipped with the Cooper Hewitt Lamps, which we find very satisfactory. We find that the strangeness of the light wears off in a very short time, and the draughtsmen, clerks and workmen as well pleased to the same. The light is very easy on the eyes, and, owing to the splendid diffusion obtained, no dark shadows are caused and the ability to see into and under objects by this light is suprisingly satisfactory.

The current consumption in the departments which are equipped with these lamps has been halved, and we have just placed our order for equipping the balance of our plant with these lamps.

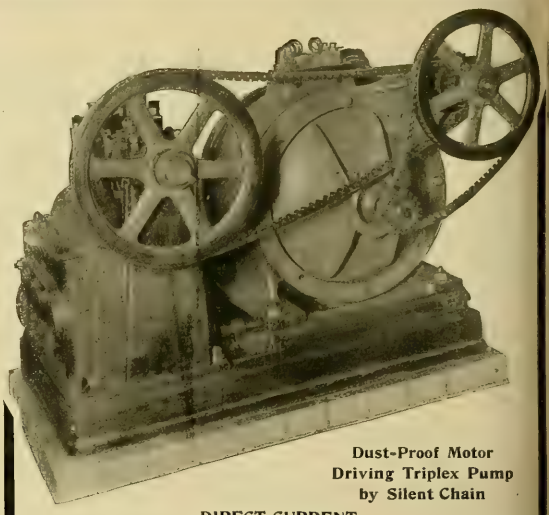
Yours very truly,
THE CUTLER-HAMMER MFG. CO.

## THE LIGHT TO WORK BY

**For use in Factories, Machine Shops, Warehouses, Covered Piers, Draughting Rooms, Offices, Press and Composing Rooms and for Photographic and Engraving Work and Blue Printing.**

## Cooper Hewitt Electric Co.

220 West 29th Street, NEW YORK CITY
PHILADELPHIA OFFICE: 1121 Walnut St.



Dust-Proof Motor Driving Triplex Pump by Silent Chain

DIRECT-CURRENT

## APPARATUS FOR POWER AND LIGHTING

*Write for List of Bulletins.*

## Western Electric Company

CHICAGO NEW YORK
AND OTHER LARGE CITIES

I am in a position to quote very attractive prices on the high-grade "EAGLE BRAND" Rubber Covered Wires and Cables.

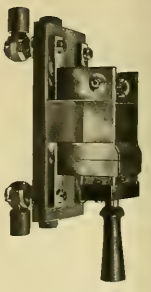
I. A. BENNETT,
529 Monadnock Block, Chicago.

We manufacture Knife Switches in sizes up to 2,000 amperes.

Prompt shipments made from stock.

Special switches made to order.

LET US QUOTE YOU.



## Pass & Seymour, Inc.

Solvay, N. Y.

New York Chicago San Francisco

"Flexduct" flexible, non-metallic conduit is the high standard required for safe and economical wiring. Its flexibility, smooth interior, tough, tenacious character promote ease of application and economical use.

## OSBURN FLEXIBLE CONDUIT COMPANY

Principal Office: 21 Park Row, New York. Chicago Office: 529-530 Monadnock Block. I. A. BENNETT, Manager.

# GRAND PRIZE

**The Highest Possible Award**

**Has Been Given to**

ELECTRA

TRADE MARK

## HIGHEST GRADE NUERNBERG CARBONS

**By the International Jury of Awards, of the Louisiana Purchase Exposition, St. Louis, 1904.**

**HUGO REISINGER, Sole Importer, 11 BROADWAY, NEW YORK**

## HORNBERGER-IRWIN Transformers

**(LARGE AND SMALL)**

**½ K. W. to 800 K. W.**

This transformer represents the latest improvements in transformer construction; made in three types; multi-coil construction; ventilated cores; built for all commercial voltages and frequencies; **higher efficiencies together with lower temperatures than have heretofore been attained are guaranteed.**

Catalogue just issued explains details.

**Manufactured by**

**Crawfordsville Electric Co.**

**CRAWFORDSVILLE, INDIANA, U. S. A.**

## Northern Back-Geared Motors

**FOR MACHINE TOOL, MACHINE AND LINE SHAFT DRIVE**

Do work required with less bulk, cost and labor than any other like device.

Electrical construction—Standard Northern; best.

Mechanical design and execution insure perfect alignment of motor pinion and countershaft gear.

**SEE BULLETIN NO. 2534 FOR DETAILS AND ILLUSTRATIONS OF APPLICATIONS**

NORTHERN BACK-GEARED MOTOR

**NORTHERN ELECTRICAL MANUFACTURING CO.**

Engineers Manufacturers

MADISON, WIS., U. S. A.

425 Monadnock Block. Chicago.

# General Electric Company

## Edgewise Wound Enclosed Arc Lamps

**FOR 110-VOLT DIRECT CURRENT SERVICE**

Embody the Latest Features of Arc Lamp Manufacture.

INDESTRUCTIBLE.
PERFECT REGULATION.
PERMANENT ADJUSTMENT.
COMPOSED OF FEW PARTS.
SIMPLICITY AND RIGIDITY OF CONNECTIONS.

Write for further information.

## GENERAL OFFICES: SCHENECTADY, N. Y.

**Chicago Office: Monadnock Block.** **Sales Offices In All Large Cities.**

# THE NEW YEAR

Finds in the Packard Lamp
Steadily maintained candlepower
600 to 800 hours guaranteed life
Economy of Operation.

**Packard Lamps Are a Good Investment. Begin the New Year by Installing Them on Your Circuit.**

**ELECTRIC APPLIANCE COMPANY,**
CHICAGO AND SAN FRANCISCO

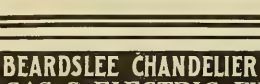
SET A STANDARD
OF
Brilliant and Efficient Lighting
By using
# EDISON LAMPS
Used in larger quantities than all other American makes combined.

All types and varieties. Regular Multiple Lamps, Street Series Lamps, Miniature Lamps.

GENERAL ELECTRIC COMPANY
Main Lamp Sales Office, HARRISON, N. J.
(5)

BEARDSLEE CHANDELIER MFG. CO. 256 AND 257 5TH CANAL ST. CHICAGO
GAS & ELECTRIC FIXTURES FOR THE TRADE.
CATALOG SENT PREPAID TO DEALERS — MENTION THIS PAPER

# WANTED
*You Who are Troubled with Sparking and Cutting of Commutators to Use*



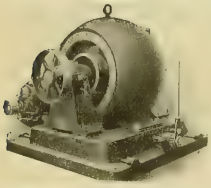

The only article that will PREVENT SPARKING. Will keep the commutator in good condition and PREVENT CUTTING.
*Absolutely will Not Gum The Brushes . . .*
It will put that high gloss on the commutator you have so long sought after.
*50 Cts. per Stick. $5.00 per Dozen.*
For Sale by all Supply Houses, or
*FREE, Sample Stick.* K. McLENNAN & CO., Sole Manufacturers, Room 411 Inter Ocean Bldg., 130 Dearborn St., CHICAGO, ILL.

# MICA INSULATION
Of all Qualities, In any Form at Lowest Prices
EUGENE MUNSELL AND CO.
NEW YORK and CHICAGO
That Is.
Micanite, Linotape, M. I. C. Compound, Empire Cloth and Paper. For Years the Standard.
MICA INSULATOR CO., Originators
NEW YORK and CHICAGO

Electric Heating Apparatus
SEND FOR 62-PAGE CATALOGUE.
UNIT" ENAMELED RHEOSTATS
SIMPLEX ELECTRIC HEATING CO.,
Cambridgeport, Mass.

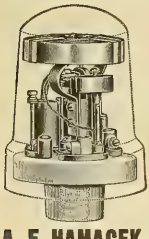
MICA-BOND
Notice how our competitors try gradually to raise Cut Mica prices—same thing would occur in manufactured mica if we were not the leaders
CHICAGO MICA CO
"PERFECTORS" VALPARAISO, IND.

CENTURY ELECTRIC CO.
MANUFACTURERS OF
SINGLE-PHASE SELF-STARTING
MOTORS AND CEILING FANS
ST. LOUIS, MO.



# WARREN ELECTRIC MFG. CO.
THE WARREN ALTERNATING-CURRENT GENERATOR
WITHOUT BRUSHES, COMMUTATOR OR MOVING WIRE
SANDUSKY, OHIO, U. S. A.

M. KLEIN & SON.
Send 2c stamp for new catalogue No. 6 of
KLEIN'S TOOLS
*For Electrical Workers and Line Builders.*
MATHIAS KLEIN & SONS,
31 W. Van Buren St., Chicago, Ill.



100
Arc lights kept burning by closing one open circuit on one broken lamp loop.
THIS AUTOMATIC Series Arc CUT-OUT
Will do so. Call for sample.
A. F. HAMACEK, Chicago, Ill.
2039 Kenmore Ave.

# A RELIABLE PAIR
THE VERY LATEST IN MAGNETIC-VANE INSTRUMENTS

Reliance Volt-meters AND Ampere Meters
For A.-C. and D.-C. Circuits

Fill the demand for reliable yet inexpensive switchboard instruments. Especially designed for automobile charging, boards and small plant work. Neat and attractive in appearance Black enameled finish with raised parts polished nickel.
Face of meter 6¼ inches, list price from 0 to 150 volts . . . . $10.00
Base " " 6¼ " " " " 0 to 60 amperes . . . 10.00
Write for circulars and special discounts to the trade.
RELIANCE INSTRUMENT CO., . . . 62-68 W. VAN BUREN ST. CHICAGO

VOLT - AMMETERS,
POCKET SIZE.
For Testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.
RELIABLE. ACCURATE.
Send for Circular.
L. M. PIGNOLET,
78-80 Cortlandt St., NEW YORK, N. Y.

DON'T BUY ELECTRICAL SUPPLIES
Until you have seen our new Catalogue and new Price List.
Free to the trade.
Manhattan Electrical Supply Co.
NEW YORK: 32 Cortlandt St.
CHICAGO: 188 Fifth Ave.

CARBON "EVERYTHING IN CARBON" — NATIONAL CARBON CO. CLEVELAND, O.

FRANK N. PHILLIPS, PRESIDENT. O. H. WAGENBEIL, TREASURER. EUGENE F. PHILLIPS, GENERAL MANAGER E. ROWLAND PHILLIPS, VICE-PRES. G. R. REMINGTON, JR., SEC

**AMERICAN ELECTRICAL WORKS,**

PROVIDENCE, R. I.

BARE AND INSULATED ELECTRIC WIRE,

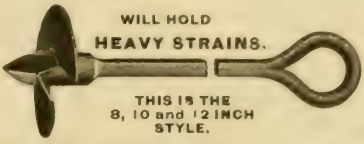
ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,
**Railway Feeder and Trolley Wire,**
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
CABLES FOR AERIAL AND UNDERGROUND USE.

NEW YORK STORE, W. J. Watson, 26 Cortlandt St.
CHICAGO STORE, F. E. Donohue, 82 Lake St.
MONTREAL BRANCH, Eugene F. Phillips' Electrical Works.
MAIN OFFICES AND FACTORIES, PHILLIPSDALE, R. I.

THE 8, 10 AND 12 INCH
**STOMBAUGH GUY ANCHOR**

WILL HOLD 20,000 LBS., 25,000 LBS. AND 30,000 LBS. RESPECTIVELY
THEY ARE USED TO ANCHOR CORNERS, DEAD ENDS AND OTHER HEAVY STRAINS

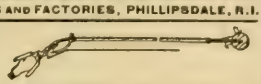
REMEMBER
**STOMBAUGH GUY ANCHORS**



WILL HOLD
HEAVY STRAINS.
THIS IS THE
8, 10 and 12 INCH
STYLE.

**W. N. MATTHEWS & BRO., Manufacturers**
603 Carleton Building ST. LOUIS

**EXPERT IN** ELECTRICITY MECHANICS PATENT CAUSES
SOLICITOR OF **PATENTS**
U. S. & FOREIGN
FORÉE BAIN, 1652-3 Monadnock Blk., CHICAGO



The Incandescent Lamp Replacer and Cleaner replaces and cleans any c.p. lamp at any height or angle.
Incandescent Electric Light Manipulator Co.,
116 Bedford St., Boston, Mass.

**REPAIRING**
**RECALIBRATING**
ELECTRIC METERS.
INTERNATIONAL ELECTRIC METER CO.
167 S. CANAL STREET, CHICAGO.

**CONTINUOUS RAIL JOINT CO. OF AM.**
NEWARK, N. J.
**OVER 20,000 MILES IN USE**
The St. Louis Exposition, 1904, awarded us the only gold medal for rail joint products.

**OTTO BUNGE**
MANUFACTURER OF
LEATHER NAIL HEADS, BELTS, SAFETY AND CLIMBER STRAPS
1130 ST. PETER STREET,
INDIANAPOLIS, - - INDIANA.

Crimshaw

Raven White Core

Raven Black Core

**ALL OUR WIRES** pass inspection and carry the above **TRADE-MARKS** on our tags. We also manufacture **Crimshaw** and **Competition Tapes** and **Splicing Compounds.**

# NEW YORK INSULATED WIRE COMPANY,

MAIN OFFICE: 114, 116 & 118 Liberty St., New York.
BRANCHES: CHICAGO: 192 Desplaines St. BOSTON: 7 Otis St. SAN FRANCISCO: 32 Second St.

**Robert Volt-Ammeter**
Dead Beat
Accurate, Durable
Guaranteed
List Price, $6.00 including leather case.
Sample instrument forwarded prepaid on receipt of $5.00.
Discount to Dealers
THE ROBERT INSTRUMENT CO.
56 Shelby Street
DETROIT - MICH.

**Water-Wheel Governors**

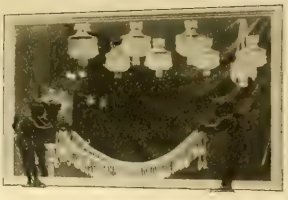
Our new mechanical governors co-operate with the inertia effect of the water and the momentum of the plant.
They have cut the cost of good government in two. Guaranteed in every particular.

**REPLOGLE GOVERNOR WORKS**
AKRON, OHIO.
WRITE FOR DESCRIPTIVE MATTER W.

**DOES THE WORK**

Write Now for Free Sample of above Stick
Convenient—Non-Corrosive—Effective
We also make the famous Crolius Commutator Compound; eliminates sparking and all commutator troubles. Free sample on request.
E. R. CROLIUS & SON
6419 Peoria Street - CHICAGO, ILL.

**Architects and Dealers in Electric Lighting Fixtures**



will find the best decorative appliances (bronze or crystal) at cut prices—all from the best artists and the best manufacturers, awarded grand prizes at St. Louis Exposition—now for bargain at low prices, on immediate application to

PAUL LETHEULE, 4808 Delmar Bd., St. Louis

**NATIONAL CODE STANDARD**

WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Ideal Wire.
Prices and Samples on Application.

**Phillips Insulated Wire Co.**
Office and Factory: PAWTUCKET, R. I.

The traveling man who calls upon his possible customers at rare intervals is almost or entirely forgotten between times.

It is necessary for him to introduce himself at each visit.

Little drops of water will wear away a stone.

But the speed with which the stone is worn away is in proportion to the frequency with which the little drops fall.

The frequent ad produces a clear-cut and indelible impression upon the mind.

The infrequent ad produces a blurred impression.

The clear-cut impression remains.

The blurred impression disappears.

An ad in the Western Electrician goes 52 times a year to the possible purchaser of your product.

The busy, possible purchaser may have a poor memory. Your ad greets him frequently, lest he forget.

**WANTED, FOR SALE** *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 3c each.* **POSITION WANTED** *advertisements (50 words or less), $1.00 an insertion; additional words 2c each.*

## POSITION WANTED.

By a good electrical construction man, who knows how to hustle and handle men. Experienced in long distance transmission work, station and lines, rebuilding lighting service lines and installing transformers. Satisfaction to employers or no pay demanded. Address BOX 436, care of Western Electrician, 510 Marquette Bldg., Chicago.

## POSITION WANTED.

As assistant to superintendent or manager of electric railway, construction, or light and power company; age 28; eight years' experience with leading firms; graduate of mechanical and electrical engineering course; A-1 references. For particulars address BOX 434, care Western Electrician, 510 Marquette Bldg., Chicago.

## POSITION WANTED.

As superintendent or electrician of electric plant. Sixteen years' practical experience at line work, wiring, motors, meters, etc. Can estimate contract work. Never drink. Twelve years in present place. Good reason for change. Address BOX 438, care Western Electrician, 510 Marquette Building, Chicago.

## WANTED.

An experienced designer of large transformers. In reply state experience and salary required. Give references. Address BOX 435, care Western Electrician, 510 Marquette Bldg., Chicago, Ill.

## WANTED.

Two experienced electric-light, power and gas solicitors, by a gas and electric company, in a city of 175,000 population. Address BOX 437, care Western Electrician, 510 Marquette Building, Chicago.

## WANTED.

By a large electrical wire manufacturer, a traveling salesman familiar with the copper wire and cable business, for Chicago and Western territory. Address BOX 439, care Western Electrician, 510 Marquette Building, Chicago.

## WANTED.

A 200 to 300 kilowatt rotary converter, 60 cycles, three phase to 550 volts direct, complete with transformers for 2,300 volts primary. Address BOX 440, care Western Electrician, 510 Marquette Building, Chicago.

## WANTED.

Salesmen to represent leading eastern jobbing house, thoroughly conversant with standard lighting supplies and prices, commanding trade in well-defined territory. Commission 10% on all gross business. Address BOX 441, care Western Electrician, 510 Marquette Building, Chicago.

## FOR SALE.

All of the property of the General Gas, Electric and Power Company of Connersville, Ind., consisting of real estate, buildings and equipments of coal gas, electric plant, central station, hot water heating plant, franchises, etc, will be offered for public sale by Receiver on March 9th, 1905, at Connersville, Indiana.

Population of city about 9,000; good proposition. Favorable city lighting contract. Address office of above Company for information.

**FOR SALE CHEAP TO QUICK BUYERS.**
**MUST BE MOVED AT ONCE.**

1 225 H. P., 18x36-in. BUCKEYE GIRDER FRAME SLOW-SPEED AUTOMATIC ENGINE.
1 650 H. P., 22x42x48 ALLIS CROSS COMPOUND CORLISS ENGINE.
1 128 H. P., 14x20-in. ATLAS LEFT-HAND HEAVY DUTY AUTOMATIC ENGINE.
1 125 H. P., 14x14-in. IDEAL CENTER CRANK AUTOMATIC ENGINE.
2 150 H. P., 72 in. x 18 ft. TUBULAR BOILERS COMPLETE WITH FULL FRONTS.

We are very anxious to move the above material at once and to sell same at very low prices. We also have a number of other slightly used engines, boilers, heaters and pumps of various makes and sizes in stock. Let us know what your requirements are and get our quotations before placing your order elsewhere, as we can save you considerable money.

**E. F. PFANNMUELLER & CO.**
733 The Rookery Chicago, Ill.

## FOR SALE

**Fine Modern Steam Plant**
**600 H. P.**

**GEARY WATER TUBE BOILERS**

**Stack, Duplex Boiler Feed Steam Pumps, Gauges, etc.**

This plant has been in use about four years at our mills at Winton Place, Ohio. Owing to the continued growth of our business we require more than double the capacity, hence the change. This plant is especially adapted for hotel or large office buildings where economy of space is required. Could give possession in 100 days. For further particulars, price, etc., write

**THE M. B. FARRIN LUMBER CO.**
Telephone Park 83. CINCINNATI, O.

## FOR SALE

| | | | | |
|---|---|---|---|---|
| 1-360 | K. W. | General Electric | Alternator, Three Phase | |
| 1-240 | " | Westinghouse | " Single | " |
| 2-150 | " | Warren | " " | " |
| 1-150 | " | Westinghouse | " " | " |
| 1-150 | " | Wood | " " | " |
| 1-150 | " | Stanley | " " | " |
| 1-120 | " | General Electric | " Three | " |
| 1-120 | " | General Electric | " Single | " |
| 1 120 | " | Westinghouse | " " | " |
| 1- 90 | " | General Electric | " " | " |
| 1- 75 | " | Westinghouse | " Two | " |
| 1- 75 | " | Westinghouse | " Single | " |
| 1- 75 | " | Westinghouse | " Two | " |

Direct connected to Gates' Engine.

Send for our **Monthly Bargain Sheet** with complete list and net prices.

**GREGORY ELECTRIC CO.**
54-62 S. Clinton St., Chicago, Ill.

## $1,000,000 Plant of Omaha & Co. Bluffs St. Ry. Co.

We have just purchased the machinery of three power houses of the Omaha & Council Bluffs Street Railway Company, and if you are in the market for any kind of New or Second-hand Power or Electrical Machinery we will be pleased to send you complete list and submit prices that cannot be duplicated elsewhere. **ALLEN P. ELY & CO., 1110 Douglas St., OMAHA, NEB.**

WORKS QUICK AND EASY. KEEPS ITS LUSTER. HOLDS OLD TRADE AND MAKES NEW. DOES NOT DETERIORATE. ESTABLISHED 16 YEARS. SOLD BY AGENTS AND DEALERS ALL OVER THE WORLD

**U.S. METAL POLISH** 3 OUNCE BOX 10 CENTS. SAMPLES SENT FREE. GEO. W. HOFFMAN

POLISHES ALL METALS. BRANCHES: NEW YORK, CHICAGO, SAN FRANCISCO. 295 E. WASHINGTON ST., INDIANAPOLIS, IND.
HIGHEST AWARD, CHICAGO WORLD'S FAIR, 1893. LOUISIANA PURCHASE EXPOSITION 1904.

## Special Bargains for Spring—Immediate Delivery.

**500-VOLT MOTORS.**

| | | |
|---|---|---|
| 1—20 H. P., C.&C. | 1—15 H.P., C&C. | 4—15 H. P. |
| 6—10 H. P. | 8—7½ H. P. | 17—5 H. P. |
| 9—3 H. P. | 10—2 H. P. | 7—1 H. P. |

**220-VOLT MOTORS.**

| | | |
|---|---|---|
| 1—20 H. P. | 3—15 H. P. | |
| 5—10 H. P. | 6—7½ H. P. | |
| 6—5 H. P. | 4—3 H. P. | |
| 11—2 H. P. | 4—1 H. P. | |

**Above Motors are Complete and of Standard Make.**
**Special Bargains in Engines up to 600 H. P. Also A. C. & D. C. Dynamos, Boilers, Pumps, Etc.**
**Write requirements. Send for Catalogue.**
**CENTRAL STATION IMPROVEMENT COMPANY, 938 Monadnock Block, CHICAGO.**

**NOXALL DYNAMO OILS.** GIVES THE BEST SERVICE. HIGH QUALITY, LOW PRICE.
**RICHARDSON LUBRICATING CO., - Quincy, Ill.**

## WHAT DID THE WOGGLE BUG SAY?

J. J. EGAN'S "ACME" COMMUTATOR COMPOUND.

**YOU CAN'T DO LESS** than give a good thing a trial. FREE SAMPLE J. J. Egan's Acme Commutator Compound, the only article that will absolutely prevent sparking, cutting or unnecessary wear of the commutator. Commutator always bright.

Agents Wanted.
**50 CENTS PER STICK ALL SUPPLY HOUSES OR $5.00 PER DOZEN**
**J. J. ECAN, 317 Austin Ave., CHICAGO**

OFFICE OF Town Clerk — A. R. KAUFMAN, CLERK
BOARD OF TRUSTEES: GEO. A. PAINTER, D. V. PARKINSON, W. F. J. REESE, P. VAN HUYS, ATTY.

Summitville Ind. Nov 23 1903

Western Electrician
Chicago Ill.

Gentlemen. You may discontinue our Want Advertisement with the one issue. As I have already received about 40 answers to same. Send me your bill and I will remit same to you. Thanking you very kindly for your promptness
I am Yours Resp.
A. R. Kaufman
Clerk.

## SAUQUOIT SILK MFG. COMPANY

**INSULATING and BRAIDING SILKS**

**MILLS:**
BETHLEHEM, PA.
PHILADELPHIA, PA.
SCRANTON, PA.

NEW YORK REPRESENTATIVES:
WILLIAM RYLE & COMPANY
54 Howard St.

PHILADELPHIA OFFICE:
4015 Clarissa St.

CHICAGO OFFICE:
210 Monroe St.

BOSTON OFFICE:
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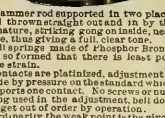

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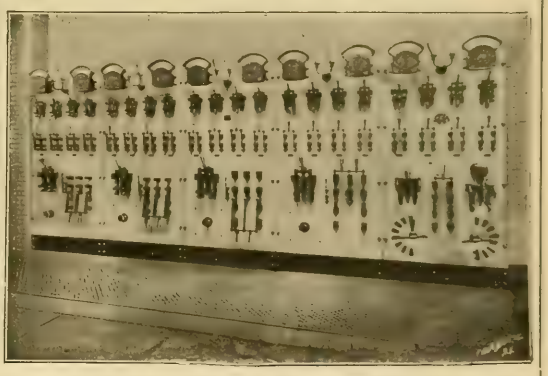

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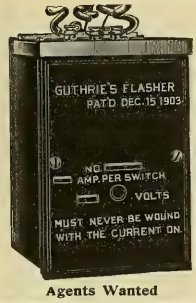


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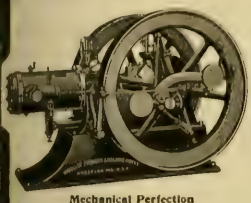

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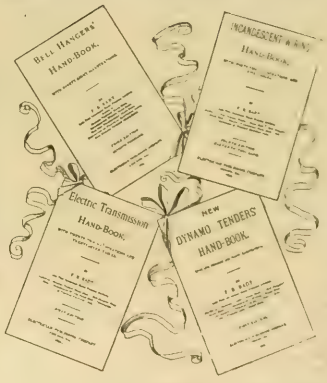


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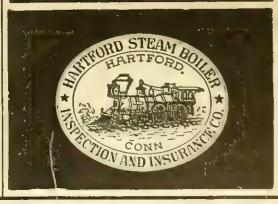


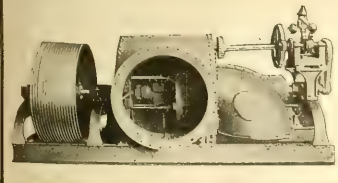

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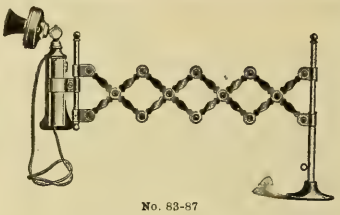

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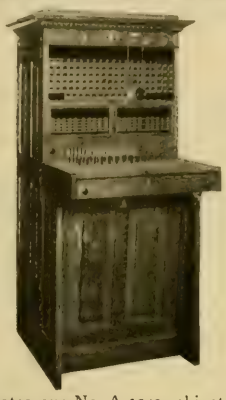

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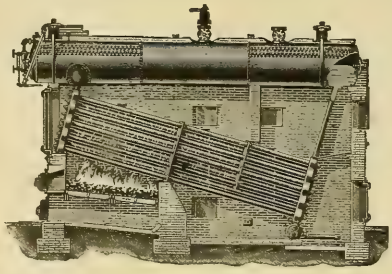

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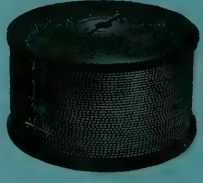

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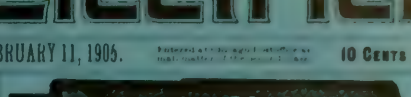

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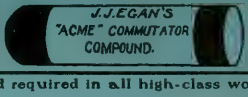

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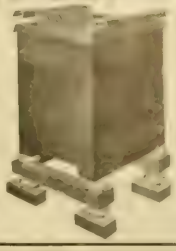

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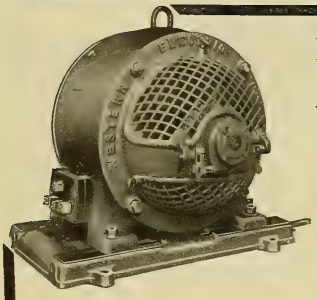

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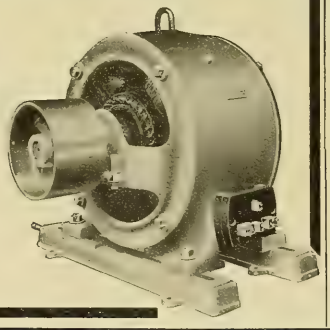

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Loud's Sons Co., H. M.
Maltby Cedar Co.
Mueller Company, William.
Pacific Coast Pole Co.
Perrizo & Sons.
Phelan, D. W.
Pittsburg & L. S. Iron Co.
Porter Cedar Company.
Sterling & Son, W. C.
Torrey Cedar Co.
Valentine-Clark Co., The.
Worcester Co., C. H.

**Polish (Metal).**
Allen Co., Inc., L. B.
Hoffman, Geo. W.

**Portables.**
Faries Mfg. Co.

**Power Transmission Machinery.**
Jeffrey Mfg. Co.

**Rail Joints.**
Continuous Rail Joint Company of America.

**Railway Supplies.**
Wesco Supply Co.

**Re-Winding—Repairs.**
Chicago Edison Co.
Gregory Electric Co.

**Rheostats.**
Amer. Electric Fuse Co.
Cutler-Hammer Mfg. Co.
General Electric Co.
Gen'l Inc. Arc Lt. Co.
Union Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Rods, Conduit.**
Cope, T. J.

**Schools and Colleges.**
Electrical Engineer Inst.
Highland Park College

**Second-Hand Mach'y.**
Bissell Co., The F.
Cent. Stat. Improvement Co.
Gregory Electric Co.
Matthews & Bro., W. N.
Walsh's Sons & Co.

**Shades, Lamp.**
Faries Mfg. Co.

**Sheet Brass & Copper.**
Plume & Atwood Mfg. Co.

**Signs, Electric.**
Haller Machine Co.
Western Display Co.
Zero Marx Sign Works.

**Silks, Insulating and Braiding.**
Sauquoit Silk Mfg. Co.

**Sockets & Receptacles.**
Pass & Seymour.
Yost Elec. Mfg. Co.

**Soldering Sticks, Salts and Paste.**
Butler Chemical Works.
Chicago Solder Co.
Crollus & Son, E. R.
Western Electric Co.

**Speaking Tubes.**
Central Electric Co.
Edwards & Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.

**Specialties, Electrical Mfrs. and Designers.**
Haller Machine Co.

**Speed Indicators.**
Weston Electrical Inst. Co.

**Storage Batteries.**
American Battery Co.
Electric Storage Battery Co.
Gould Storage Battery Co.

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Central Electric Co.
Century Electric Co.
Chicago Edison Co.
Electric Appliance Co.
General Electric Co.
Manhattan Elect'l Supply C
Wesco Supply Co.
Western Electric Co.

**Switchboards.**
Bissell Co., The F.
Gen. Incan. Arc Light Co.

**Telephones, Telephon Material and Switchboards.**
American El. Telephone C
Automatic Electric Co.
Bissell Co., The F.
Central Electric Co.
Central Tel. & El. Co.
Electric Appliance Co.
International Tel. Mfg. Co.
Kellogg Switchb. & Sup. C
Manhattan Elec. Supply C
Stromberg-Carlson Tel. M.C
Wesco Supply Co.
Western Electric Co.

**Time Switches.**
Bissell Co., The F.

**Tools.**
Klein & Sons, Mathias.
Standard Tool Co
Western Electric Co.

**Transformers.**
Central Electric Co.
Crawfordsville Electric Co.
Crocker-Wheeler Co.
Electric Appliance Co.
Ft. Wayne Elec. Works, Ir
General Electric Co.
Gregory Electric Co.
Kuhlman Electric Co.
Manhattan Elec. Supply C
National Electric Co.
Stanley Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. C

**Trucks, Electric Car.**
General Electric Co.
Westinghouse El. & Mfg. C

**Turbines, Steam.**
Allis-Chalmers Co.
General Electric Co.
Westinghouse El. & Mfg. C

**Turbine Water Wheel**
Leffel & Co., Jas.

**Vulcanized Fibre.**
Vulcanized Fibre Co.

**Wires & Cables—Magnet Wires.**
American Electrical Works
Bissell Co., The F.
Central Electric Co.
Chicago Insulated Wire Co.
Crescent Ins. Wire & Cble. C
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
Indiana Rub. & Ins. Wire C
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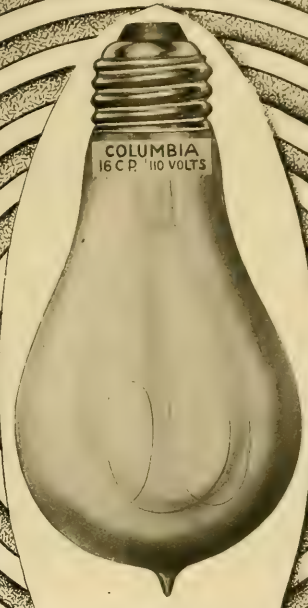
Insulating Co.
Kellogg Switch. & Sup. Co.
Manhattan Elec. Supply C
Marion Ins. Wire & Rub. C
National India Rubber Co.
New York Insulated Wire C
Northern Wire & Cable C
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co
Roebling's Sons Co., J. A.
Runzel-Lenz Elec. Mfg. C
Safety Ins. Wire & Cable C
Simplex Electrical Co.
Standard Underground C. C
Wesco Supply Co.
Western Electric Company


For Alphabetical Index of Advertisements See Page 3.

# COLUMBIA LAMPS GIVE MOST LIGHT.

LOOK FOR THE LICENSE LABEL IN THE STEM

LOOK FOR THE LICENSE LABEL IN THE STEM




Licensed Under
Patent No. 537,693, April 16, '95
Patent No. 723,293, April 28, '03
Patent No. 444,530, Jan. 13, '91
Patent No. 582,760, Jan. 22, '95

FEW AS GOOD

NONE BETTER

WRITE FOR OUR CATALOGUE OF COLUMBIA CRYSTAL LAMPS, (MERIDIAN TYPE).

## THE COLUMBIA INCANDESCENT LAMP CO.

ST. LOUIS MO., U.S.A.

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CHICAGO: Central Electric Co.
SAN FRANCISCO: Paul Seller Elec. Works
PHILADELPHIA: 1227 Real Estate Trust Bldg.
MINNEAPOLIS: 638 Boston Block.
MEMPHIS: 302 Scimitar Bldg.
MEXICO: Monterey, Van Veorhis Hnos.

C. WATSON.

# Read What the Butterick Publishing Co. Think About the Cooper Hewitt Mercury Vapor Lamp.

New York, January 17, 1905.

COOPER HEWITT ELECTRIC COMPANY,
220 West 29th Street, New York.

Gentlemen

Referring to your request of recent date, asking our opinion as to the value of the light for printing in black, we beg to say that after making an exhaustive test of the arc, incandescent and Cooper Hewitt mercury vapor lamps, in our Webb press rooms for this purpose, we decided to use your lamps there for the following reasons:

**On account of the excellent quality of the light.**

**We can detect defects in black printing under your lamps, which are not noticeable under either the arc or the incandescent.**

**The large saving of current used, being a substantial economy.**

**Our employes in the Webb press rooms prefer it because of its softness and steadiness, as it does not affect their eyes detrimentally.**

We expect shortly to take up the question of lighting some of our other departments with your lamps.

Yours respectfully,

THE BUTTERICK PUBLISHING CO., Ltd., Per M. R. O'Loughlin.

## The Light To Work By

For use in Factories, Machine Shops, Warehouses, Covered Piers, Drafting Rooms, Offices, Press and Composing Rooms and for Photographic and Engraving Work and Blue Printing.

*Send for Booklet*

## Cooper Hewitt Electric Co.

**220 West 29th Street, New York**
**Philadelphia Office, 1121 Walnut Street**



N. E. CODE STANDARD SACHS TRADE NOARK REG. U.S. PAT. OFF. FUSE SPOT SHOWS WHEN BLOWN

OUR LABEL

# NATIONAL ELECTRIC CODE STANDARD FUSE DEVICES ARE READY

**250-VOLT**

**TYPE B (Ferrule Contact).**
1-30 Amps., 1, 2, 3 Pole, Main Line.
31-60 Amps., 1, 2, 3 Pole, Main Line.

**TYPE E (Knife Blade Contact).**
61 100 Amps., 1, 2, 3 Pole, Main Line.

**TYPE E (Knife Blade Contact).**
101-200 Amps., 1 Pole, Main Line.
201-400 Amps., 1 Pole, Main Line.
401-600 Amps., 1 Pole, Main Line.

**600-VOLT**

**TYPE B (Ferrule Contact).**
1-30 Amps , 1 Pole, Main Line.
31-60 Amps., 1 Pole, Main Line.

**TYPE E (Knife Blade Contact).**
61-100 Amps., 1 Pole Main Line.

**TYPE E (Knife Blade Contact).**
101-200 Amps., 1 Pole, Main Line.
201-400 Amps., 1 Pole, Main Line.
401-600 Amps., 1 Pole, Main Line.

MILWAUKEE CHICAGO ST. LOUIS CLEVELAND PITTSBURG

## H. W. JOHNS-MANVILLE CO.

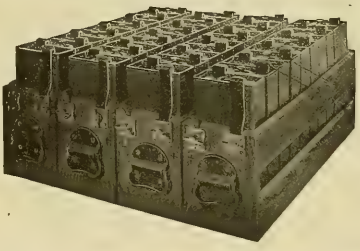
Mfrs. Asbestos and Magnesia Pipe and Boiler Coverings, Roofing and Packings

100 WILLIAM ST., NEW YORK.

BOSTON PHILADELPHIA LONDON PARIS BRUSSELS



# SATISFACTION ASSURED



***Every battery has its own guarantee.***

***Lighting Batteries,***

***Automobile Sparkers.***

Prompt delivery made on rush orders.

We work night and day.

**Northwestern Storage Battery Co.,**
**285 Madison St., - - - Chicago, Ill.**



# "Diamond H" Switches

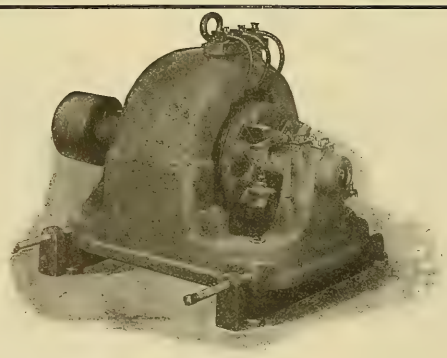
Trade H Mark

This Trade-Mark guarantees quality.

The Hart Mfg. Co., Hartford, Conn.

New York Boston Chicago Toronto, Ont.





*CENTRAL STATION MANAGERS*

# Don't Be Afraid

of the Gas Plant

**WORK UP A MOTOR LOAD**

We can furnish you

## SINGLE PHASE MOTORS

that will start under full load in sizes ranging from 1/8 to 35 H. P.

***Wagner Electric Mfg. Co.***

*ST. LOUIS, MO., U. S. A.*

# GRAND PRIZE

**The Highest Possible Award**

**Has Been Given to**

ELECTRA

·TRADE MARK·

## HIGHEST GRADE NUERNBERG CARBONS

**By the International Jury of Awards, of the Louisiana Purchase Exposition, St. Louis, 1904.**

**HUGO REISINGER, Sole Importer, 11 BROADWAY, NEW YORK**

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**127 FULTON STREET** **CHICAGO**

# SIGNS

For Signs, Letters, Flashers, Dimmers, Timeswitches, Lamps, Rubberrings and anything pertaining to Signs,

—WRITE DIRECT TO—

**HALLER MACHINE COMPANY**

Designers and Manufacturers, of Sheetmetal, Electric and Machinery Specialties.

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## Architects and Dealers in Electric Lighting Fixtures

will find the best decorative appliances (bronze or crystal) at cut prices—all from the best artists and the best manufacturers, awarded grand prizes at St. Louis Exposition—now for bargain at low prices, on immediate application to

PAUL LETHEULE, 4808 Delmar Bd., St. Louis

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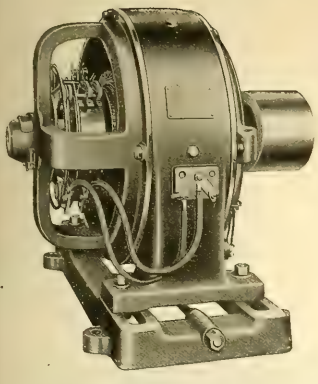
# General Electric Company



## New Slow Speed Motor

Made in Sizes from 20 H. P. to 150 H. P.

General Electric Motors have always been distinguished by the highest merit. This one sets the standard still higher.

WRITE FOR FURTHER INFORMATION

## PRINCIPAL OFFICE: SCHENECTADY, N. Y.

Chicago Office, Monadnock Block. Sales Offices In All Large Cities.

# THE NEW YEAR

Finds in the Packard Lamp
Steadily maintained candlepower
600 to 800 hours guaranteed life
Economy of Operation.

**Packard Lamps Are a Good Investment. Begin the New Year by Installing Them on Your Circuit.**

**ELECTRIC APPLIANCE COMPANY,**
CHICAGO AND SAN FRANCISCO

# LAMPS

Get acquainted with the
**PEERLESS**—MONEY SAVERS
MADE RIGHT
PRICED RIGHT
ARE RIGHT
THE WESCO SUPPLY CO., ST. LOUIS, MO.
"EVERYTHING ELECTRICAL"

# MICA
Of all Qualities, in any Form at Lowest Prices
EUGENE MUNSELL AND CO.
NEW YORK and CHICAGO

# INSULATION That Is.
Micanite, Linotape, M. I. C. Compound, Empire Cloth and Paper. For Years the Standard.
**MICA INSULATOR CO., Originators**
NEW YORK and CHICAGO

# SPARKING
*Reduces the working capacity of a motor or dynamo, wears out the commutator, wastes power and may cause a fire. All this may be avoided if you use . . . . . .*

The only article that will PREVENT SPARKING. Will keep the Commutator in good condition and PREVENT CUTTING.
**Absolutely Will Not Gum The Brushes.**
50 Cents per Stick. $5.00 per Dozen.
*SEND FOR FREE SAMPLE STICK.*
For sale by all supply houses, or
It will put that high gloss on the Commutator you have so long sought after.
K. McLENNAN & CO. Sole Mfrs., Room 411 Inter Ocean Bldg., 130 Dearborn St., CHICAGO

# MICABOND
CHICAGO MICA CO.,
"PERFECTORS" VALPARAISO, IND.
THE PEER OF INSULATORS.

**VOLT - AMMETERS,**
POCKET SIZE,
For Testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.
RELIABLE. ACCURATE.
Send for Circular.
L. M. PIGNOLET,
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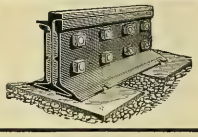
**CONTINUOUS RAIL JOINT CO. OF AM.**
NEWARK, N. J.
**OVER 20,000 MILES IN USE**
Highest Award at Paris Exposition, 1900, Buffalo, 1901, and St. Louis, 1904.



**WE BUY OLD BELTS**
OR SCRAPS, ANY SIZE OR CONDITION.
WE CLEAN, REPAIR AND RENEW OLD BELTS.
*LEATHER PRESERVER MFG. CORP.*
27 W. MONROE ST., CHICAGO

# TRAY PLATE BATTERY COMPANY
MANUFACTURERS OF THE CELEBRATED
## PATENT TRAY PLATE STORAGE BATTERY
FOR CENTRAL LIGHTING, POWER AND ISOLATED PLANTS.
ALSO AN IMPROVED CELL TYPE BATTERY IN ALL GENERAL STYLES FOR ELECTRIC VEHICLES, SPARKING BATTERIES, ETC.
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***Sockets, Wall Sockets, Weatherproof Sockets, Rosettes, Receptacles, Cord Adjusters.***
*Catalogue for the asking.*
THE YOST ELECTRIC MFG. CO.
TOLEDO, OHIO.

# EDISON
## CANDELABRA AND DECORATIVE LAMPS
For ornamental fixtures and sign and decorative lighting. Can be used in regular Edison sockets with our candelabra socket adapter
All kinds of Miniature Lamps, Telephone Lamps, Battery Lamps
EDISON DECORATIVE & MINIATURE LAMP DEPARTMENT.
General Electric Company, Harrison, N. J.
(6)

# "STAR" INCANDESCENT LAMPS

LONG LIFE
GUARANTEED CANDLEPOWER,
HIGHEST EFFICIENCY.
MADE BY THE MOST SKILLED WORKMEN.
STANDARD ELECTRICAL MFG. COMPANY, Niles, Ohio.

# "FRES-KO" SOLDERING STICK
ABSOLUTELY NON-CORROSIVE
In addition to this we sell the Fres-Ko Soldering Paste. This paste flux under the heat of the iron, has the property of creeping into every crevice.
FRES-KO CHEMICAL CO. - Fort Wayne, Ind.

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**AMERICAN ELECTRICAL WORKS,**

PROVIDENCE, R. I.

BARE AND INSULATED ELECTRIC WIRE,
ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,
**Railway Feeder and Trolley Wire,**
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CABLES FOR AERIAL AND UNDERGROUND USE.

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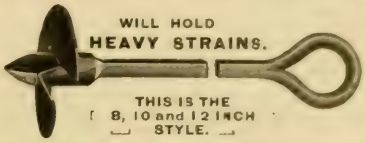
**EXPERT IN** ELECTRICITY MECHANICS PATENT CAUSES
SOLICITOR OF U. S. & FOREIGN **PATENTS**
FORÉE BAIN, 1652-3 Monadnock Blk., CHICAGO

**"AMERICAN" STORAGE CELLS**
ARE THE BEST. Send for descriptive Circular.
**AMERICAN BATTERY CO.,**
ESTD 1888. 171 S. Clinton St., Chicago.

THE 8, 10 AND 12 INCH
**STOMBAUGH GUY ANCHOR**
WILL HOLD 20,000 LBS., 25,000 LBS., 30,000 LBS. RESPECTIVELY
THEY ARE USED TO ANCHOR CORNERS, DEAD ENDS AND OTHER HEAVY STRAINS
If you desire our latest price list, write us. We quote you
If for any reason, factory, return at our expense. We guarantee

REMEMBER
**STOMBAUGH GUY ANCHORS**

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603 Carleton Building ST. LOUIS

**NATIONAL CODE STANDARD**

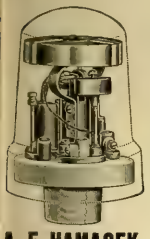
WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Ideal Wire.
Prices and Samples on Application.

**Phillips Insulated Wire Co.**
Office and Factory: PAWTUCKET, R. I.

**"DON'T BE HELD UP"**
**"EVERY KNOCK A BOOST"**
KESTER SELF-FLUXING SOLDER
MADE WORKS ALL **RIGHT**
L. F. MAHLER CO., R. 1008 Chemical Bldg., St. Louis, Mo.
General Western Agent.

**CHICAGO SOLDER COMPANY,**
Formerly Kester Electric Mfg. Co.
46 N. UNION STREET, CHICAGO, ILLINOIS.



**100**
Arc lights kept burning by closing one open circuit on one broken lamp loop.
THIS AUTOMATIC Series Arc CUT-OUT
Will do so. Call for sample.
**A. F. HAMACEK, Chicago, Ill.**
2039 Kenmore Ave.

SAUQUOIT SILK MFG. COMPANY
INSULATING and BRAIDING SILKS
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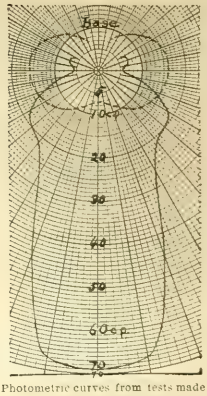
**HOLOPHANE**
GLOBES AND REFLECTORS

No. 2631




Dotted line bare 16 c. p. lamp. Full line same lamp with No. 2031 Pagoda Reflector.

Photometric curves from tests made by General Electric Co.

**HOLOPHANE GLASS CO.**
GLACKNER BUILDING NEW YORK

There is no race suicide among ideas.

Ideas are prolific.

Each idea gives birth to a brood.

They multiply and replenish the earth.

The electrical business is based on ideas.

The gray matter in electrical craniums is active gray matter.

But two craniums are better than one—and a thousand are better than two.

The wide-awake man who carefully peruses the Western Electrician acquires the ideas of others. He is informed of the progress that is being made in every branch of electricity.

As a reading man he is intelligent. He is a man of ideas.

Some ideas are born too soon. They are undeveloped, sickly, puny.

In the incubator cranium of a thinking man they become strong and healthy.

They live and are useful.

Each number of the Western Electrician contains an installment of the latest and best electrical ideas.

It tells the story of the thinkers.

**WANTED, FOR SALE** *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 3c each.* **POSITION WANTED** *advertisements (50 words or less), $1.00 an insertion; additional words 2c each.*

## POSITION WANTED.

As superintendent or electrician of electric plant. Sixteen years' practical experience at line work, wiring, motors, meters, etc. Can estimate contract work. Never drink. Twelve years in present place. Good reason for change. Address BOX 438, care Western Electrician, 510 Marquette Building, Chicago.

## POSITION WANTED.

By an experienced meter, arc lamp and repair man, 22 years of age, 5 years' practical experience around electric-lighting plant, can furnish good reference. Address BOX 443 care of Western Electrician, 510 Marquette Building, Chicago.

## POSITION WANTED.

Electrical and mechanical engineer, associate member A. I. E. E. and A. S. M. E., now holding position of general manager and engineer of several consolidated companies, desires to connect himself with new or operating companies: 14 years' experience in the construction and operation of lighting and street-railroad properties in this country and South America; competent to design, construct and manage same; Mexico preferred. Address BOX 442, care of Western Electrician, 510 Marquette Building, Chicago.

## WANTED.

Two experienced electric-light, power and gas solicitors, by a gas and electric company, in a city of 175,000 population. Address BOX 437, care Western Electrician, 510 Marquette Building, Chicago.

## WANTED.

Second-hand, modern type, 100 K. W. 3-phase 60 cycle, 2,200-volt generator. Address ROCKPORT WATER WORKS CO., Rockport, Ind.

## WANTED.

A 200 to 300 kilowatt rotary converter, 60 cycles, three phase to 550 volts direct, complete with transformers for 2,300 volts primary. Address BOX 440, care Western Electrician, 510 Marquette Building, Chicago.

## FOR SALE.

One 25 H.P. Nash gas engine, direct-connected to 15-K.W. Crocker-Wheeler dynamo; can be used for 115 or 230 volts. This would be a first-class outfit for automobile charging station. GRAHAM BROS. CO., 662 Hudson St., New York City.

## FOR SALE.

Fuller engine Western Electric, 15 K.W., direct-connected unit, used 9 months, good as new must have larger machine. HOTEL WARNER, Chicago.

**DO YOU KNOW**
On what easy terms you can buy
**ROBERTSON-THOMPSON INDICATOR?**
We want to tell you.
**Jas. L. Robertson & Sons**
198 Fulton St. - New York

**Have YOU read the**

## NEW DYNAMO TENDERS HAND-BOOK

**By F. B. BADT?**

## IF NOT, WHY NOT?

Dynamo tenders cannot get along with out it.

Sent prepaid on receipt of price, $1.00

**ELECTRICIAN PUBLISHING CO.,**
510 Marquette Building, · CHICAGO

## FOR SALE

| | | | | |
|---|---|---|---|---|
| 1-360 | K. W. | General Electric | Alternator, Three Phase | |
| 1-240 | " | Westinghouse | " Single | " |
| 2-150 | " | Warren | " " | " |
| 1-150 | " | Westinghouse | " " | " |
| 1-150 | " | Wood | " " | " |
| 1-150 | " | Stanley | " " | " |
| 1-120 | " | General Electric | " Three | " |
| 1-120 | " | General Electric | " Single | " |
| 1-120 | " | Westinghouse | " " | " |
| 1- 90 | " | General Electric | " " | " |
| 1- 75 | " | Westinghouse | " Two | " |
| 1- 75 | " | Westinghouse | " Single | " |
| 1- 75 | " | Westinghouse | " Two | " |

Direct connected to Gates' Engine.

Send for our **Monthly Bargain Sheet** with complete list and net prices.

**GREGORY ELECTRIC CO.**
54-62 S. Clinton St., Chicago, Ill.

## FOR SALE

**Fine Modern Steam Plant**
**600 H. P.**

**GEARY WATER TUBE BOILERS**

Stack, Duplex Boiler Feed Steam Pumps, Gauges, etc.

This plant has been in use about four years at our mills at Winton Place, Ohio. Owing to the continued growth of our business we require more than double the capacity, hence the change. This plant is especially adapted for hotel or large office buildings where economy of space is required. Could give possession in 100 days. For further particulars, price, etc., write

**THE M. B. FARRIN LUMBER CO.**
Telephone Park 83. CINCINNATI, O.

**NOXALL CRANK CASE OIL.** IT NEVER FAILS TO PLEASE.
**RICHARDSON LUBRICATING CO., - Quincy, Ill.**

## Special Bargains for Spring—Immediate Delivery.

**500-VOLT MOTORS.**

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| 1—20 H. P., C.&C. | 1—18 H.P., C&C. | 4—15 H. P. |
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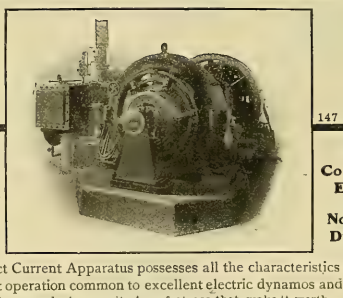

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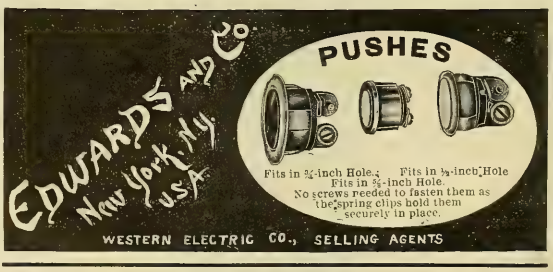


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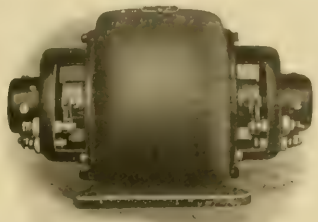

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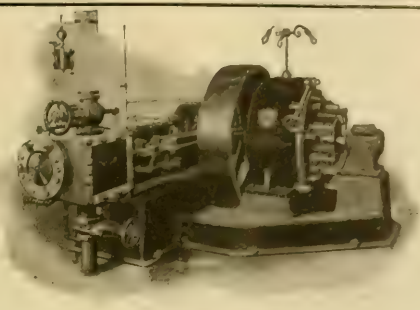

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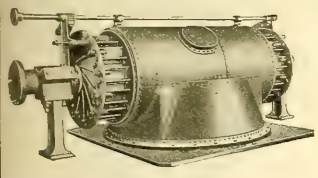

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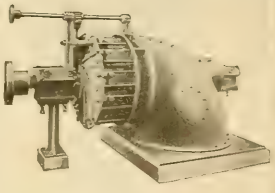

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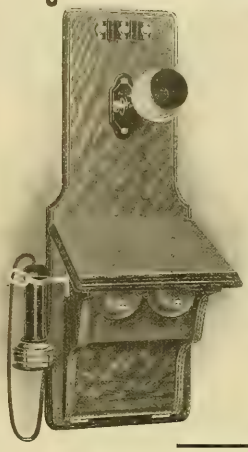

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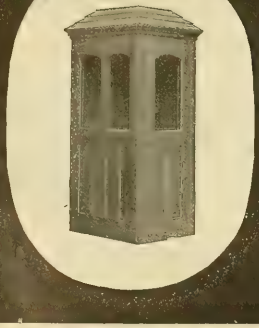

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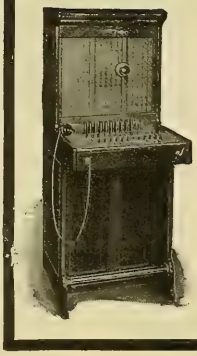

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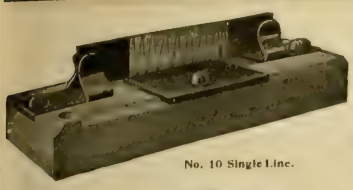

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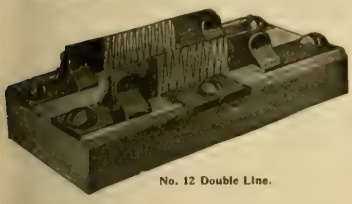

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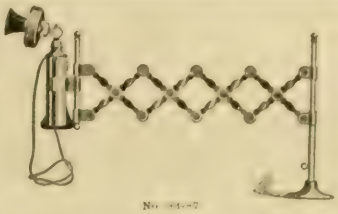

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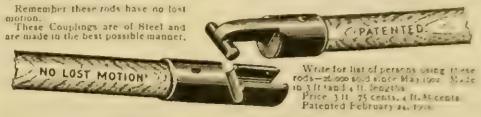


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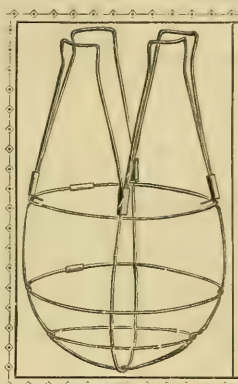

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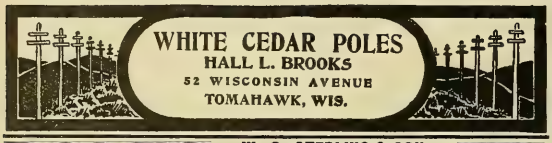
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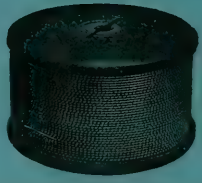

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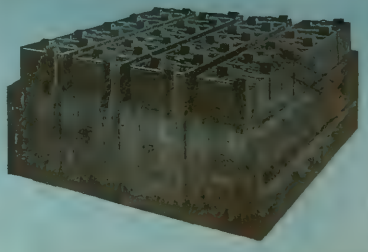

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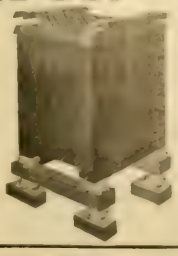

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COLONIAL SIGN AND INSULATOR CO., - - - AKRON, O.

# PLATINUM

## BAKER & CO., INC.

WORKS: Newark, New Jersey
NEW YORK OFFICE: 120 Liberty Street

GRAND PRIZE
UNIVERSAL EXPOSITION
ST. LOUIS, 1904


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If you want Wires or Cables insulated with the HIGHEST CLASS INDIA RUBBER INSULATION you should buy . . . . . .

HABIRSHAW

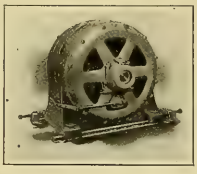
Complete stock of all sizes constantly on hand and for sale at lowest market prices by

CHICAGO EDISON COMPANY,

WRITE FOR PRICES. 139 ADAMS STREET, CHICAGO.

S. K. C. Single and Polyphase Induction Motors

are the culmination of years of patient study and experiment. They represent the highest type of motor construction.



Adaptable for floor, wall or ceiling use. Simple, compact and rigid construction. Bearings are self-oiling, and self-aligning.

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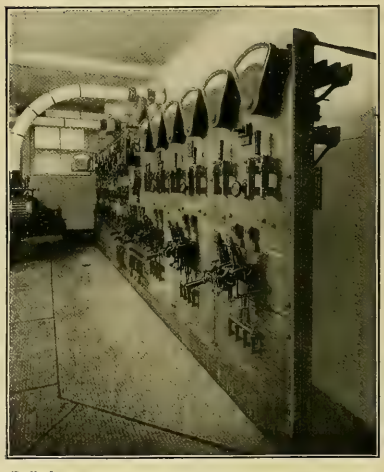
Pittsfield, - - - Massachusetts.

Large Power Switchboard



Built by

THE F. BISSELL COMPANY, TOLEDO, O.

Engineers, and Manufacturers of Switchboards

Send for Booklet 117 W.

You Have Heard of "Essentials to Good Work."

HERE ARE TWO OF THEM

P. & S. Attachment Plugs

YOUR ORDERS SOLICITED

Patented November 22, 1898 May 23, 1899.

Porcelain Cap.

Brass Cap.

PASS & SEYMOUR, Inc.

SOLVAY, N. Y.

NEW YORK CHICAGO SAN FRANCISCO

# ANNOUNCEMENT

It gives us pleasure to announce to our friends and patrons that while the fire of Feb'y 11th completely destroyed our offices and warehouse and temporarily interfered with our facilities, ***it did not put us out of business*** and we will not allow it to interfere with our taking care of your orders promptly.

We are temporarily established at Nos. 209-211 E. Jackson Boulevard, and now have everything running smoothly again—with a full new stock of supplies. We have made arrangements to take care of all orders promptly and hope therefore we will continue to receive the generous support that our trade has at all times given us.

OKONITE — IT NEVER DISAPPOINTS

**Central Electric Company,**

ELECTRICAL SUPPLIES

OKONITE — IT NEVER DISAPPOINTS

***Temporary Offices: 209-211 E. Jackson Boulevard, Chicago***

## THE SPARKLESS STARTER FOR LARGE MOTORS

Our experience has taught us that the sliding contact type of starter is not the best to use on motors above 35 H. P. 110 volts, and 50 H. P. 220 and 500 volts.

For motors of greater H. P. than these we advise our Multiple Switch type, which doesn't spark, and each switch of which will carry 250 amperes per square inch of contact surface.

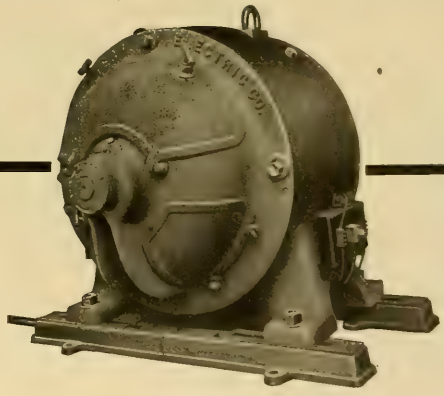
Its interlocking mechanism makes it necessary to close switches in their proper order, and a no-voltage magnet automatically releases switches when current is interrupted.

Bulletin 101 gives detailed description.

THE CUTLER-HAMMER MFG. CO.

MILWAUKEE, WISCONSIN

New York. Boston. Chicago.



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## Motors and Generators

Arc Lighting Systems

Bulletins on Request.

**Western Electric Company**

CHICAGO NEW YORK

OTHER LARGE CITIES

## Preeminently the Storage Battery

It costs no more than the Cell Type.

It has comparatively, considerably more active material and occupies less space (about half that required by Cell Type).

It is far more durable—is cleaner and more economical in operation and much less expensive in cost of maintenance.

Besides, this important fact must not be overlooked: There are no annoying and destructive fumes as with the Cell Type. The gas does not escape, therefore no corrosion of adjacent pipe or iron work or even the tarnishing of bright metal work.

## TRAY PLATE BATTERY CO.

Successors Smith Storage Battery Co.

5-11 FREDERICK ST., BINGHAMTON, N. Y.


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Machado & Roller.
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Wesco Supply Co.
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Crocker-Wheeler Company.
General Electric Co.

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Jeffrey Mfg. Co.

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Allis-Chalmers Company.
Marinette Gas Engine Co.
Woolley Fdy. & Mach. Wks.

**Engines, Oil.**
American Diesel Engine Co.

**Engines, Steam.**
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Crocker-Wheeler Company.
Edison Mfg. Co.
General Electric Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Fibre.**
Kartavert Mfg. Co.
Vulcanized Fibre Co.

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Barnett Co., G. & H.

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Faries Mfg. Co.

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Beardslee Chandelier Mfg.Co.
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Bissell Co., The F.
Doxsee Elec'l. Co., A. S.
Haller Machine Co.
Reynolds El. Flasher Mfg.Co
Wesco Supply Co.

**Flexible Shafts.**
Stow Mfg. Co.

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Central Electric Co.
Central Tel. & El. Co.
Chicago Fuse Wire & Mfg.Co.
Clinton Stamping & Elec. Co.
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Haller Machine Co.
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Dixon Crucible Co., Jos.
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Johns-Manville Co., H. W.
Kartavert Mfg. Co.
Manhattan Elec. Supply Co.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Sterling Varnish Co.
Vulcanized Fibre Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

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Bossert Elect. Const. Co.

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Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
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Hipwell Manufacturing Co
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Electric Appliance Co.
Fostoria Incand. Lamp Co.
Franklin Electric Mfg. Co.
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Hernst Lamp Co.
Sawyer-Man Elec. Co.
Standard Elec'l Mfg. Co.
Wesco Supply Co.
Western Electric Co.
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**Lamps, Nernst.**
Nernst Lamp Co.

**Lamps, Vapor.**
Cooper, Hewitt Elec. Co.

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Chicago Edison Co.
Gregory Electric Co.

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Electrical Engineer Inst.
Highland Park College

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Plume & Atwood Mfg. Co.

**Signs, Electric.**
Haller Machine Co.
Western Display Co.
Zero Mark Sign Works.

**Silks, Insulating and Braiding.**
Sauquoit Silk Mfg. Co.

**Sockets & Receptacles.**
Pass & Seymour.
Perkins Elec. Switch Mfg. Co.
Yost Elec. Mfg. Co.

**Soldering Sticks, Salts and Paste.**
Chicago Solder Co.
Crolius & Son, E. R.
Western Electric Co.

**Speaking Tubes.**
Central Electric Co.
Edwards & Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.

**Specialties, Electrical Mfrs. and Designers.**
Haller Machine Co.

**Speed Indicators.**
Weston Electrical Inst. Co.

**Storage Batteries.**
American Battery Co.
Electric Storage Battery Co.
Gould Storage Battery Co.

**Supplies, General Elec.**
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Chicago Edison Co.
Electric Appliance Co.
General Electric Co.
Manhattan Elect'l Supply Co
Wesco Supply Co.
Western Electric Co.

**Switchboards.**
Bissell Co., The F.
Gen. Incan. Arc Light Co.

**Telephones, Telephone Material and Switchboards.**
American El. Telephone Co
Automatic Electric Co.
Bissell Co., The F.
Central Electric Co.
Central Tel. & El. Co.
Electric Appliance Co.
International Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co.
Manhattan Elec. Supply Co.
Stromberg-Carlson Tel. M.Co
Wesco Supply Co.
Western Electric Co.

**Time Switches.**
Bissell Co., The F.

**Tools.**
Klein & Sons, Mathias.
Western Electric Co.

**Transformers.**
Central Electric Co.
Crawfordsville Electric Co.
Crocker-Wheeler Co.
Electric Appliance Co.
Ft. Wayne Elec. Works, Inc.
General Electric Co.
Gregory Electric Co.
Kuhlman Electric Co.
Manhattan Elec. Supply Co.
National Electric Co.
Stanley Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Trucks, Electric Car.**
General Electric Co.
Westinghouse El. & Mfg. Co.

**Turbines, Steam.**
Allis-Chalmers Co.
General Electric Co.
Westinghouse El. & Mfg. Co

**Turbine Water Wheels**
Leffel & Co., Jas.

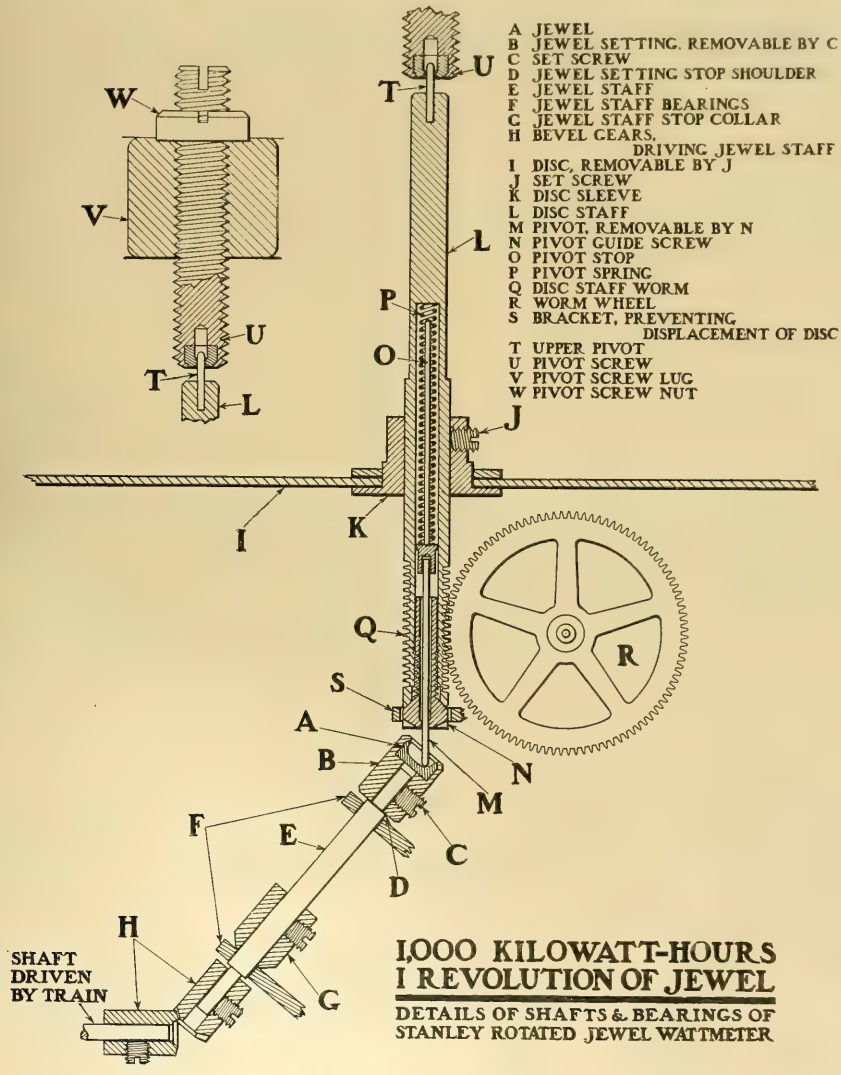
**Vulcanized Fibre.**
Vulcanized Fibre Co.

**Wires & Cables—Magnet Wires.**
American Electrical Works.
Bissell Co., The F.
Central Electric Co.
Chicago Insulated Wire Co.
Crescent Ins. Wire & Cble. Co
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
Indiana Rub. & Ins. Wire Co
India Rubber & Gutta Percha Insulating Co.
Kellogg Switch. & Sup. Co.
Manhattan Elec. Supply Co.
Marion Ins. Wire & Rub. Co.
National India Rubber Co
New York Insulated Wire Co.
Norwalk Wire & Cable Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co
Roebling's Sons Co., J. A.
Runzel-Lenz Elec. Mfg. Co.
Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Standard Underground C. Co
Wesco Supply Co.
Western Electric Company.


For Alphabetical Index of Advertisements See Page 3.

# Stanley Rotated Jewel Wattmeters

## HOW THEY ARE MADE



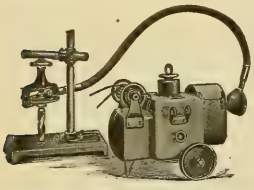

**1,000 KILOWATT-HOURS**
**1 REVOLUTION OF JEWEL**

DETAILS OF SHAFTS & BEARINGS OF STANLEY ROTATED JEWEL WATTMETER

Send Your Orders To

# STANLEY INSTRUMENT COMPANY

GREAT BARRINGTON - - MASS



ESTABLISHED 1875.
COMBINATION OF
**Stow Flexible Shaft**
—AND—
**MULTI-SPEED MOTOR**
Practically dust and water proof. For Portable Drilling, Tapping, Reaming, Emery Grinding, etc. Write for Catalogue and Prices.
**STOW MFG. CO., Binghamton, N. Y.**
Gen'l European Agents, Selig, Sonnenthal & Co., 85 Queen Victoria Street, London, England

ELECTRIC SIGN
**FLASHERS**
**BEST IN THE WORLD**
Write for full particulars
Reynolds Elec. Flasher Mfg. Co.
221 Fifth Ave., Chicago.

**REPAIRING**
**RECALIBRATING**
**ELECTRIC METERS.**
INTERNATIONAL ELECTRIC METER CO.
167 S. CANAL STREET, CHICAGO.

**Electric Heating Apparatus**
SEND FOR 62-PAGE CATALOGUE.
**UNIT" ENAMELED RHEOSTATS**
SIMPLEX ELECTRIC HEATING CO.,
Cambridgeport, Mass.

GRAND PRIZE WORLD'S FAIR, ST. LOUIS
**COLUMBIA**
CARBONS BATTERIES—BRUSHES
NATIONAL CARBON COMPANY
CLEVELAND, O.

MONEY-SAVING
**Benjamin Drop-Light Sockets**
**And Some Reasons "Why"**

431. Key Socket.

1.—By extending the fiber lining of the cap through the neck a perfect insulation is obtained without necessitating the use of a socket bushing.

2.—Instead of side terminals as are commonly employed in sockets, the terminals of the BENJAMIN DROP-LIGHT SOCKETS are so placed on the back face of the porcelain that the removal of the lower shell is not necessary, making it the most easily wired socket on the market for **drop-light work.**

430. Keyless Socket.

3.—Our proposition on Standard Packages of 250 sockets will interest you. Will you write for it today?

4.—We can make prompt deliveries.

5.—If you have not used them we know you are losing money daily.

**BENJAMIN ELECTRIC MFG. CO.**
NEW YORK CHICAGO SAN FRANCISCO

REVOLVING FIELD
**ALTERNATORS**
BELTED, ENGINE OR WATER WHEEL TYPE...
BUILT IN ALL CAPACITIES

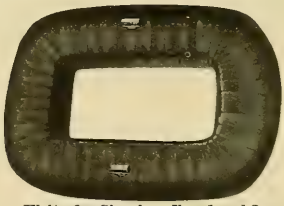
**National Electric Company**
GENERAL SALES OFFICE & WORKS
**Milwaukee, U. S. A.**

District Offices
New York, 135 Broadway.
Chicago, 604 Colony Bldg.
Philadelphia, 1509 Land Title Bldg.
Pittsburg, Farmers' Bank Bldg.
Atlanta, Ga., Empire Bldg.
New Orleans, La., Hibernia Bank Bldg.

Sales Offices
Cleveland, Barton Stevenson & Co.
Detroit, Miller-Seldon ElectricCo.
St. Louis, 320 Chemical Bldg.
Denver, Hendrie & Bolthoff Mfg. and Supply Co.
Seattle and San Francisco, Kilbourne & Clark Co.

**Field and Armature Trouble Eliminated**

BY USING
**Deltabeston Magnet Wire**
Heatproof
Moistureproof



**Insulated with Pure Asbestos**
No Paper or Cotton Used

Write for Circulars Nos. 1 and 2.

**ASBESTOS INSULATION PREVENTS BREAKDOWN**
**D. & W. FUSE COMPANY, Wire Dept., Providence, R. I.**

# GRAND PRIZE

**The Highest Possible Award**

**Has Been Given to**

ELECTRA

TRADE MARK

## HIGHEST GRADE NUERNBERG CARBONS

**By the International Jury of Awards, of the Louisiana Purchase Exposition, St. Louis, 1904.**

**HUGO REISINGER, Sole Importer, 11 BROADWAY, NEW YORK**

# McRoy Conduits.

"ROOKERY"—Chicago—

**We are making immediate shipments on our High-Grade Eagle Brand Rubber Covered National Code Standard**

# WIRES and CABLES

**Before You Buy Get Our Prices. Catalogue Upon Request**

## MARION INSULATED WIRE & RUBBER COMPANY

MARION, INDIANA CHICAGO, 529-530 Monadnock Block, I. A. Bennett, Mgr.

# General Electric Company

*MANUFACTURES*

**A Most Complete Line of**

## National Electrical Code Standard Enclosed Fuses and Cut-Outs

**From 30 to 600 Amperes, in both the 250 and 600 Voltages**

600 Amp., 600 Volt

30 Amp. 250 Volt

## GENERAL OFFICES: SCHENECTADY, N. Y.

**Chicago Office, Monadnock Block.** **Sales Offices In All Large Cities.**

# THE NEW YEAR

Finds in the Packard Lamp
Steadily maintained candlepower
600 to 800 hours guaranteed life
Economy of Operation.

**Packard Lamps Are a Good Investment. Begin the New Year by Installing Them on Your Circuit.**

**ELECTRIC APPLIANCE COMPANY,**
CHICAGO AND SAN FRANCISCO

# EDISON LAMPS

**Can be Obtained Promptly**

Extensive Factory Facilities and Large Stocks insure quick and accurate delivery.

All Types and Varieties
Regular Multiple Lamps
Street Series Lamps
Miniature Lamps
(7)

GENERAL ELECTRIC COMPANY
Main Lamp Sales Office:
HARRISON, N. J.

# MICA

Of all Qualities, In any Form at Lowest Prices
EUGENE MUNSELL AND CO.
NEW YORK and CHICAGO

# INSULATION That Is.

Micanite, Linotape, M. I. C. Compound, Empire Cloth and Paper. For Years the Standard.

**MICA INSULATOR CO., Originators**
NEW YORK and CHICAGO

**BEARDSLEE CHANDELIER M'F'G CO.** 256 and 257 SO. CANAL ST. CHICAGO
GAS & ELECTRIC FIXTURES FOR THE TRADE.
CATALOG SENT PREPAID TO DEALERS — MENTION THIS PAPER

# YOU NEED IT!

**Gale's Commutator Compound.**
The Only Article That Will Prevent Sparking.
Will keep the Commutator in good condition and prevent cutting. Absolutely will not gum the brushes.
50c. per stick. $5.00 per dozen Send 50c. for trial stick.
FOR SALE BY ALL SUPPLY HOUSES OR
**K. McLENNAN & CO.,** Sole Manufacturers, Room 411 Inter Ocean Bldg., 130 Dearborn Street CHICAGO

"Flexduct" is that high standard required in all high-class work. It is very flexible, a high insulation and indestructible

# FLEXIBLE CONDUIT

"Flexduct" the National Code Standard. It does not deteriorate, always usable to highest degree

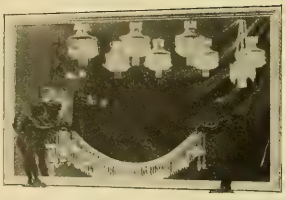
OSBURN FLEXIBLE CONDUIT COMPANY,
NEW YORK CHICAGO SAN FRANCISCO

**VOLT - AMMETERS**
POCKET SIZE
For testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.
RELIABLE. - ACCURATE.
Send for Circular.
**L. M. PIGNOLET**
78-80 Cortlandt St., NEW YORK, N. Y.

**MICA-BOND** Notice how our competitors try gradually to raise Cut Mica prices—same thing would occur in manufactured mica if we were not the leaders
CHICAGO MICA CO
"PERFECTORS" VALPARAISO, IND.

**CENTURY ELECTRIC CO.**
MANUFACTURERS OF
SINGLE-PHASE SELF-STARTING
MOTORS AND CEILING FANS
ST. LOUIS, MO.

## Architects and Dealers in Electric Lighting Fixtures



will find the best decorative appliances (bronze or crystal) at cut prices—all from the best artists and the best manufacturers, awarded grand prizes at St. Louis Exposition—now for bargain at low prices, on immediate application to

PAUL LETHEULE, 4808 Delmar Bd., St. Louis

**CONTINUOUS RAIL JOINT CO. OF AM.**
NEWARK, N. J.
**OVER 20,000 MILES IN USE**
The St. Louis Exposition, 1904, awarded us the only gold medal for rail joint products.

**Water-Wheel Governors**

Our new mechanical governors co-operate with the inertia effect of the water and the momentum of the plant.
They have cut the cost of good government in two. Guaranteed in every particular.

**REPLOGLE GOVERNOR WORKS**
AKRON, OHIO.
WRITE FOR DESCRIPTIVE MATTER W.

"MANROSS"
**HAIR SPRINGS**
For Electric Indicating and Recording Gauges, Steam Gauges, Etc

LARGEST MANUFACTURER OF HAIR SPRINGS in the United States.
**F. N. MANROSS,**
FORESTVILLE, CONN.

U. S. and Foreign Patents

**THE FACTS ARE!** That electric signs are a sure and continual source of profit to lighting companies. That they have become indispensable to modern business methods. That the "REFLECTRIC" is the only electric sign sold with a written guarantee. Send for booklet.

**WESTERN DISPLAY CO.,** Sole Manufacturers
ST. PAUL, MINN.

FRANK H. PHILLIPS, President. EUGENE F. PHILLIPS, General Manager. E. ROWLAND PHILLIPS, Vice-Pres. O. H. WAGENSEIL, Treasurer. S. R. REMINGTON, Jr., Sec.

**AMERICAN ELECTRICAL WORKS,**

PROVIDENCE, R. I.

BARE AND INSULATED ELECTRIC WIRE,
ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,
**Railway Feeder and Trolley Wire,**
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
CABLES FOR AERIAL AND UNDERGROUND USE.

NEW YORK STORE, W. J. Watson, 26 Cortlandt St.
CHICAGO STORE, F. E. Donohoe, 82 Lake St.
MONTREAL BRANCH, Eugene F. Phillips' Electrical Works.
MAIN OFFICES AND FACTORIES, PHILLIPSDALE, R. I.

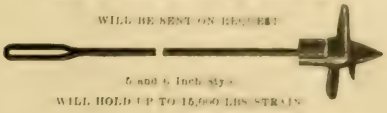
**"ANCHORS THAT HOLD"**

IS THE TITLE OF OUR NEW CATALOGUE E

**STOMBAUGH GUY ANCHORS**

IT IS TO BE ISSUED MARCH FIRST AND WILL CONTAIN MUCH OF INTEREST TO THOSE WHO HAVE POLES AND OTHER THINGS TO ANCHOR.

WILL BE SENT ON REQUEST



6 and 8 Inch Size

WILL HOLD UP TO 15,000 LBS STRAIN

**W. N. MATTHEWS & BRO.**
MANUFACTURERS
603 Carleton Building ST. LOUIS, MO.

**EXPERT IN** ELECTRICITY MECHANICS PATENT CAUSES
SOLICITOR OF U. S. & FOREIGN **PATENTS**
FOREGAIN, 1652-3 Monadnock Blk., CHICAGO

**OTTO BUNGE**
MANUFACTURER OF
LEATHER NAIL HEADS, BELTS, SAFETY AND CLIMBER STRAPS
1130 S7. PETER STREET,
INDIANAPOLIS, - - INDIANA.

**NATIONAL CODE STANDARD**

WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Ideal Wire.
Prices and Samples on Application.

**Phillips Insulated Wire Co.**
Office and Factory: PAWTUCKET, R. I.

**SINGLE AND POLYPHASE TRANSFORMERS**
KUHLMAN ELECTRIC CO., - - Elkhart, Ind.

**PRICE $10 LIST.**

FOR A. C. and D. C. WORK.
DISCOUNT TO THE TRADE.
WRITE FOR CIRCULARS

**RELIANCE INSTRUMENT CO.**
60-68 W. Van Buren St., Chicago.

**DON'T BUY ELECTRICAL SUPPLIES**

Until you have seen our new Catalogue and new Price List.
Free to the trade.

**Manhattan Electrical Supply Co.**
NEW YORK: 32 Cortlandt St. CHICAGO: 188 Fifth Ave.

**"STAR" INCANDESCENT LAMPS**

LONG LIFE
GUARANTEED CANDLEPOWER,
HIGHEST EFFICIENCY.

MADE BY THE MOST SKILLED WORKMEN.

**STANDARD ELECTRICAL MFG. COMPANY, : Niles, Ohio.**

**YOST SPECIALTIES.**

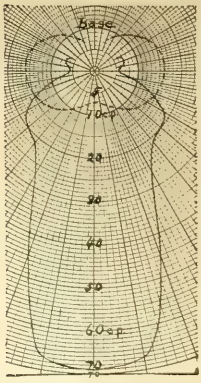
***Sockets, Wall Sockets, Weatherproof Sockets, Rosettes, Receptacles, Cord Adjusters.***

*Catalogue for the asking.*

**THE YOST ELECTRIC MFG. CO.**
TOLEDO, OHIO.

**HOLOPHANE**
**GLOBES AND REFLECTORS**

No. 2631




Dotted line bare 16 c. p. lamp. Full line same lamp with No. 2631 Pagoda Reflector.

Photometric curves from tests made by The Electrical Testing Laboratories, New York.

**HOLOPHANE GLASS CO.**
CLACKNER BUILDING NEW YORK

Several years ago a down-east manufacturer of belting—one of the ultra-conservative kind—did not believe in advertising. He had an idea that belting could be sold in but one way—through personal calls by representatives on the road.

The belting was of good quality—in fact it was and is one of the best on the market.

Every little while one of his road men would enter the office of a belting user who would tell him he had never heard of —— belting. He had never seen the belting advertised, and consequently did not know there was such a belting on the market.

Cases of this kind happened so frequently as to become annoyingly monotonous.

The road representatives finally got their heads together and drafted a sort of round-robin, politely demanding that the home office commence advertising in the trade papers.

The demand was complied with, and as a result, the sales during the following twelve months increased 75 per cent.

This is a true story—and it has a general application.

Advertising paves the way for the man on the road.

Advertising in the WESTERN ELECTRICIAN will pave the way for your representatives in the Central, Western and Southern States.

**WANTED, FOR SALE** *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 3c each.* **POSITION WANTED** *advertisements (50 words or less), $1.00 an insertion; additional words 2c each.*

## POSITION WANTED.

As engineer and electrician in lighting or power plant. Age 32. Twelve years' experience with high and low-speed compound-condensing engines, high and low tensions A. C. and D. C. systems, water works and water power plants. Have first-class indicating outfit and well supplied with engine-room tools. Six years with present company; strictly temperate; best of references. Address H. G. CHILDS, 715 Washtenaw St., Lansing, Mich.

## POSITION WANTED.

Electrical and mechanical engineer, associate member A. I. E. E. and A. S. M. E., now holding position of general manager and engineer of several consolidated companies, desires to connect himself with new or operating companies; 14 years' experience in the construction and operation of lighting and street-railroad properties in this country and South America; competent to design, construct and manage same; Mexico preferred. Address BOX 442, care of Western Electrician, 510 Marquette Building, Chicago.

## POSITION WANTED.

As manager or superintendent of telephone interests. Maine man; excellent education, and six years' practical experience with one of the largest companies, especially in the executive department. Best of recommendations and references furnished. Address "T," Room 410, Y. M. C. A. Bldg., Portland, Maine.

## WANTED.

Wanted experienced armature winder for repair shop. Must be familiar with all kinds of winding. Address BOX 444, care Western Electricin, 510 Marquette Building, Chicago.

## FOR SALE.

One 25-H.P. Nash gas engine, direct-connected to 15-K.W. Crocker-Wheeler dynamo; can be used for 115 or 230 volts. This would be a first-class outfit for automobile charging station. GRAHAM BROS. CO., 662 Hudson St., New York City.

## FOR SALE.

Fuller engine—Western Electric, 15 K. W., direct-connected unit, used 9 months, good as new—must have larger machine. HOTEL WARNER, Chicago.

## FOR SALE.

One Erie City Iron Works engine, 14-in. x 16-in. automatic center crank, 200 r.p.m., normal rating 120 h.p. Governor wheel 4 ft. 6 in. in diameter by 12¾-in. face. Fly wheel 7 ft. 1 in. in diameter by 14¾-in. face. Engine has been recently overhauled by maker. Has been operated but little since and is in perfect secondhand operative condition. Was superseded by larger engine. Price $350 f. o. b. cars Northeast, Pa. Northeast Electric Light and Power Company, Northeast, Pa. Office, 780 Ellicott Square, Buffalo, N. Y.

## FOR SALE.

1—12x24x36 Allis Tandem engine.
1—150-175 H. P. Ball & Wood cross-compound engine.
1—125 H. P. Russell engine.
2—150 H. P. Tandem Compound Ball & Wood engines.
1—50 K. W. 133 Cycle Ft. Wayne generator.
2—A-70 General Electric alternators.
1—A-120 General Electric alternator.

CENTRAL CONSTRUCTION CO., Oshkosh, Wis.

### PROPOSALS FOR LIGHTING THE CITY OF SHREVEPORT, LA.

Bids are hereby invited for the electric lighting of the City of Shreveport, La., for a period of five and 10 years, the number of lights to be not less than one hundred and fifty (150), and subject to be increased to..... Arc lights to be not less than 2,000 candlepower. Bids shall specify the charge for arc lights, and also for incandescent lights and shall specify the maximum charge to be made to private consumers of arc and incandescent lights. Certified check for Twenty-Five Hundred ($2,500.00) Dollars to accompany each bid. Successful bidders shall be required to give bond for faithful performance. Arc lights for street lighting shall burn every night. City reserves the right to reject any and all bids. All bids to be in the hands of the City Comptroller by 6 p. m., on April 11th, 1905.

C. G. RIVES, Comptroller,
Shreveport, La.

## TELEPHONE TROUBLES

Price 25 Cts.

DO YOU NEED ONE IN YOUR BUSINESS?

Electrician Pub. Co., 510 Marquette Bldg., Chicago

WORKS QUICK AND EASY. KEEPS ITS LUSTER. HOLDS OLD TRADE AND MAKES NEW. DOES NOT DETERIORATE. ESTABLISHED 16 YEARS. SOLD BY AGENTS AND DEALERS ALL OVER THE WORLD

## U.S. METAL POLISH

3 Ounce Box, 10 cents. Samples sent free

GEO. W. HOFFMAN

POLISHES ALL METALS. Branches: New York, Chicago, San Francisco. 295 E. Washington St., Indianapolis, Ind.
HIGHEST AWARD—CHICAGO WORLDS FAIR, 1893. LOUISIANA PURCHASE EXPOSITION 1904.

## FOR SALE

| | | | | |
|---|---|---|---|---|
| 1-360 | K. W. | General Electric | Alternator, | Three Phase |
| 1-240 | " | Westinghouse | " | Single " |
| 2-150 | " | Warren | " | " " |
| 1-150 | " | Westinghouse | " | " " |
| 1-150 | " | Wood | " | " " |
| 1-150 | " | Stanley | " | " " |
| 1-120 | " | General Electric | " | Three " |
| 1-120 | " | General Electric | " | Single " |
| 1 120 | " | Westinghouse | " | " " |
| 1- 90 | " | General Electric | " | " " |
| 1- 75 | " | Westinghouse | " | Two " |
| 1- 75 | " | Westinghouse | " | Single " |
| 1- 75 | " | Westinghouse | " | Two " |

Direct connected to Gates' Engine.

Send for our **Monthly Bargain Sheet** with complete list and net prices.

**GREGORY ELECTRIC CO.**
**54-62 S. Clinton St., Chicago, Ill.**

## FOR SALE

**Fine Modern Steam Plant**
**600 H. P.**

**GEARY WATER TUBE BOILERS**

**Stack, Duplex Boiler Feed Steam Pumps, Gauges, etc.**

This plant has been in use about four years at our mills at Winton Place, Ohio. Owing to the continued growth of our business we require more than double the capacity, hence the change. : : : This plant is especially adapted for hotel or large office buildings where economy of space is required. : : Could give possession in 100 days. For further particulars, price, etc., write

**THE M. B. FARRIN LUMBER CO.**

Telephone Park 83. CINCINNATI, O.

## NOXALL CUP GREASE.

A PERFECT LUBRICANT. HIGH QUALITY, LOW PRICE.

**RICHARDSON LUBRICATING CO., - Quincy, Ill.**

## Special Bargains for Spring—Immediate Delivery.

### 500-VOLT MOTORS.

| | | |
|---|---|---|
| 1—20 H. P., C.&C. | 1—18 H.P., C&C. | 4—15 H. P. |
| 6—10 H. P. | 8—7½ H. P. | 17—6 H. P. |
| 9—3 H. P. | 10—2 H. P. | 7—1 H. P. |

### 220-VOLT MOTORS.

| | | |
|---|---|---|
| 1—30 H. P. | 3—15 H. P. | |
| 5—10 H. P. | 6—7½ H. P. | |
| 6—5 H. P. | 4—3 H. P. | |
| 11—2 H. P. | 4—1 H. P. | |

**Above Motors are Complete and of Standard Make.**
**Special Bargains in Engines up to 600 H. P. Also A. C. & D. C. Dynamos, Boilers, Pumps, Etc.**
**Write requirements. Send for Catalogue.**

CENTRAL STATION IMPROVEMENT COMPANY, 938 Monadnock Block, CHICAGO.

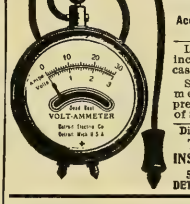
## FIVE CENTS A HOLE FOR YOU

Perhaps you have never stopped to figure that every time you hammer, file and ream to get a round hole in a cast-iron junction box you waste about five cents worth of time to say nothing of the broken boxes. It costs you nothing to put holes in

**BOSSERT JUNCTION BOXES**

One blow of the hammer removes the hermetically sealed plug, leaving a smooth round hole. The boxes are made of drawn steel and never break. This saving of five cents a hole amounts to a considerable sum in a year. Write for prices.

Bossert Electric Construction Co., Utica, N. Y.




## Robert Volt-Ammeter

Dead Beat
Accurate, Durable
Guaranteed

List Price, $6.00 including leather case.

Sample instrument forwarded prepaid on receipt of $5.00.

Discount to Dealers

**THE ROBERT INSTRUMENT CO.**
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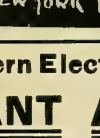

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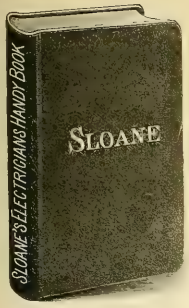


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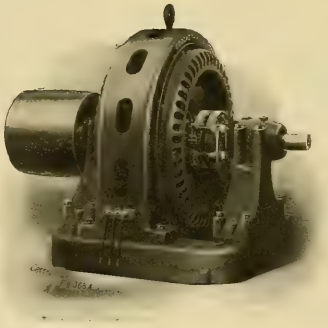

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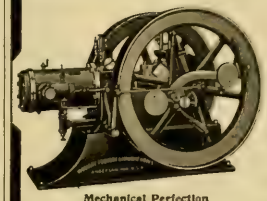

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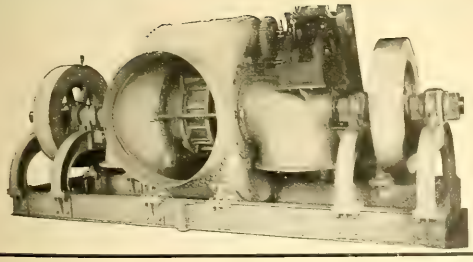

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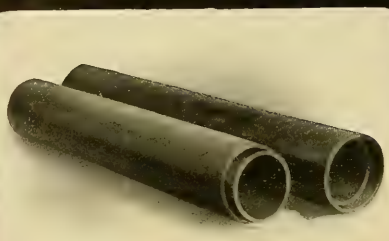

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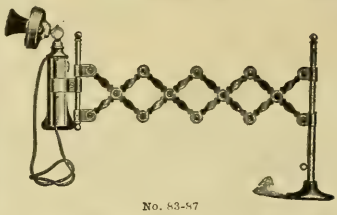

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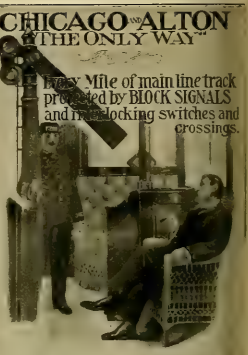

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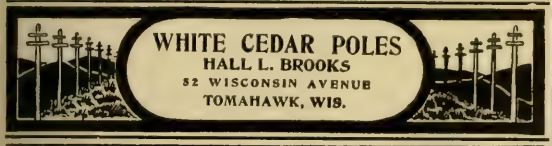


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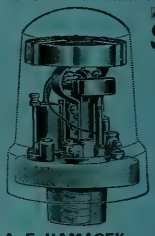

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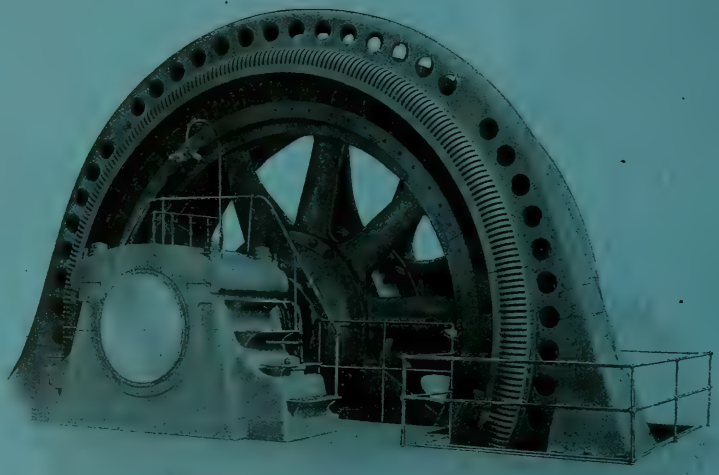

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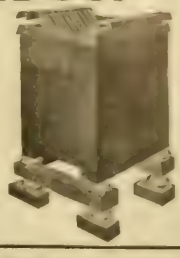

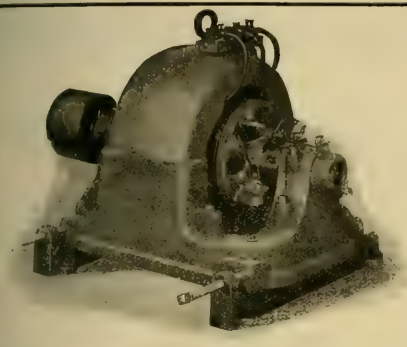

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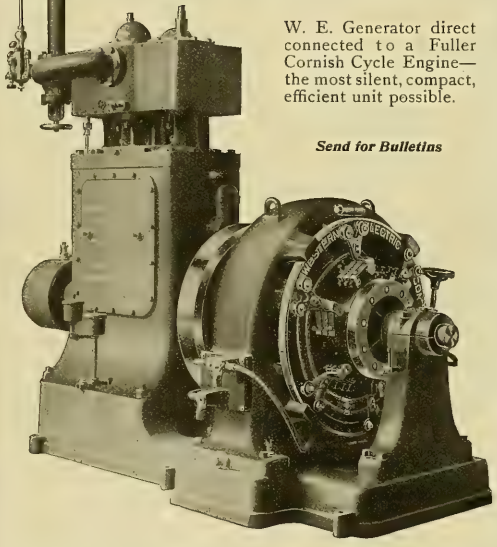

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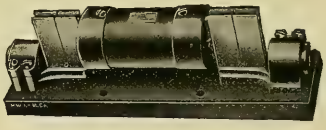

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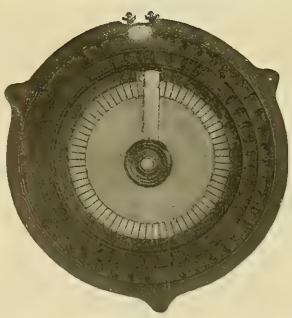

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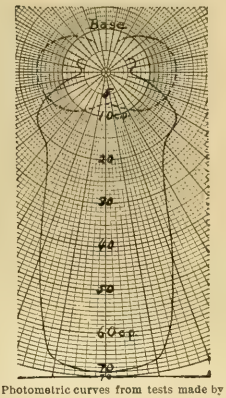


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Central Tel. & El. Co.
Electric Appliance Co.
International Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co.
Manhattan Elec. Supply Co.
Stromberg-Carlson Tel. M.Co.
Wesco Supply Co.
Western Electric Co.

**Time Switches.**
Bissell Co., The F.

**Tools.**
Klein & Sons, Mathias.
Western Electric Co.

**Transformers.**
Central Electric Co.
Crawfordsville Electric Co.
Crocker-Wheeler Co.
Electric Appliance Co.
Ft. Wayne Elec. Works, Inc.
General Electric Co.
Gregory Electric Co.
Kuhlman Electric Co.
Manhattan Elec. Supply Co.
National Electric Co.
Stanley Elec. Mfg Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Trucks, Electric Car.**
General Electric Co.
Westinghouse El. & Mfg. Co.

**Turbines, Steam.**
Allis-Chalmers Co.
General Electric Co.
Westinghouse El. & Mfg. Co

**Turbine Water Wheels**
Leffel & Co., Jas.

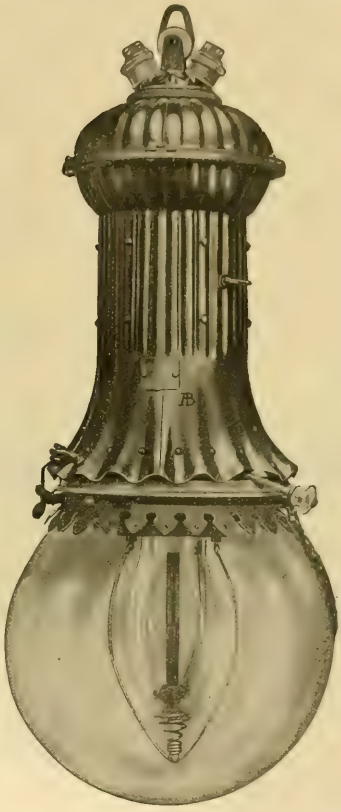
**Vulcanized Fibre.**
Vulcanized Fibre Co.

**Wires & Cables—Magnet Wires.**
American Electrical Works.
Bissell Co., The F.
Central Electric Co.
Chicago Insulated Wire Co.
Cresconi Ins. Wire & Cble. Co
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
Indiana Rub. & Ins. Wire Co
India Rubber & Gutta Percha Insulating Co.
Kellogg Switch. & Sup. Co.
Manhattan Elec. Supply Co.
Marion Ins. Wire & Rub. Co.
National India Rubber Co
New York Insulated Wire Co.
Northern Wire & Cable Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co
Roebling's Sons Co., J. A.
Runzel-Lenz Elec. Mfg Co.
Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Standard Underground C. Co
Wesco Supply Co.
Western Electric Company.


**For Alphabetical Index of Advertisements See Page 8.**

# A-B ARC LAMPS

## FOR ALL CIRCUITS



### SPECIAL FEATURES

Accessibility of Mechanism,

Ease of Removing Inner and Outer Globe,

Ease of Trimming,

Weatherproof Construction,

Stamped Copper Cases and Simplicity of Mechanism.

### THERE IS

A greater number of Adams-Bagnall Constant Direct Current Series Enclosed Arc Lamps used for street lighting throughout the United States, Canada and Mexico than all other makes of this type of lamp combined.

SEND FOR CATALOGUE

*AGENCIES*

*Doubleday-Hill Electric Co., Pittsburg, Pa.*
*Electric Appliance Co., Chicago, Ill.*
*The Wesco Supply Co., St. Louis, Mo.*
*H. C. Roberts Electric Supply Co., Philadelphia, Pa.*
*Pettingell-Andrews Co., Boston, Mass.*
*Cia. Benbow-Dutton, S. A., City of Mexico, Mex.*
*Geo. F. Rohn, Milwaukee, Wis.*

*AGENCIES*

*B-R Electric Co., Kansas City, Mo.*
*A. J. Michell, Atlanta, Ga.*
*Interstate Electric Co., New Orleans, La.*
*Post-Glover Electric Co., Cincinnati, O.*
*Miller-Seldon Electric Co., Detroit, Mich.*
*W. G. Nagel Electric Co., Toledo, Ohio.*
*R. E. T. Pringle Co., Ltd., Montreal Que.*

## THE ADAMS - BAGNALL ELECTRIC CO.

New York Office: 136 Liberty St. CLEVELAND, OHIO Chicago Office: 303 Dearborn St.

Type H—6 Lamp.

## Cooper Hewitt
## Mercury Vapor Lamps

are being adopted wherever wide diffusion of light is necessary. In the new New York Times Building these lamps are used in the press rooms several stories below ground and the Butterick Publishing Co. have installed it with great success in several departments.

There is no consumption of the light-giving element; no trimming is required.

Twice the efficiency of the arc lamp and from 7 to 9 times the efficiency of the incandescent.

For use on all direct-current systems.

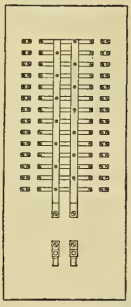
## THE LIGHT TO WORK BY

**For use in Factories, Machine Shops, Warehouses, Covered Piers, Draughting Rooms, Offices, Press and Composing Rooms and for Photographic and Engraving Work and Blue Printing.**

## Cooper Hewitt Electric Co.

220 West 29th Street, NEW YORK CITY
PHILADELPHIA OFFICE: 1121 Walnut St.

## Thrice armed is he who hath his prices just—



particularly if he also has them just when he wants them Dealers sell our

## Security Panel Boards

because they are the kind that's sought and because our Panel Bulletin enables dealers to quote prices on the spot. Our quick deliveries make friends, too.

**THE F. BISSELL COMPANY**
Manufacturers and Jobbers of
ELECTRICAL GOODS
226-228-230 Huron Street
TOLEDO, O.

## "FRES-KO" SOLDERING PASTE

**IT "CREEPS" INTO EVERY CREVICE**

**ABSOLUTELY NON-CORROSIVE**

This flux paste under the heat of the iron will "run" into every crevice—around a bunch of wires in a socket for instance.

FRES-KO CHEMICAL CO. - Fort Wayne, Ind.

## ADJUST YOUR LIGHT

by means of our

**Wall, Desk, Floor or Ceiling Adjustable Fixtures**

**TO ANY DESIRED POSITION INSTANTLY.**

Many shapes and styles—plain and ornamental—for shop, factory, store, office, residence—in fact, wherever the incandescent lamp is used.
Catalog mailed upon request.

**FARIES MFG. CO.,**
DECATUR, ILL.

## "Diamond H" Switches

Trade H Mark

This Trade-Mark guarantees quality.

The Hart Mfg. Co., Hartford, Conn.

New York Boston Chicago Toronto, Ont.

GRAND PRIZE WORLD'S FAIR, ST. LOUIS

## COLUMBIA

CARBONS BATTERIES—BRUSHES

NATIONAL CARBON COMPANY
CLEVELAND, O.

# GRAND PRIZE

**The Highest Possible Award**

**Has Been Given to**

ELECTRA

TRADE MARK

## HIGHEST GRADE NUERNBERG CARBONS

**By the International Jury of Awards, of the Louisiana Purchase Exposition, St. Louis, 1904.**

**HUGO REISINGER, Sole Importer, 11 BROADWAY, NEW YORK**

---

**NEXT TIME TRY THE**

## Kester Self-Fluxing Solder

**MADE WORKS ALL RIGHT**

**L. F. MAHLER CO., R. 1008 Chemical Bldg., St. Louis, Mo.**
**General Western Agent**

## CHICAGO SOLDER COMPANY,

**Formerly Kester Electric Mfg. Co.**

**46 N. UNION STREET CHICAGO, ILLINOIS**

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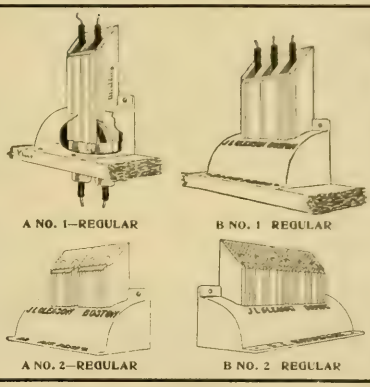


A NO. 1—REGULAR B NO. 1 REGULAR

A NO. 2—REGULAR B NO. 2 REGULAR

## Gleason's Moulding Boxes.

Send posta for descriptive pamphlet and price list to

**JOHN L. GLEASON**
**290 South St.**
**Jamaica Plain, Mass.**

---

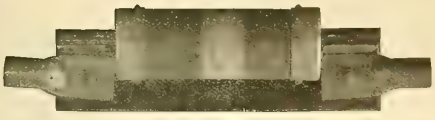
# General Electric Company

*MANUFACTURES*

**A Most Complete Line of**

## National Electrical Code Standard Enclosed Fuses and Cut-Outs

**From 30 to 600 Amperes, in both the 250 and 600 Voltages**



600 Amp., 600 Volt

30 Amp. 250 Volt

## GENERAL OFFICES: SCHENECTADY, N. Y.

**Chicago Office, Monadnock Block.** **Sales Offices In All Large Cities.**

# In The Spring

There will be a great many street-lighting contracts expire.
In figuring on new contracts you will want prices on Series Alternating Arc Lamps.
You will want a system that has been tried and not found wanting.
You will want Adams-Bagnall Arc Lamps.

**ELECTRIC APPLIANCE COMPANY**
Electrical Supplies
Chicago and San Francisco

# LAMPS

Get acquainted with the
**PEERLESS**—MONEY SAVERS
MADE RIGHT
PRICED RIGHT
ARE RIGHT
THE WESCO SUPPLY CO., ST. LOUIS, MO.
"EVERYTHING ELECTRICAL"

# MICA

Of all Qualities, In any Form at Lowest Prices
EUGENE MUNSELL AND CO.
NEW YORK and CHICAGO

# INSULATION That Is.

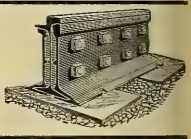
Micanite, Linotape, M. I. C. Compound, Empire Cloth and Paper. For Years the Standard.
**MICA INSULATOR CO., Originators**
NEW YORK and CHICAGO

# WANTED

*You Who are Troubled with Sparking and Cutting of Commutators to Use*

The only article that will PREVENT SPARKING. Will keep the commutator in good condition and PREVENT CUTTING.
*Absolutely Will Not Gum The Brushes . . .*
It will put that high gloss on the commutator you have so long sought after.
*50 Cts. per Stick. $5.00 per Dozen*
For Sale by all Supply Houses, or
*FREE, Sample Stick.*
**K. McLENNAN & CO.,**
Sole Manufacturers,
909 Title and Trust Bldg., CHICAGO, ILL.

**CONTINUOUS RAIL JOINT CO. OF AM.**
NEWARK, N. J.
**OVER 20,000 MILES IN USE**
Highest Award at Paris Exposition, 1900, Buffalo, 1901, and St. Louis, 1904.



SAUQUOIT SILK MFG. COMPANY
INSULATING and BRAIDING SILKS
**MILLS:**
BETHLEHEM, PA.
PHILADELPHIA, PA.
SCRANTON, PA.
NEW YORK REPRESENTATIVES:
WILLIAM RYLE & COMPANY
54 Howard St.
PHILADELPHIA OFFICE:
4015 Clarissa St.
CHICAGO OFFICE:
210 Monroe St.
BOSTON OFFICE:
78 Chauncy St

# MICABOND

CHICAGO MICA CO.,
"PERFECTORS" VALPARAISO, IND.
THE PEER OF INSULATORS.

**VOLT - AMMETERS**
**POCKET SIZE**
For testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.
RELIABLE. - ACCURATE
Send for Circular.
**L. M. PIGNOLET**
78-80 Cortlandt St., NEW YORK, N. Y.

# EDISON SIGN LAMPS

4 C.P.—19 watts
3 C.P.—14 "
2 C.P.—13 or 9 watts

**RELIABLE, LONG AND BRILLIANT LIFE.**

We supply a number of 2 C. P. sign lamps taking only 9 watts and operating two in series on 100–130-volt circuits.

**Most Economical Sign Lamp Made.**

GENERAL ELECTRIC COMPANY
Main Lamp Sales Office, Harrison, N. J.
(8)

# "STAR" INCANDESCENT LAMPS

LONG LIFE
GUARANTEED CANDLEPOWER,
HIGHEST EFFICIENCY.
MADE BY THE MOST SKILLED WORKMEN.
**STANDARD ELECTRICAL MFG. COMPANY, : Niles, Ohio.**

TYPE B.

ALTERNATING CURRENT.

# SCHEEFFER INTEGRATING WATTMETER

Type E for Alternating Current Type F for Direct Current Circuits

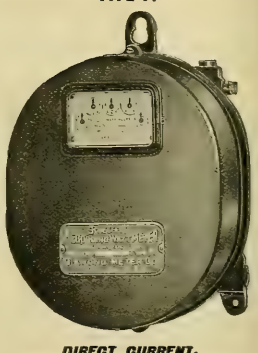
***DUST AND BUG PROOF***
***IMPROVED CONSTRUCTION***

MOVING PARTS ARE EXTREMELY LIGHT, INSURING A HIGHLY SENSITIVE AND ACCURATE METER.

WRITE FOR PRICES AND DESCRIPTIVE LITERATURE.

**DIAMOND METER COMPANY,**
PEORIA, ILL., - - - - - U. S. A.

TYPE F.

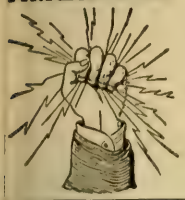


DIRECT CURRENT.

FRANK N. PHILLIPS, President. O. N. WAGENHEIL, Treasurer. EUGENE F. PHILLIPS, General Manager. E. ROWLAND PHILLIPS, Vice-Pres. O. R. REMINGTON, Jr., Sec.

**AMERICAN ELECTRICAL WORKS,**

PROVIDENCE, R. I.



BARE AND INSULATED ELECTRIC WIRE,
ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,
**Railway Feeder and Trolley Wire,**
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
CABLES FOR AERIAL AND UNDERGROUND USE.

NEW YORK STORE, W. J. Watson, 26 Cortlandt St.
CHICAGO STORE, F. E. Donohoe, 82 Lake St.
MONTREAL BRANCH, Eugene F. Phillips Electrical Works.
MAIN OFFICES AND FACTORIES, PHILLIPSDALE, R. I.

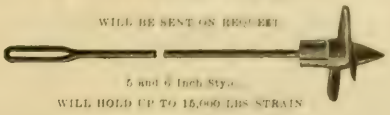
**"ANCHORS THAT HOLD"**

IS THE TITLE OF OUR NEW CATALOGUE

**STOMBAUGH GUY ANCHORS**

IT IS TO BE ISSUED MARCH FIRST AND WILL CONTAIN MUCH OF INTEREST TO THOSE WHO HAVE POLES AND OTHER THINGS TO ANCHOR

WILL BE SENT ON REQUEST



5 and 6 Inch Style

WILL HOLD UP TO 15,000 LBS STRAIN

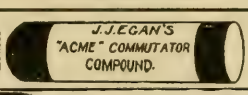
W. N. MATTHEWS & BRO.
MANUFACTURERS
603 Carleton Building ST. LOUIS, MO.

**EXPERT IN** ELECTRICITY MECHANICS PATENT CAUSES
SOLICITOR OF U. S. & FOREIGN **PATENTS**
FORÉE BAIN, 1852-3 Monadnock Blk., CHICAGO

**REPAIRING**
**RECALIBRATING**
**ELECTRIC METERS.**
INTERNATIONAL ELECTRIC METER CO.
167 S. CANAL STREET. CHICAGO.

**Electric Heating Apparatus**
SEND FOR 62-PAGE CATALOGUE.
**UNIT" ENAMELED RHEOSTATS**
SIMPLEX ELECTRIC HEATING CO.,
Cambridgeport, Mass.

All Supply Houses




J. J. EGAN'S "ACME" COMMUTATOR COMPOUND absolutely prevents sparking or cutting. One stick of "Acme" is equal to one gallon of oil for lubricating commutators. Free Sample. AGENTS WANTED. 50c per Stick. $5.00 per doz.
J. J. Egan Sole Mfg., 317 Austin Ave., Tel. Polk, 1779 Chicago

ELECTRIC SIGN
**FLASHERS**
**BEST IN THE WORLD**
Write for full particulars
Reynolds Elec. Flasher Mfg. Co.
221 Fifth Ave., Chicago.

**"AMERICAN" STORAGE CELLS**
ARE THE BEST. Send for descriptive Circular.
AMERICAN BATTERY CO.,
Estd 1889. 171 S. Clinton St., Chicago.

Grimshaw

Raven White Core

Raven Black Core

**ALL OUR WIRES** pass inspection and carry the above **TRADE-MARKS** on our tags. We also manufacture **Grimshaw** and **Competition Tapes** and **Splicing Compounds.**

**NEW YORK INSULATED WIRE COMPANY,**

MAIN OFFICE: 114, 116 & 118 Liberty St., New York.
BRANCHES: CHICAGO: 192 Desplaines St. BOSTON: 7 Otis St. SAN FRANCISCO: 32 Second St.

**Warren Alternator**

**No Collector Rings**

**No Brushes**

WE GUARANTEE WHAT WE SELL AND SELL WHAT WE GUARANTEE

WARREN ELECTRIC MFG. CO.

Sandusky, O.

**HENRY NEWGARD & CO.**

**ELECTRICAL CONSTRUCTION**

**Power and Light Plants. Switchboards and Panel Boards.**

We install Municipal and Isolated Electric Lighting Plants.
We manufacture Switchboards, Table boards, Iron Cutout Boxes and Electrical Specialties.
We sell Dynamos, Motors and Electrical Supplies.
We wire old as well as new Residences, Factory Buildings, School and College Buildings.

**87 Fifth Avenue, Chicago, Illinois.**

**NATIONAL CODE STANDARD**

"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Ideal Wire.

**Prices and Samples on Application.**

**Phillips Insulated Wire Co.**

Office and Factory: PAWTUCKET, R. I.

One billion dollars a year is spent in advertising in the United States. The expenditure of this enormous and almost unthinkable sum has contributed more than all other causes combined to the rapid and phenomenal commercial growth of the country.

The American appreciates the value of publicity. He knows that money spent in continuous and judicious advertising is an investment that will bring returns of increasing value. He knows, too, that it is impossible for him to do business without the assistance of printer's ink.

Most of the largest commercial concerns have grown from small beginnings. Their growth has been chiefly due—in some cases wholly due—to advertising of the right kind.

They told the people that they had something to sell; and the people bought.

Tell your electrical tale to the readers of the Western Electrician. They will buy.

**WANTED, FOR SALE** *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 2c each.* **POSITION WANTED** *advertisements (50 words or less), $1.00 an insertion; additional words 2c each.*

## POSITION WANTED.

As engineer and electrician in lighting or power plant. Age 32. Twelve years' experience with high and low-speed compound-condensing engines, high and low tensions A. C. and D. C. systems, water works and water power plants. Have first-class indicating outfit and well supplied with engine-room tools. Six years with present company; strictly temperate; best of references. Address H. G. CHILDS, 715 Washtenaw St., Lansing, Mich.

## POSITION WANTED.

Electrical and mechanical engineer, associate member A. I. E. E. and A. S. M. E., now holding position of general manager and engineer of several consolidated companies, desires to connect himself with new or operating companies; 14 years' experience in the construction and operation of lighting and street-railroad properties in this country and South America; competent to design, construct and manage same; Mexico preferred. Address BOX 442, care of Western Electrician, 510 Marquette Building, Chicago.

## POSITION WANTED.

As engineer. Thirteen years' experience in operating and repairing steam engines, boilers, pumps, gasoline engine saw mill and other machinery. Four months' experience in electrical plant. Sober and have first-class license. Satisfaction to employer or no pay. References can be had if wanted. Address J. A. THOMPSON, Benson, Minn.

## FOR SALE.

Fuller engine—Western Electric, 15 K. W., direct-connected unit, used 9 months, good as new—must have larger machine. HOTEL WARNER, Chicago.

**DO YOU KNOW**
On what easy terms you can buy
**ROBERTSON-THOMPSON INDICATOR?**
We want to tell you.
**Jas. L. Robertson & Sons**
198 Fulton St. - New York

### PROPOSALS FOR LIGHTING THE CITY OF SHREVEPORT, LA.

Bids are hereby invited for the electric lighting of the City of Shreveport, La., for a period of five and 10 years, the number of lights to be not less than one hundred and fifty (150), and subject to be increased to..... Arc lights to be not less than 2,000 candlepower. Bids shall specify the charge for arc lights, and also for incandescent lights and shall specify the maximum charge to be made to private consumers of arc and incandescent lights. Certified check for Twenty-Five Hundred ($2,500.00) Dollars to accompany each bid. Successful bidders shall be required to give bond for faithful performance. Arc lights for street lighting shall burn every night. City reserves the right to reject any and all bids. All bids to be in the hands of the City Comptroller by 6 p. m., on April 11th, 1905.

C. G. RIVES, Comptroller,
Shreveport, La.

### BARGAINS IN POWER EQUIPMENT.

**HEATER**
1—400 H. P. BARAGWANATH with Brass Tubes Absolutely as Good as New.

**CORLISS ENGINES:**
1—650 H. P. 22x42x48-in. ALLIS CROSS COMPOUND.
2—175 H. P. 14x42-in. ALLIS HEAVY DUTY WITH CONDENSERS AND HEATERS.
1—275 H. P. 20x48-in. L. H. WHEELOCK, Fine Condition.

**AUTOMATIC ENGINES:**
1—125 H. P. 14x14-in. IDEAL CENTER CRANK.
1—175 H. P. 16x16-in. R. H. RICE, Good as New.
1—128 H.P. 14x20-in. L. H. ATLAS, Almost New.

**BOILERS, TUBULAR AND WATER TUBE:**
3—150 H. P.,—2—100 H. P.,—2—80 H. P.
Many others. Let us know your wants and save money.

**F. E. PFANNMUELLER & CO.**
733 The Rookery Chicago, Ill.

**Western Electrician**
# WANT ADS
**Bring Results.**

# SPECIAL BARGAINS

### ENGINES

One 650 H. P. 14⅜, 21 9-16 and 33½x30 Williams Triple.
One 350 H. P. 11⅞, 18 5-16 and 28 7-16x22 Williams Triple.
Two 400 H. P. 17 and 30x30 Noye Tandem Compound.
One 280 H. P. 18x36 Cummer Automatic.
One 160 H. P. 13 and 20x12 Ball Cross Compound Automatic.
One 160 H. P. 15½x15 Armington & Sims Automatic.
One 70 H. P. 10x12 Ball Automatic.

### BOILERS

Two 323 H. P. Heine Water Tube, 160 lbs. pressure.
Four 125 H. P. Root Water Tube, 125 lbs. pressure.
Five 100 H. P. 60x18 Return Tubular, 105 lbs. pressure.

### CONDENSERS

One Dean Jet Condenser, Single Cylinder Air Pump, 10x14x18.
One Dean Jet Condenser, Single Cylinder Air Pump, 10x12x12.

### DIRECT-CURRENT GENERATORS

One 200 K. W. General Electric, 275 volts.
Four 150 K. W. Edison Bi-polar, 140 volts.
Six 50 K. W. Edison Bi-polar, 125 volts.

### ALTERNATING-CURRENT GENERATORS

Two 300 K. W. 60-cycle three-phase General Electric, direct connected to two 16 and 32x30 McIntosh & Seymour Engines.
Two 120 K. W. 60-cycle single-phase General Electric.
One 75 K. W. 133-cycle single-phase Westinghouse.

### FEED WATER HEATERS

One 1,250 H. P. Cochrane Open-feed Water Heater.
One 1,500 H. P. Warren Webster Open-feed Water Heater.
One 500 H. P. Otis Closed-feed Water Heater.

### BOILER FEED PUMPS

One 10x7x12 Smith & Vaile Duplex.
Two 10x6x10 Smith & Vaile Duplex.
Two 7½x4½x10 Worthington Duplex.
One 12x7x10 Smith & Vaile Duplex.
One receiving tank and float controlling a 5½x4⅝x5 Worthington Duplex.

### BELTS

12 inches to 28 inches wide.
One Self-supporting Steel Stack, 75 feet high, 9 feet in diameter.

**THE EDISON ILLUMINATING COMPANY**
**DETROIT, MICHIGAN**

### FOR SALE CHEAP.

**Machinery as follows: From 19th and Nicholas:**
2 250-h.p. Westinghouse Compound engines with all steam and exhaust pipe connections.
Line shaft 5 in. diameter, 32 ft. long.
5 Stands, 5 Pulleys 60 in. diameter.
1 600-h.p. Allis Cross-Compound Engine with all steam and exhaust pipe connections.
Line shaft 7 in. diameter, 61 ft. long.
7 Stands, 7 Pulleys 60 in. diameter.
1 Belt Tightener for 60 in belt.
1 Belt 60 in.x118 ft. long.
4 Belts 14 in.x60 ft. long.
3 Belts 14 in.x52 ft. long.
3 Belts 14 in.x65 ft. long.
1 Belt 14 in.x78 ft. long.
1 Boiler Feed Pump.
2 Heaters with all steam and exhaust connections.
4 Boilers 16x66.
6 Boilers 16x60 with all steam pipe connections.

**From 22nd and Nicholas.**
2 John Moore Boilers 16x60.
3 Allis Boilers 16x60.
1 Wilson & Drake Boiler 18x72, with all steam pipes fronts, grates and fixtures complete.
2 Boiler Feed Pumps.
1 20x48 Allis Coplis Engine.
1 28x48 Allis Corliss Engine.
1 Allis Heater with all steam pipe connections.
7 D. 62 T. & H. Generators.
1 Belt 40 in.x122 ft. long.
1 Belt 34x114 ft. long.
7 Generator Belts.
All line shafting, pulleys, stands and clutches complete.

**From Council Bluffs.**
Boilers 32x14, with all steam pipe connections, fronts, grates and heater.
No. 5 Knowles' Boiler Feed Pump.
Westinghouse Engines 16x27x16, with all steam and exhaust pipe connections.
(Two of above engines at Armour Packing Co., South Omaha.)
3 D. Generators.
Line shaft, pulleys, clutches and belts.
We are very anxious to sell these goods as quickly as possible before we dismantle them; we can afford to make much better prices if we do not have to take them down and store them.

**ALLEN P. ELY & CO.,**
1110 Douglas Street - - - Omaha, Neb.




**BOSSERT'S BOXES**
Drawn steel. One blow of a hammer gives clean round hole. No filing.
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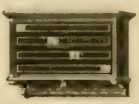

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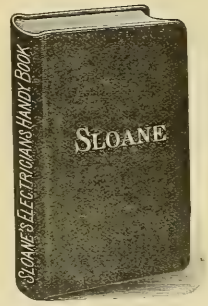


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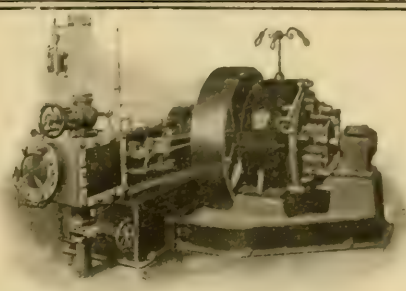

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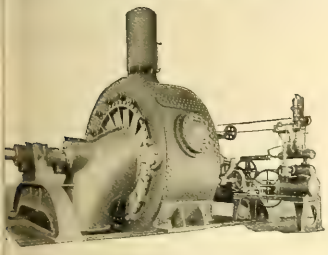

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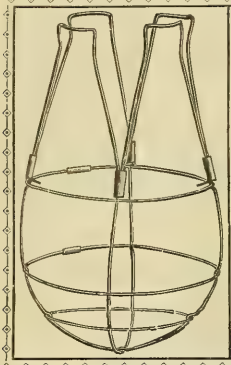

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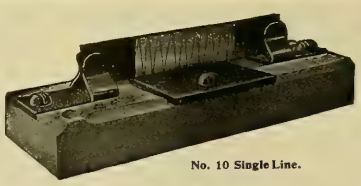

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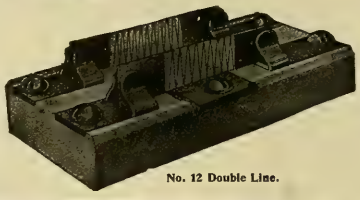

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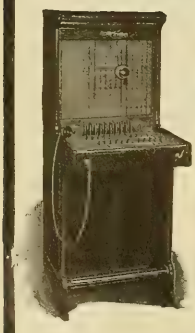

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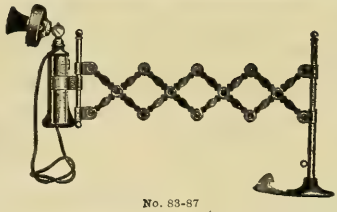

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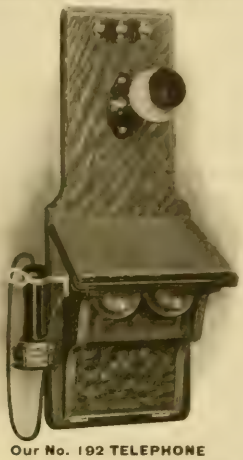

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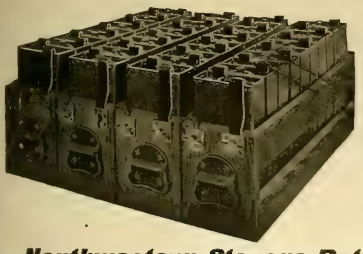

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**Alternating and Direct Current**

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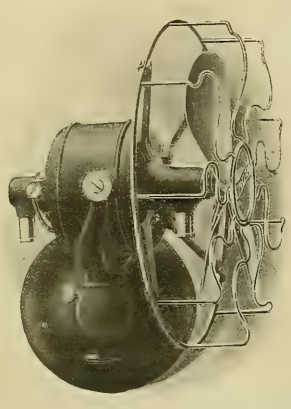

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**Adjustable Speeds**

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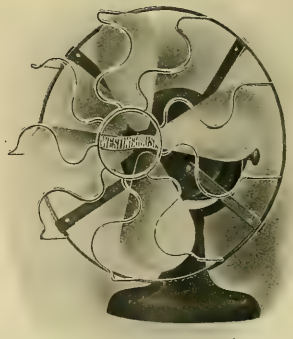

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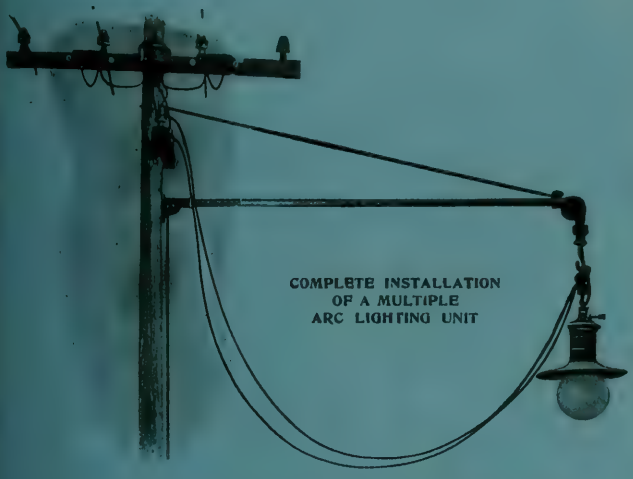
## ALTERNATING CURRENT STREET LIGHTING SYSTEM



COMPLETE INSTALLATION OF A MULTIPLE ARC LIGHTING UNIT

**The Fort Wayne Multiple System of alternating current enclosed arc street lighting was designed to fill a very frequent demand for a simple, inexpensive method of lighting small towns or isolated sections of larger places.**

It is a 3-wire single-phase high-tension transmission system with a 2-wire or 3-wire secondary distribution for incandescent lighting and a 2-wire multiple arc lighting circuit for each lamp.

The arc lighting circuit consists of one of the incandescent mains and an additional third wire connected at the switchboard to the other side of the incandescent lighting circuit through a single-pole switch.

**In many instances it is desirable to locate arc lamps in places where arc circuits are not installed. In such cases a Type MA transformer with Form C arc lamp is installed directly on the incandescent primary circuit.**

This requires no extra expense for special wiring or extension of arc light circuit already in use elsewhere. In installing this system a third wire is run with the two wires for incandescent lighting and the arc lighting unit connected between the third wire and one of the incandescent wires. The only extra station equipment is one switch controlling the arc circuit.

**There are no regulating devices in the station except the switch, and nothing to get out of order or cause trouble in any way on the line or in the station. The arc lamp transformers furnish the regulation and protection to lamps.**

**This System is Worth Investigating. Write us.**

## Fort Wayne Electric Works

"WOOD" LIGHTING AND POWER SYSTEMS FORT WAYNE, INDIANA

221

### A Few Advantages of the Multiple Street Arc Lighting System

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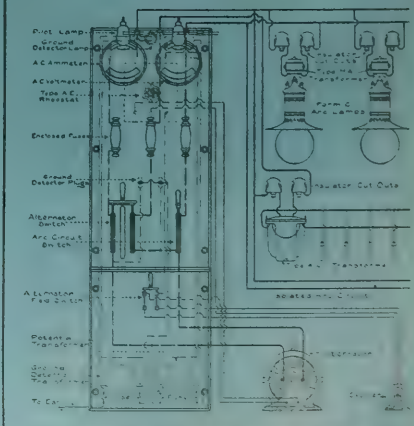
2. Extreme simplicity.
3. Efficiency the same for all loads.
4. Power factor the same for all loads.
5. Absolute cut-outs are not required with the lamps.
6. Lamps of various candle-powers can be installed on the same circuit.
7. The number of lamps that can be installed on a circuit is limited only by generator capacity.
8. Station appliances reduced to a minimum, which reduces first cost of installation.
9. Lamp in secondary or low-tension circuit is safe to handle, and insulation strain is reduced to a minimum.
10. Trouble with one lamp will not interfere with the operation of any other lamps of the system, as they are independent units.
11. Primary and secondary coils separated from each other by air space obviates chance of electrical connection between them.
12. Apparent energy varies directly with the number of lamps in operation, which always maintains the consumed generator capacity at a minimum.
13. Arc lamps can be placed in suburban districts without extra expense for wiring, as the transformer and arc lamp can be operated directly from the incandescent mains.
14. Transformer maintains practically constant energy in secondary with wide variations of resistance in secondary circuit. It can be short-circuited without damage to either transformer or arc light.



General Plan of Multiple Alternating-Current Street Arc Lighting System.

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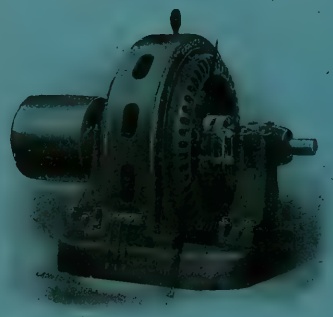

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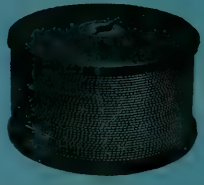

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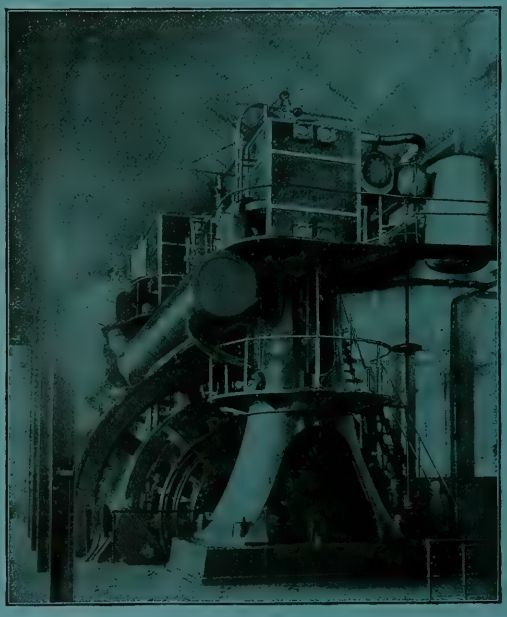

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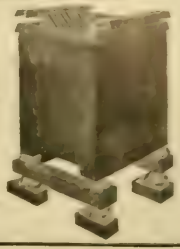

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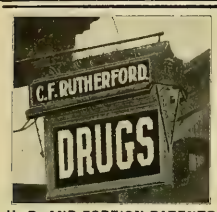


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217
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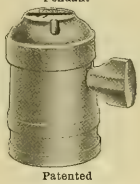

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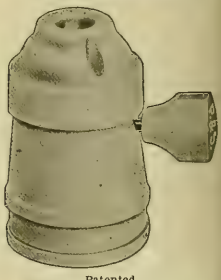
September 8, 1896
October 6, 1896

317
For Re-inforced Cord



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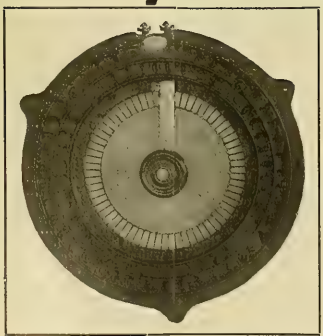

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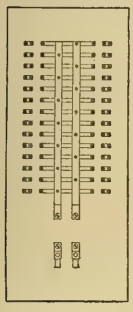

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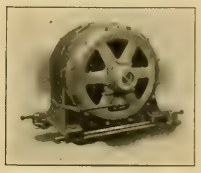

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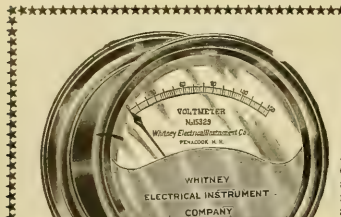


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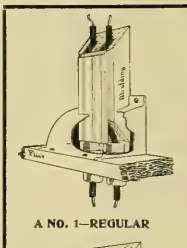
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D. & W. Fuse Company.
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Manhattan Elec. Supply Co.
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Munsell & Co., Eugene.
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Mica Insulator Co.
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Walsh's Sons & Co.

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Plume & Atwood Mfg. Co.

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Perkins Elec. Switch Mfg. Co.
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Central Electric Co.
Century Electric Co.
Chicago Edison Co.
Electric Appliance Co.
General Electric Co.
Manhattan Elect'l Supply Co
Wesco Supply Co.
Western Electric Co.

**Switchboards.**
Bissell Co., The F.
Gen. Incan. Arc Light Co.

**Telephones, Telephone Material and Switchboards.**
American El. Telephone Co
Automatic Electric Co.
Bissell Co., The F.
Central Electric Co.
Central Tel. & El. Co.
Electric Appliance Co.
International Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co.
Manhattan Elec. Supply Co.
Stromberg-Carlson Tel. M.Co
Wesco Supply Co.
Western Electric Co.

**Time Switches.**
Bissell Co., The F.

**Tools.**
Klein & Sons, Mathias.
Western Electric Co.

**Transformers.**
Central Electric Co.
Crawfordsville Electric Co.
Crocker-Wheeler Co.
Electric Appliance Co.
Ft. Wayne Elec. Works, Inc.
General Electric Co.
Gregory Electric Co.
Kuhlman Electric Co.
Manhattan Elec. Supply Co.
National Electric Co.
Stanley Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Trucks, Electric Car.**
General Electric Co.
Westinghouse El. & Mfg. Co.

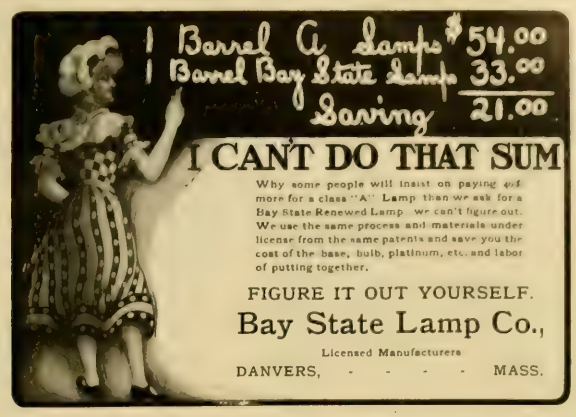
**Turbines, Steam.**
Allis-Chalmers Co.
General Electric Co.
Westinghouse El. & Mfg. Co

**Turbine Water Wheels**
Leffel & Co., Jas.

**Vulcanized Fibre.**
Vulcanized Fibre Co.

**Wires & Cables—Magnet Wires.**
American Electrical Works.
Bissell Co., The F.
Central Electric Co.
Chicago Insulated Wire Co.
Crescent Ins. Wire & Cble. Co
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
Indiana Rub. & Ins. Wire Co
India Rubber & Gutta Percha Insulating Co.
Kellogg Switch. & Sup. Co.
Manhattan Elec. Supply Co.
Marion Ins. Wire & Rub. Co.
National India Rubber Co
New York Insulated Wire Co.
Northern Wire & Cable Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co
Roebling's Sons Co., J. A.
Runzel-Lenz Elec. Mfg. Co.
Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Standard Underground C. Co
Wesco Supply Co.
Western Electric Company.


For Alphabetical Index of Advertisements See Page 3.




# LUNDELL UNIVERSAL MOTORS

National

TRADE MARK

## National Electric Company Milwaukee.

**District Offices**
New York, 135 Broadway.
Chicago, Old Colony Bldg.
Philadelphia, 1509 Land Title Bldg.
Pittsburg, Farmers' Bank Bldg.
Atlanta, Ga., Empire Bldg.
New Orleans, La., Hibernia Bank Bldg.

**Sales Offices**
Cleveland, Barton, Stevenson & Co.
Detroit, Miller-Seldon Electric Co.
St. Louis, 320 Chemical Bldg.
Denver, Hendrie & Bolthoff Mfg. and Supply Co.
Seattle and San Francisco, Kilbourne & Clark Co.

# HENRY NEWGARD & CO.

## ELECTRICAL CONSTRUCTION

**Power and Light Plants. Switchboards and Panel Boards.**

We install Municipal and Isolated Electric Lighting Plants.
We manufacture Switchboards, Table boards, Iron Cutout Boxes and Electrical Specialties.
We sell Dynamos, Motors and Electrical Supplies.
We wire old as well as new Residences, Factory Buildings, School and College Buildings.

**87 Fifth Avenue, Chicago, Illinois.**

# THE BEST BRAZING TORCH

FOR ELECTRICIANS

## HOTTEST ON EARTH

The Turner 4B Gasoline Brazing Torch is used by all mechanics for light work in brazing, annealing, tempering and drawing temper of small tools, etc. This torch produces an intensely hot, pointed flame of over 3,000° Fahr. Burns 4 hours from one filling.

**PRICE $4.50 NET**

**THE TURNER BRASS WORKS**
**23 N. Franklin St., Chicago**

Grimshaw

Raven White Core

Raven Black Core

**ALL OUR WIRES** pass inspection and carry the above **TRADE-MARKS** on our tags. We also manufacture **Grimshaw** and **Competition Tapes** and **Splicing Compounds.**

# NEW YORK INSULATED WIRE COMPANY,

MAIN OFFICE: 114, 116 & 118 Liberty St., New York.
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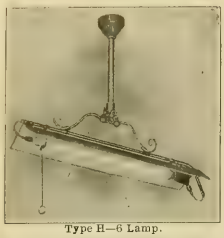
GRAND PRIZE WORLD'S FAIR, ST. LOUIS

# COLUMBIA

CARBONS BATTERIES BRUSHES

NATIONAL CARBON COMPANY CLEVELAND, O.



Type H—6 Lamp.

## Cooper Hewitt
### Mercury Vapor Lamps

are being adopted wherever wide diffusion of light is necessary. In the new New York Times Building these lamps are used in the press rooms several stories below ground and the Butterick Publishing Co. have installed it with great success in several departments.

There is no consumption of the light-giving element; no trimming is required.

Twice the efficiency of the arc lamp and from 7 to 9 times the efficiency of the incandescent.

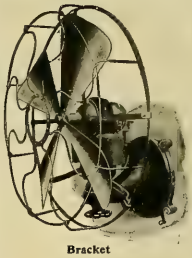
For use on all direct-current systems.

## THE LIGHT TO WORK BY

**For use in Factories, Machine Shops, Warehouses, Covered Piers, Draughting Rooms, Offices, Press and Composing Rooms and for Photographic and Engraving Work and Blue Printing.**

## Cooper Hewitt Electric Co.

220 West 29th Street, NEW YORK CITY
PHILADELPHIA OFFICE: 1121 Walnut St.



Bracket

## W. E. FAN MOTORS

**All Voltages**
**All Circuits**

Desk

Ceiling

**Write for Our New Fan Motor Catalogue**

## Western Electric Company

CHICAGO NEW YORK
OTHER LARGE CITIES

**"Flexduct" is that high standard required in all high-class work. It is very flexible, a high insulation and indestructible**

# FLEXIBLE CONDUIT

**"Flexduct" the National Code Standard. It does not deteriorate, always usable to highest degree**

## OSBURN FLEXIBLE CONDUIT COMPANY,

**NEW YORK CHICAGO SAN FRANCISCO**

## Preeminently the Storage Battery

It costs no more than the Cell Type.

It has comparatively, considerably more active material and occupies less space (about half that required by Cell Type).

It is far more durable—is cleaner and more economical in operation and much less expensive in cost of maintenance.

Besides, this important fact must not be overlooked: There are no annoying and destructive fumes as with the Cell Type. The gas does not escape, therefore no corrosion of adjacent pipe or iron work or even the tarnishing of bright metal work.

## TRAY PLATE BATTERY CO.

**Successors Smith Storage Battery Co.**

**5-11 FREDERICK ST., BINGHAMTON, N. Y.**

# McRoy Conduits.

"ROOKERY"—Chicago

# GRAND PRIZE

**The Highest Possible Award**

**Has Been Given to**

ELECTRA

TRADE MARK

## HIGHEST GRADE NUERNBERG CARBONS

**By the International Jury of Awards, of the Louisiana Purchase Exposition, St. Louis, 1904.**

**HUGO REISINGER, Sole Importer, 11 BROADWAY, NEW YORK**

# "Diamond H" Switches

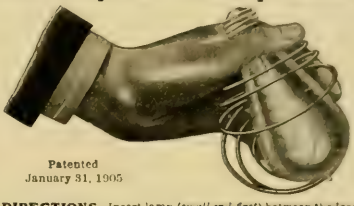
Trade H Mark

This Trade-Mark guarantees quality.

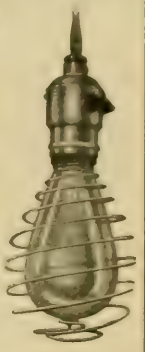
The Hart Mfg. Co., Hartford, Conn.

New York Boston Chicago Toronto, Ont.

## The "Spiral" Lamp Guard



Patented
January 31, 1905



**DIRECTIONS**—Insert lamp (*small end first*) between the *largest* helices in the manner shown above, and place the tip of lamp in the eye of the guard. **"IT'S SPRINGY ALL OVER"**

The simplest and best guard on the market. Each guard compressed and put up in a 4x4 in. Manila envelope. 6 gross in a barrel. Easy to handle. Convenient for stock. :: Write for free sample and prices.

**S. H. COUCH CO., Inc., 156 Pearl St., Boston, Mass.**

TEL. 4626 MAIN

# General Electric Company

*MANUFACTURES*

**A Most Complete Line of**

## National Electrical Code Standard Enclosed Fuses and Cut-Outs

**From 30 to 600 Amperes, in both the 250 and 600 Voltages**

600 Amp., 600 Volt

30 Amp. 250 Volt

## GENERAL OFFICES: SCHENECTADY, N. Y.

Chicago Office, Monadnock Block. Sales Offices In All Large Cities.

# In The Spring

There will be a great many street-lighting contracts expire.
In figuring on new contracts you will want prices on Series Alternating Arc Lamps.
You will want a system that has been tried and not found wanting.
You will want Adams-Bagnall Arc Lamps.

**ELECTRIC APPLIANCE COMPANY**
Electrical Supplies
Chicago and San Francisco

INSURE
RELIABLE
LIGHTING RESULTS
BY ORDERING EDISON LAMPS

Exclusively used by most discriminating purchasers

All types and varieties
Regular Multiple Lamps
Street Series Lamps
Miniature Lamps.

General Electric Company
MAIN LAMP SALES OFFICE
Harrison, N. J.

(9)

**BEARDSLEE CHANDELIER MFG. CO.** 256 AND 257 SO. CANAL ST. CHICAGO
GAS & ELECTRIC FIXTURES FOR THE TRADE.
CATALOG SENT PREPAID TO DEALERS — MENTION THIS PAPER

**SPARKING** *Reduces the working capacity of a motor or dynamo, wears out the commutator, wastes power and may cause a fire. All this may be avoided if you use . . . . . .*

The only article that will PREVENT SPARKING. Will keep the Commutator in good condition and PREVENT CUTTING.

Absolutely Will Not Gum The Brushes.

It will put that high gloss on the Commutator you have so long sought after.

50 Cents per Stick. $5.00 per Dozen.
*SEND FOR FREE SAMPLE STICK*
For sale by all supply houses, or
K. McLENNAN & CO., Sole Mfrs., Room 411, Inter Ocean Bldg., 130 Dearborn St., Chicago

**MICA** Of all Qualities, in any Form at Lowest Prices
EUGENE MUNSELL AND CO.
NEW YORK and CHICAGO

**INSULATION** That Is.
Micanite, Linotape, M. I. C. Compound, Empire Cloth and Paper. For Years the Standard.
**MICA INSULATOR CO., Originators**
NEW YORK and CHICAGO

**VOLT - AMMETERS**
POCKET SIZE
For testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.
RELIABLE. - ACCURATE.
Send for Circular.
L. M. PIGNOLET
78-80 Cortlandt St., New York, N. Y.

LET US HAVE YOUR INQUIRIES WHEN IN NEED OF MICA OF ANY DESCRIPTION— WE CAN GIVE YOU WHAT YOU NEED QUICK AND AT THE RIGHT PRICES.
CHICAGO MICA CO., VALPARAISO, IND.

**REPAIRING**
**RECALIBRATING**
ELECTRIC METERS.
INTERNATIONAL ELECTRIC METER CO.
330 W. RANDOLPH STREET, CHICAGO.

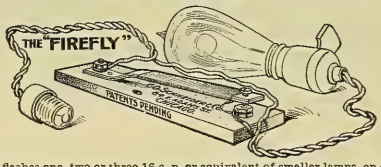
**Warren Alternator**

Acme of Electrical Perfection,
Mechanical Simplicity,
Regulation,
Efficiency.

WE GUARANTEE WHAT WE SELL AND SELL WHAT WE GUARANTEE

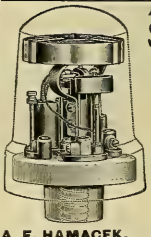
WARREN ELECTRIC MFG. CO.
Sandusky, O.

**A MOTORLESS FLASHER**




Automatically flashes one, two or three 16 c. p. or equivalent of smaller lamps, on either direct or alternating current. Contacts are heavy platinum and will wear indefinitely. Requires no attention and has nothing to get out of order. PRICE $2.00 EACH. Write for discount to the trade.
C. O. Schneider & Co., Mfrs. 84 E. Adams St., Chicago

**AUTOMATIC SERIES ARC CUT-OUT**



For Power, St. Ry., A. C. and D. C. Series Circuits.
A. F. HAMACEK, CHICAGO, ILL.
2039 KENMORE AVE.

M. KLEIN & SON.
Send 2c stamp for new catalogue No. 6 of
**KLEIN'S TOOLS**
*For Electrical Workers and Line Builders.*
MATHIAS KLEIN & SONS,
81 W. Van Buren St., Chicago, Ill.

**Cope's Patent Quick Coupling Conduit Rod**

Remember these rods have no lost motion.
These Couplings are of Steel and are made in the best possible manner.

Write for list of persons using these rods—20,000 sold since May 1902. Made in 3 ft. and 4 ft. lengths.
Price, 3 ft. 75 cents, 4 ft. 85 cents.
Patented February 24, 1903.

T. J. COPE
3244 North Fifteenth Street PHILADELPHIA, PA.

**DON'T BUY ELECTRICAL SUPPLIES**

Until you have seen our new Catalogue and new Price List.
Free to the trade.

Manhattan Electrical Supply Co.
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USE
**"SAFETY" RUBBER COVERED WIRE AND CABLE**
FOR EVERY ELECTRICAL SERVICE.
**M. B. AUSTIN & CO.,**
CHICAGO REPRESENTATIVE.
**THE SAFETY INSULATED WIRE & CABLE CO.,**
WORKS: Bayonne, N. J. 114-116 LIBERTY STREET, N. Y.

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LEATHER NAIL HEADS, BELTS, SAFETY AND CLIMBER STRAPS
1130 ST. PETER STREET,
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PROVIDENCE, R. I.

BARE AND INSULATED ELECTRIC WIRE,

ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,
**Railway Feeder and Trolley Wire,**
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
CABLES FOR AERIAL AND UNDERGROUND USE.

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Chicago Store, F. E. Donohoe, 82 Lake St.
Montreal Branch, Eugene F. Phillips' Electrical Works.
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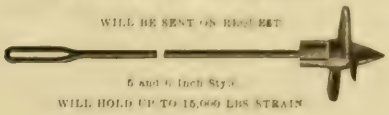
IS THE TITLE OF OUR NEW CATALOGUE ON

**STOMBAUGH GUY ANCHORS**

IT IS TO BE ISSUED MARCH FIRST AND WILL CONTAIN MUCH OF INTEREST TO THOSE WHO HAVE POLES AND OTHER THINGS TO ANCHOR

WILL BE SENT ON REQUEST



5 and 6 Inch Style
WILL HOLD UP TO 15,000 LBS STRAIN

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MANUFACTURERS
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ELECTRICITY MECHANICS PATENT CAUSES
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**CENTURY ELECTRIC CO.**
MANUFACTURERS OF
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**MOTORS AND CEILING FANS**
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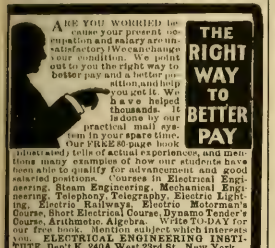

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Motor Starter with Automatic Release. Manufactured under our own patents.

**MOTOR STARTERS, SPEED REGULATORS, FIELD REGULATORS**

EQUIPPED WITH RENEWABLE SEGMENTS WITHOUT EXTRA CHARGE

And Special Controlling Devices of all Kinds. Send for catalogue and discounts.

**UNION ELECTRIC MFG. CO.,**
Milwaukee, Wis.

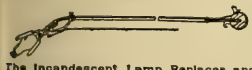
**PRICE $10 LIST**

From 0 to 60 Amperes
Also made up to 400 Amperes.
FOR A. C. and D. C. WORK
DISCOUNT TO THE TRADE.
WRITE FOR CIRCULARS

**RELIANCE INSTRUMENT CO.**
60-68 W. Van Buren St., Chicago.

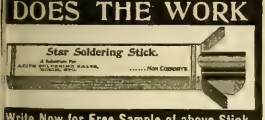
**SINGLE AND POLYPHASE**
**TRANSFORMERS**
KUHLMAN ELECTRIC CO., - - Elkhart, Ind.

**CONTINUOUS RAIL JOINT CO. OF AM.**
NEWARK, N. J.
**OVER 20,000 MILES IN USE**
The St. Louis Exposition, 1904, awarded us the only gold medal for rail joint products.



The Incandescent Lamp Replacer and Cleaner replaces and cleans any c. p. lamp at any height or angle.
Incandescent Electric Light Manipulator Co.,
116 Bedford St., Boston, Mass.

**DOES THE WORK**




Write Now for Free Sample of above Stick
Convenient—Non-Corrosive—Effective
We also make the famous Crolius Commutator Compound; eliminates sparking and all commutator troubles. Free sample on request.
E. R. CROLIUS & SON
6419 Peoria Street - CHICAGO, ILL.

**NATIONAL CODE STANDARD**

WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Ideal Wire.
Prices and Samples on Application.

**Phillips Insulated Wire Co.**
Office and Factory: PAWTUCKET, R. I.

**YOST SPECIALTIES.**

*Sockets, Wall Sockets, Weatherproof Sockets, Rosettes, Receptacles, Cord Adjusters.*

*Catalogue for the asking.*

**THE YOST ELECTRIC MFG. CO.**
TOLEDO, OHIO.

**ELECTRIC MACHINES IN STOCK-READY FOR IMMEDIATE SHIPMENT**

431

WE carry at our works a comprehensive line of new dynamos and motors—standard sizes, voltages and speeds. Extensive stocks at principal industrial centers. Wire us your requirements. Our manufacturing facilities enable us to make prompt deliveries on apparatus not standard—we will hurry your work with all speed consistent with good, careful work.

*Motor Booklet No. 2538*

NORTHERN ELECTRICAL MFG. CO. ENGINEERS MANUFACTURERS
Madison, Wis., U. S. A.
425 Monadnock Block, CHICAGO

The fact that a youngster is born with a wooden leg does not conclusively prove that its sire fought and bled for his country.

The fact that a man buys a particular headache powder at the corner pill shop does, however, conclusively prove that that particular headache powder is well advertised.

Whether you want to buy a steam engine, a dynamo, or a cake of soap, you will buy that which is extensively advertised. It is not necessarily the best, although advertised most, but as a rule the best things are advertised best and most.

If you want to buy, you will make no mistake in buying that which is extensively advertised.

If you want to sell—and have something of merit—advertise it first, last and all the time—and chuckle as your business grows. Most pessimists advertise little or not at all. Most optimists advertise much.

Advertising in the Western Electrician makes optimists of pessimists and substitutes smiles for frowns.

**WANTED, FOR SALE** *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 3c each.* **POSITION WANTED** *advertisements (50 words or less), $1.00 an insertion; additional words 2c each.*

## POSITION WANTED.

All-around electrician and steam engineer as superintendent of a lighting and power plant. Have indicator and electric testing instruments, eight years' practical experience in constructing and operating central stations. Best references, married, thirty years old, temperate, reliable, know the business thoroughly and can put your system on a paying basis. Address box 446, care of Western Electrician, 510 Marquette Bldg., Chicago.

## POSITION WANTED.

In plant either steam or water power. Several years all around experience. Expert meter reader. Would consider position reading meters, or would take charge of plant. No less than $65.00 per month considered. Married man, steady and do not drink. Address BOX 447, care of Western Electrician, 510 Marquette Bldg., Chicago.

## FOR SALE.

Electric-light plant in a growing county seat town of 3,000 population in eastern Iowa. Good water power, also steam for emergency. 150 H.P. Corliss engine; franchise and city contract. This is worth investigating, as owner must go to different climate. Address BOX 445, care of Western Electrician, 510 Marquette Bldg., Chicago.

## FOR SALE CHEAP.

**Machinery as follows: From 19th and Nicholas:**

2 250-h.p. Westinghouse Compound engines with all steam and exhaust pipe connections.
Line shaft 5 in. diameter, 32 ft. long.
5 Stands, 5 Pulleys 60 in. diameter.
1 600-h.p. Allis Cross-Compound Engine with all steam and exhaust pipe connections.
Line shaft 7 in. diameter, 61 ft. long.
7 Stands, 7 Pulleys 60 in. diameter.
1 Belt Tightener for 60 in belt.
1 Belt 60 in.x118 ft. long.
4 Belts 14 in.x60 ft. long.
3 Belts 14 in.x52 ft. long.
3 Belts 14 in.x65 ft. long.
1 Belt 14 in.x78 ft. long.
1 Boiler Feed Pump.
2 Heaters with all steam and exhaust connections.
4 Boilers 16x60.
2 Boilers 16x60 with all steam pipe connections.

**From 22nd and Nicholas.**

2 John Moore Boilers 16x60.
3 Allis Boilers 16x60.
1 Wilson & Drake Boiler 18x72, with all steam pipes fronts, grates and fixtures complete.
2 Boiler Feed Pumps.
1 20x48 Allis Corliss Engine.
1 28x48 Allis Corliss Engine.
1 Allis Heater with all steam pipe connections.
7 D. 62 T. & H. Generators.
1 Belt 40 in.x122 ft. long.
1 Belt 34x114 ft. long.
7 Generator Belts.
All line shafting, pulleys, stands and clutches complete.

**From Council Bluffs.**

Boilers 52x14, with all steam pipe connections, fronts, grates and heater.
No. 5 Knowles' Boiler Feed Pump.
Westinghouse Engines 16x27x16, with all steam and exhaust pipe connections.
(Two of above engines at Armour Packing Co., South Omaha.)
3 D. Generators.
Line shaft, pulleys, clutches and belts.

We are very anxious to sell these goods as quickly as possible before we dismantle them; we can afford to make much better prices if we do not have to take them down and store them.

**ALLEN P. ELY & CO.,**
**1110 Douglas Street - - - Omaha, Neb.**

## GUNS

**Civil War Relics and Curios $7.00 each** or in exchange for scrap lead, copper, brass, iron, paper, etc. Write for catalogue.
**Walsh's Sons & Co., Newark, N.J**

## FOR SALE

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| 1-360 | K. W. | General Electric | Alternator, | Three Phase |
| 1-240 | " | Westinghouse | " Single | " |
| 2-150 | " | Warren | " " | " |
| 1-150 | " | Westinghouse | " " | " |
| 1-150 | " | Wood | " " | " |
| 1-150 | " | Stanley | " " | " |
| 1-120 | " | General Electric | " Three | " |
| 1-120 | " | General Electric | " Single | " |
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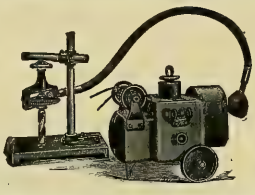

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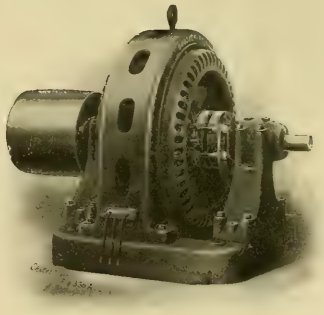

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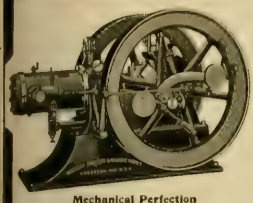

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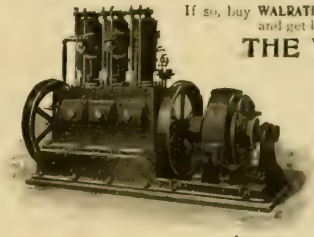

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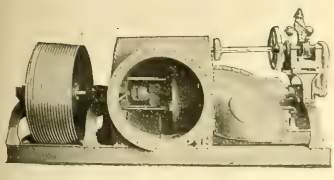

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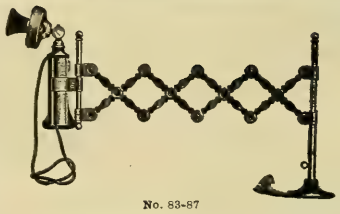

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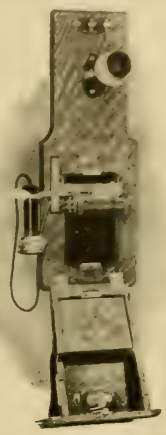

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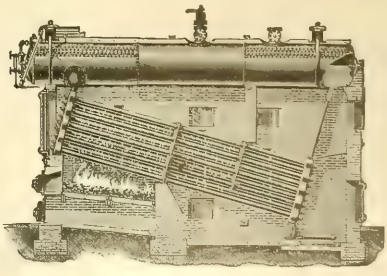

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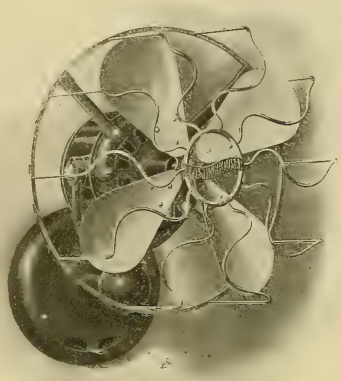

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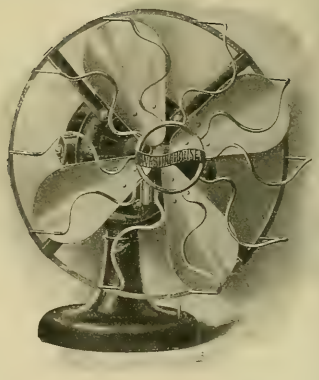

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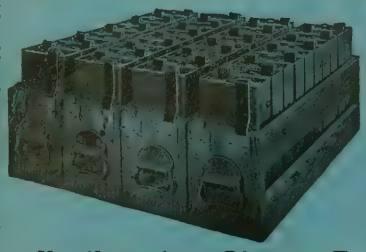

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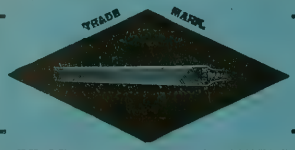


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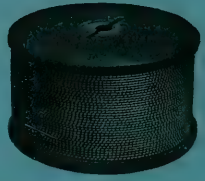

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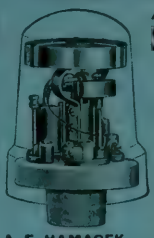

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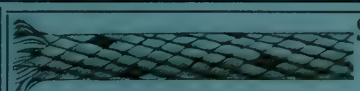

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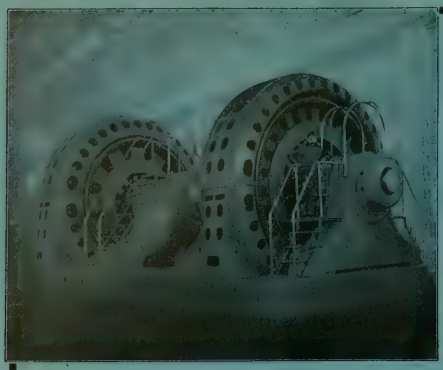

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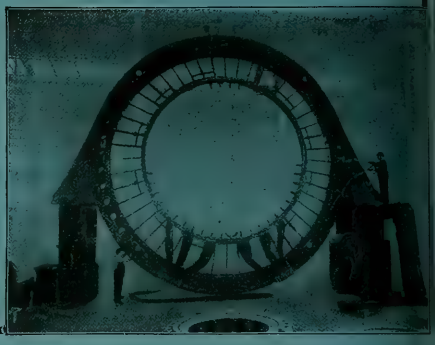

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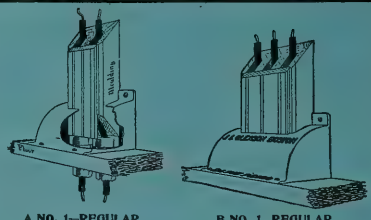

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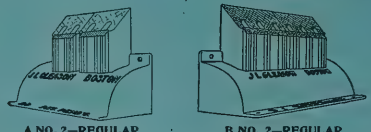

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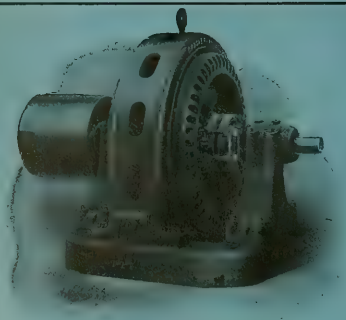

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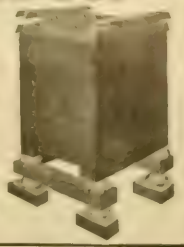

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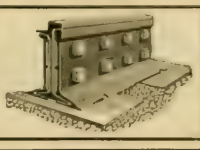

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**UNIVERSAL EXPOSITION**
ST. LOUIS, 1904


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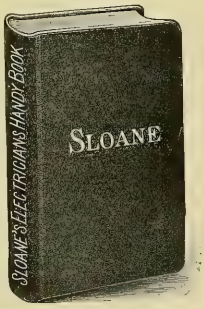


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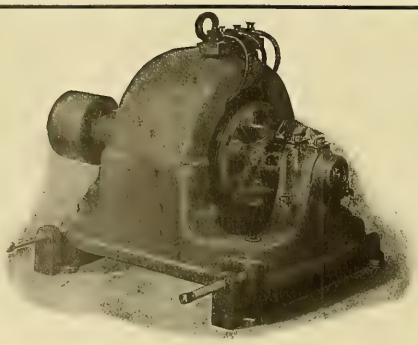

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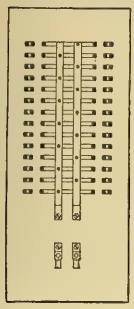

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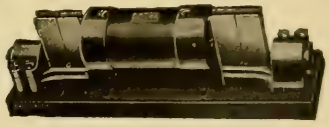

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Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Lamps, Arc.**
Bissell Co., The F.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Gregory Electric Co.
Hipwell Manufacturing Co
Manhattan Elec. Supply Co.
Stanley Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Lamps, Incandescent.**
Bay State Lamp Co.
Bissell Co., The F.
Bryan-Marsh Company.
Buckeye Electric Company.
Central Electric Co.
Chicago Edison Co.
Columbia Incan. Lamp Co.
Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
Fostoria Incand. Lamp Co.
Franklin Electric Mfg. Co.
General Electric Co.
Nernst Lamp Co.
Sawyer-Man Elec. Co.
Standard Elec'l Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Lamps, Incandescent—Replacers & Cleaners.**
Inc. El. Lt. Manipulator Co.

**Lamps, Nernst.**
Nernst Lamp Co.

**Lamps, Vapor.**
Cooper, Hewitt Elec. Co.

**Leather Specialties.**
Bunge, Otto.

**Letters, Metal, Sign.**
Haller Machine Co.

**Lightning Arresters.**
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Manhattan Elec. Supply Co.
Stanley Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.

**Linemen's Climbers.**
Klein & Sons, Mathias.

**Lubricating, Oil, Grease.**
Richardson Lubricating Co.

**Magnet Wires.**
(See Wires and Cables.)

**Mechanical Draft.**
Green Fuel Economizer Co.

**Mica.**
Chicago Mica Co.
Mica Insulator Co.
Munsell & Co., Eugene.

**Mining Apparatus, Elec.**
Allis-Chalmers Company.
Crocker-Wheeler Company.
General Electric Co.
Jeffrey Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Motors.** (See Dynamos and Motors.)

**Nippers and Pliers.**
Klein & Sons, Mathias.

**Nozzles.**
Faries Mfg. Co.

**Overalls.**
Carhartt & Co., Hamilton.

**Patent Attorneys.**
Bain, Force.

**Phosphor Bronze.**
Phosphor Bronze Sm. Co. Ltd.

**Platinum, Wire and Sheet.**
Baker & Company Inc.

**Poles and Ties.**
Berthold & Jennings.
Brooks, Hall L.
Columbia Mfg. Co.
Fowler, John H.
Fowler-Jacobs Company.
Kellogg Switch. & Sup. Co.
Lindsley Bros. Co.
Loud's Sons Co., H. M.
Maltby Cedar Co.
Mueller Company, William.
Pacific Coast Pole Co.
Perrizo & Sons.
Phelan, D. W.
Pittsburg & L. S. Iron Co.
Porter Cedar Company.
Sterling & Son, W. C.
Torrey Cedar Co.
Valentine-Clark Co., The.
Worcester Co., C. H.

**Polish (Metal).**
Allen Co., Inc., L. B.
Hoffman, Geo. W.

**Portables.**
Faries Mfg. Co.

**Power Transmission Machinery.**
Jeffrey Mfg. Co.

**Rail Joints.**
Continuous Rail Joint Company of America.

**Railway Supplies.**
Wesco Supply Co.

**Re-Winding—Repairs.**
Chicago Edison Co.
Gregory Electric Co.

**Rheostats.**
Amer. Electric Fuse Co.
Cutler-Hammer Mfg. Co.
General Electric Co.
Union Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Rods, Conduit.**
Cope, T. J.

**Schools and Colleges.**
Electrical Engineer Inst.
Highland Park College

**Second-Hand Mach'y.**
Bissell Co., The F.
Cent. Tel. & El. Improvement Co.
Ely & Co., Allen P.
Gregory Electric Co.
Matthews & Bro., W. N.
Walsh's Sons & Co.

**Shades, Lamp.**
Faries Mfg. Co.

**Sheet Brass & Copper.**
Plume & Atwood Mfg. Co.

**Signs, Electric.**
Haller Machine Co.
Western Display Co.
Zero Marx Sign Works.

**Silks, Insulating and Braiding.**
Sauquoit Silk Mfg. Co.

**Sockets & Receptacles.**
Pass & Seymour.
Perkins Elec. Switch Mfg. Co.
Yost Elec. Mfg. Co.

**Soldering Sticks, Salts and Paste.**
Chicago Solder Co.
Crolius & Son, E. R.
Western Electric Co.

**Speaking Tubes.**
Central Electric Co.
Edwards & Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.

**Specialties, Electrical Mfrs. and Designers.**
Haller Machine Co.

**Speed Indicators.**
Weston Electrical Inst. Co.

**Storage Batteries.**
American Battery Co.
Electric Storage Battery Co.
Gould Storage Battery Co.

**Supplies, General Elec.**
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Chicago Edison Co.
Electric Appliance Co.
General Electric Co.
Manhattan Elect'l Supply Co
Wesco Supply Co.
Western Electric Co.

**Switchboards.**
Bissell Co., The F.
Gen. Incan. Arc Light Co.

**Telephones, Telephone Material and Switchboards.**
American El. Telephone Co
Automatic Electric Co.
Bissell Co., The F.
Central Electric Co.
Central Tel. & El. Co.
Electric Appliance Co.
International Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co
Manhattan Elec. Supply Co
Stromberg-Carlson Tel. M.Co.
Wesco Supply Co.
Western Electric Co.

**Time Switches.**
Bissell Co., The F.

**Tools.**
Klein & Sons, Mathias.
Western Electric Co.

**Transformers.**
Central Electric Co.
Crawfordsville Electric Co.
Crocker-Wheeler Co.
Electric Appliance Co.
Ft. Wayne Elec. Works, Inc.
General Electric Co.
Gregory Electric Co.
Kuhlman Electric Co.
Manhattan Elec. Supply Co.
National Electric Co.
Stanley Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Trucks, Electric Car.**
General Electric Co.
Westinghouse El. & Mfg. Co.

**Turbines, Steam.**
Allis-Chalmers Co.
General Electric Co.
Westinghouse El. & Mfg. Co

**Turbine Water Wheels**
Leffel & Co., Jas.

**Vulcanized Fibre.**
Vulcanized Fibre Co.

**Wires & Cables—Magnet Wires.**
American Electrical Works.
Bissell Co., The F.
Central Electric Co.
Chicago Insulated Wire Co.
Crescent Ins. Wire & Cble. Co
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
Indiana Rub. & Ins. Wire Co
India Rubber & Gutta Percha Insulating Co.
Kellogg Switch. & Sup. Co.
Manhattan Elec. Supply Co.
Marion Ins. Wire & Rubb. Co.
National India Rubber Co
New York Insulated Wire Co.
Northern Wire & Cable Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co
Roebling's Sons Co., J. A.
Runzel-Lenz Elec. Mfg Co.
Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Standard Underground C. Co
Wesco Supply Co.
Western Electric Company.


For Alphabetical Index of Advertisements See Page 3.

# COLUMBIA LAMPS

## GIVE MOST LIGHT

Columbia Lamps stand for quality, uniformity and all other features so essential to the satisfactory and economical operation of Electric light plants. Place a trial order for a case or larger quantity, subject to our guarantee, and be convinced that the Columbia is all that we claim for it.

Licensed Under
Patent No. 537,693. April 16, '95
Patent No. 723,293. April 28, '03
Patent No. 444,590. Jan. 13, '91
Patent No. 532,760. Jan. 22, '95

Do not overlook the fact that Columbia Lamps will give greater total candle power (illumination from all angles) than other lamps on the market, and without any increase in current consumption.
THIS IS A FACT

LOOK FOR THE LICENSE LABEL IN THE STEM

Send for our Catalogue of Crystal Lamps (Meridian type).

We are prepared to furnish a complete line of Pagoda Reflectors and Holophane Globes. Write for prices.

Copy of our "Wallet Full of Wisdom" mailed on request.

LOOK FOR THE LICENSE LABEL IN THE STEM

## THE COLUMBIA INCANDESCENT LAMP CO.

### ST. LOUIS, MO., U. S. A.

NEW YORK: 1311 Havemeyer Bldg.
CHICAGO: Central Electric Co.
SAN FRANCISCO: Paul Seiler Elec. Works
PHILADELPHIA: 1227 Real Estate Trust Bldg.
MINNEAPOLIS: 638 Boston Block
MEMPHIS: 302 Scimitar Bldg.
MEXICO: Monterey, Van Veorhis Hnos.

REVOLVING FIELD

# ALTERNATORS

BUILT IN ALL CAPACITIES

## National Electric Company

Milwaukee.

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Chicago, Old Colony Bldg.
Philadelphia, 1509 Land Title Bldg.
Pittsburg, Farmers' Bank Bldg.
Atlanta, Ga., Empire Bldg.
New Orleans, La., Hibernia Bank Bldg.

Sales Offices
Cleveland, Barton, Stevenson & Co.
Detroit, Miller-Seldon Electric Co.
St. Louis, 320 Chemical Bldg.
Denver, Hendrie & Bolthoff Mfg. and Supply Co.
Seattle and San Francisco, Kilbourne & Clark Co.

# TRAY PLATE BATTERY COMPANY

MANUFACTURERS OF THE CELEBRATED

## PATENT TRAY PLATE STORAGE BATTERY

FOR CENTRAL LIGHTING, POWER AND ISOLATED PLANTS.

ALSO AN IMPROVED CELL TYPE BATTERY IN ALL GENERAL STYLES FOR ELECTRIC VEHICLES, SPARKING BATTERIES, ETC.

5-11 FREDERICK STREET, BINGHAMTON, N. Y., U. S. A.

"FRES-KO"

# SOLDERING STICK

ABSOLUTELY NON-CORROSIVE

The Latest Thing in Soldering Paste. SEND FOR FREE SAMPLE. You'll have the "best of it," if you do.

FRES-KO CHEMICAL CO. - Fort Wayne, Ind.

"Flexduct" is that high standard required in all high-class work. It is very flexible, a high insulation and indestructible

# FLEXIBLE CONDUIT

"Flexduct" the National Code Standard. It does not deteriorate, always usable to highest degree

## OSBURN FLEXIBLE CONDUIT COMPANY,

NEW YORK CHICAGO SAN FRANCISCO

"AMERICAN" STORAGE CELLS

ARE THE BEST. Send for descriptive Circular.

AMERICAN BATTERY CO.,

ESTD 1889. 171 S. Clinton St., Chicago.

ELECTRIC SIGN FLASHERS

BEST IN THE WORLD

Write for full particulars

Reynolds Elec. Flasher Mfg. Co

221 Fifth Ave., Chicago

The more money you spend in advertising the more money you have.
The less money you spend in advertising the less money you have.

Practical Running of Dynamos.

A little booklet on the care and the locating and remedying of troubles in dynamos and motors.

Price, 10 Cents.

Catalogue of mechanical and electrical books free.

ELECTRICIAN PUBLISHING COMPANY.
510 Marquette Bldg., Chicago.

Grimshaw

Raven White Core

Raven Black Core

ALL OUR WIRES pass inspection and carry the above TRADE-MARKS on our tags. We also manufacture Grimshaw and Competition Tapes and Splicing Compounds.

# NEW YORK INSULATED WIRE COMPANY,

MAIN OFFICE: 114, 116 & 118 Liberty St., New York.

BRANCHES: CHICAGO: 192 Desplaines St. BOSTON: 7 Otis St. SAN FRANCISCO: 32 Second St.

# McRoy Conduits.

"ROOKERY"—Chicago—

# GRAND PRIZE

**The Highest Possible Award**

**Has Been Given to**

ELECTRA

TRADE MARK

## HIGHEST GRADE NUERNBERG CARBONS

**By the International Jury of Awards, of the Louisiana Purchase Exposition, St. Louis, 1904.**

**HUGO REISINGER, Sole Importer, 11 BROADWAY, NEW YORK**

## HENRY NEWGARD & CO.

**ELECTRICAL CONSTRUCTION**

**Power and Light Plants. Switchboards and Panel Boards**

We install Municipal and Isolated Electric Lighting Plants.
We manufacture Switchboards, Tablet boards, Iron Cutout Boxes and Electrical Specialties.
We sell Dynamos, Motors and Electrical Supplies.
We wire old as well as new Residences, Factory Buildings, School and College Buildings.

**225 E. Washington St., Chicago, Illinois.**

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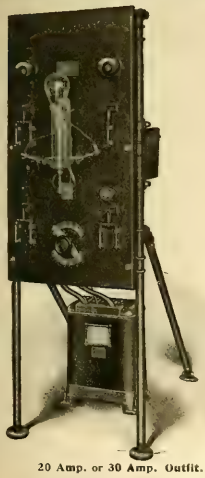
Shades
Brackets
Clusters
Portables
Canopies
Chandeliers
Nozzles
Fittings
Castings

**are UNIVERSALLY USED**

Catalog Mailed on Application

**FARIES MFG. CO.**
DECATUR, ILL.

# General Electric Company



20 Amp. or 30 Amp. Outfit.

## MERCURY ARC RECTIFIER

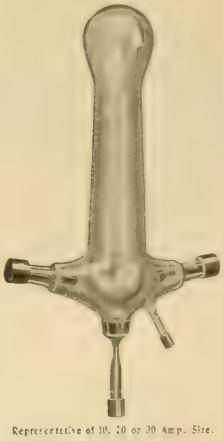
(SINGLE-PHASE)

**A simple device for changing alternating current into direct current for charging storage batteries.**

## CHARACTERISTIC FEATURES

**Simplicity — Readily operated by user on his own premises.**
**Economy in floor space.**
**High efficiency—consequent low cost of operation.**
**Large saving in first cost.**
**Peculiarly adapted to private or public charging stations.**

*AWARDED THE GOLD MEDAL AT THE LOUISIANA PURCHASE EXPOSITION.*



Representative of 10, 20 or 30 Amp. Size.

## GENERAL ELECTRIC COMPANY

**Principal Offices: Schenectady, N. Y., U. S. A.** New York Office: 44 Broad St.

SALES OFFICES IN ALL LARGE CITIES IN U. S.

# GOLD MEDAL

Awarded Dearborn Methods of Treating Boiler Waters and Dearborn Vegetable Feed-Water Treatment at the World's Fair, St. Louis.

**DEARBORN DRUG & CHEMICAL WORKS,**

27-34 RIALTO BUILDING, CHICAGO, ILL. WM. H EDGAR, President Telephone: Harrison 3930 and 3931.

# DIESEL ENGINES

Operating on CRUDE or FUEL Oil

**Guaranteed Fuel Consumption**

on variable load, ranging from ¼ to full load

**12½ Gals. per 100 Kw. Hours**

SUITABLE FOR ALL STATIONARY POWER

For further information address

**AMERICAN DIESEL ENGINE COMPANY**

11 Broadway NEW YORK

**Fuel Reduced** 10 to 20 Per Cent.

Steam + Fuel

**Steam Gained** 20 to 40 Per Cent.

**GREEN'S ECONOMIZER**

Has accomplished these results in many of the largest and most successful Electric Light and Power Plants in the world by simply utilizing the waste gases before entering the chimney

CATALOGUE EXPLAINS— FREE

**THE GREEN FUEL ECONOMIZER CO., Matteawan, N.Y.**

**JEFFREY** Elevating, Conveying, Power Transmission, Screening, Crushing Dredging, Rock and Coal Drilling, Coal Cutting, Hauling and Washing Machinery.

OUR CATALOGUES ARE YOURS FOR THE ASKING.

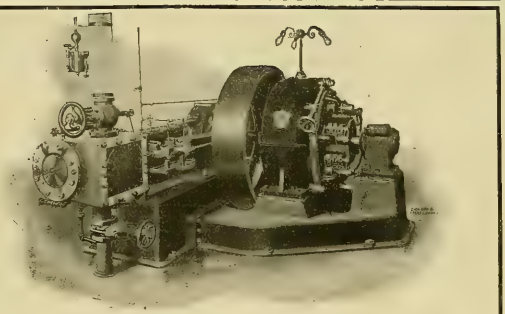
The JEFFREY MANUFACTURING CO., Columbus, O., U. S. A.

**Dixon's Pure Flake Graphite**

*As a Cylinder Lubricant*

Makes cylinders, valves and rods wonderfully smooth and bright. Reduces friction, saving oil and packing. Booklet 125C and sample upon request.

JOSEPH DIXON CRUCIBLE CO., JERSEY CITY, N. J.



The Brownell Direct-Connected Outfit.

**THE BROWNELL CO., Dayton, O.**

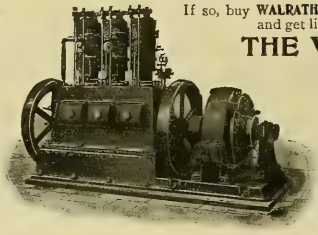
Manufacturers of Boilers, Engines, Heaters and Sheet Iron Work.

# ARE YOU LOOKING FOR MONEY?

If so, buy WALRATH GAS OR GASOLINE ENGINES and get light on the subject.

**THE WALRATH**

Received the Highest Award at the Pan-American Exposition.



It will produce as good a commercial light as that of an automatic steam engine, either belted or direct-connected generator. Simple, Economical and Reliable

Send for Catalogue W

**MARINETTE GAS ENGINE CO.,**

CHICAGO HEIGHTS, ILL.

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Strong, Carlisle & Hammond Co., 61-67 Frankfort St., Cleveland, Ohio
Mackay Engineering Co., 149 Broadway, N. Y.
C. H. Seidenglanz., 52 When Bldg., Indianapolis, Ind.

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Engineers interested in electricity should send for our complete Catalogue (mailed free to any address). Any electrical book published sent prepaid on receipt of price.

**ELECTRICIAN PUBLISHING CO., - 510 Marquette Bldg., Chicago.**

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"Phosphor Bronze"

DELTA

THE PHOSPHOR BRONZE SMELTING CO. LIMITED, 2200 WASHINGTON AVE., PHILADELPHIA.

"ELEPHANT BRAND PHOSPHOR-BRONZE" INGOTS, CASTINGS, WIRE, RODS, SHEETS, ETC.

— DELTA METAL —

CASTINGS, STAMPINGS AND FORGINGS

ORIGINAL AND SOLE MAKERS IN THE U.S.

# SAMSON TURBINE

To insure close speed regulation in a Turbine it is necessary to have a gate which is easily operated. The gates on our SAMSON TURBINES are balanced, and consequently moved with the greatest ease.

**THE JAMES LEFFEL & CO., 307 Lagonda Street, SPRINGFIELD, OHIO, U. S. A.**

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AMERICAN ELECTRICAL WORKS,

PROVIDENCE, R. I.

BARE AND INSULATED ELECTRIC WIRE,

ELECTRIC LIGHT LINE WIRE, INCANDESCENT AND FLEXIBLE CORDS,

Railway Feeder and Trolley Wire,

AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.

CABLES FOR AERIAL AND UNDERGROUND USE.

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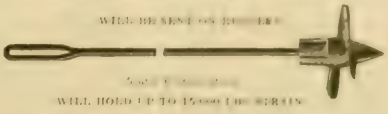
CHICAGO STORE, F. E. Donohoe, 82 Lake St.
MONTREAL BRANCH, Eugene F. Phillips' Electrical Works.

MAIN OFFICES AND FACTORIES, PHILLIPSDALE, R.I.

"ANCHORS THAT HOLD"

STOMBAUGH GUY ANCHORS



W. N. MATTHEWS & BRO.

MANUFACTURERS

603 Carleton Building ST. LOUIS, MO.

EXPERT IN ELECTRICITY MECHANICS PATENT CAUSES

SOLICITOR OF U. S. & FOREIGN PATENTS

FORÉE BAIN, 1652-3 Monadnock Blk., CHICAGO

M. KLEIN & SON

Send 2c stamp for new catalogue No. 6 of

KLEIN'S TOOLS

*For Electrical Workers and Line Builders.*

MATHIAS KLEIN & SONS.

81 W. Van Buren St., Chicago, Ill.

NATIONAL CODE STANDARD

WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

"O. K." Weatherproof Wire.

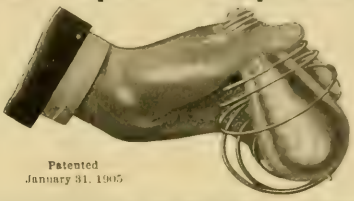
Slow - Burning Weatherproof and Ideal Wire.

Prices and Samples on Application.

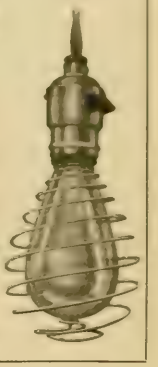
Phillips Insulated Wire Co.

Office and Factory: PAWTUCKET, R. I.

The "Spiral" Lamp Guard



Patented January 31, 1905



DIRECTIONS -Insert lamp (*small end first*) between the largest helices in the manner shown above, and place the tip of lamp in the eye of the guard. "IT'S SPRINGY ALL OVER"

The simplest and best guard on the market. Each guard compressed and put up in a 4x4 in. Manila envelope. 6 gross in a barrel. Easy to handle. Convenient for stock. :: Write for free sample and prices.

S. H. COUCH CO., Inc., 156 Pearl St., Boston, Mass.

TEL. 4626 MAIN

Warren Alternator

NINETY-NINE PER CENT

of thought goes into the making of the Warren Alternator to render it efficient, reliable and easy to care for.

WE GUARANTEE WHAT WE SELL AND SELL WHAT WE GUARANTEE

WARREN ELECTRIC MFG. CO.

Sandusky, O.

HOLOPHANE

GLOBES AND REFLECTORS

NEW CHICAGO POST OFFICE.

Over 1,500 Holophane Globes
" 6,500 Pagoda Reflectors
will be used in this building.
The Government wants the best.
Therefore they specified Holophane Globes and Pagoda Reflectors exclusively.

HOLOPHANE GLASS CO.

GLACKNER BUILDING NEW YORK

A does not advertise because business is good. His plant is being operated to its full capacity. He could not fill additional orders if he had them. He believes in advertising when business is poor, as he then needs the advertising.

B does not advertise because business is so poor that he cannot afford it. This is his "off" season. He says he will advertise when business improves.

C advertises all the time — year in and year out, — when business is poor and when business is good. When it is poor he advertises to make it good. When it is good he advertises to keep it good or make it better. His business is generally good. It is never very poor, although it may fluctuate in volume.

D never advertises. He does not believe in it, and never did believe in it. His credit is poor. For some time past his business has been running at a loss; and it is rumored that it will soon be in the hands of a receiver.

C'S ad can be found in each and every issue of the Western Electrician.

**WANTED, FOR SALE** *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 3c each.*
**POSITION WANTED** *advertisements (50 words or less), $1.00 an insertion; additional words 2c each.*

## POSITION WANTED.

An industrious young man with 6 years' experience in meter, arc lamp and repair department of electric-lighting plant desires a position; can furnish good references. Address BOX 449, care of Western Electrician, 510 Marquette Bldg., Chicago.

## WANTED.

Electrician. — A first-class, up-to-date and energetic man, capable of taking foremanship in repair shop; must be familiar with all branches of armature and field windings and machine work in connection with electrical repair work in general; only those qualified to fill the above position need apply. Address, stating full particulars, to Graham Bros. Co., 662 Hudson St., New York City.

## FOR SALE.

Electric Light Plant, in up-to-date little city in Central Illinois. Just got a new five-year city contract for lighting the streets at $90.00 a year per lamp. Gross income over $8,000 a year and can be easily increased. A first-class business proposition. Good reasons for selling. Address BOX 542, Henry, Ill.

## FOR SALE.

One 25-H. P. Nash gas engine, direct-connected to 15-K. W. Crocker-wheeler dynamo; can be used for 115 or 230 volts. This would be a first-class outfit for automobile charging station. GRAHAM BROS. CO., 662 Hudson St., New York City.

## FOR SALE.

Consulting electrical and mechanical engineering firm of Chicago desires to sell out its established engineering business. Address BOX 448, care of Western Electrician, 510 Marquette bldg., Chicago.

## FOR SALE

| | | | | |
|---|---|---|---|---|
| 1-360 | K. W. | General Electric | Alternator, | Three Phase |
| 1-240 | " | Westinghouse | " | Single " |
| 2-150 | " | Warren | " | " " |
| 1-150 | " | Westinghouse | " | " " |
| 1-150 | " | Wood | " | " " |
| 1-150 | " | Stanley | " | " " |
| 1-120 | " | General Electric | " | Three " |
| 1-120 | " | General Electric | " | Single " |
| 1 120 | " | Westinghouse | " | " " |
| 1- 90 | " | General Electric | " | " " |
| 1- 75 | " | Westinghouse | " | Two " |
| 1- 75 | " | Westinghouse | " | Single " |
| 1- 75 | " | Westinghouse | " | Two " |

Direct connected to Gates' Engine.

Send for our **Monthly Bargain Sheet** with complete list and net prices.

**GREGORY ELECTRIC CO.**
**54-62 S. Clinton St., Chicago, Ill.**

## FOR SALE CHEAP.

**4—200 to 330 H. P. 16x27x16-in. WESTINGHOUSE COMPOUND ENGINES.**
**1—150 to 250 H. P. 14x24x14-in. WESTINGHOUSE COMPOUND ENGINE.**
**1—400 H. P. BRASS TUBE HEATER.**
**1—150 H. P. BRASS TUBE HEATER.**
**2—72-in.x18-ft. BOILERS.**
**1—66-in.x16-ft. BOILER.**
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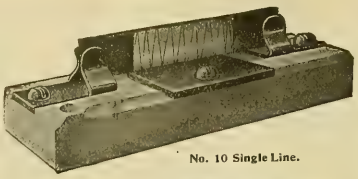

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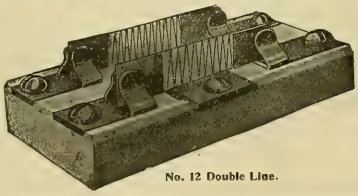

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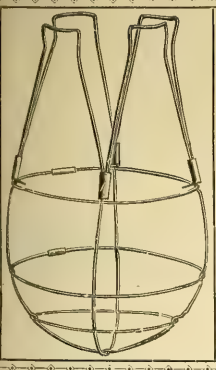

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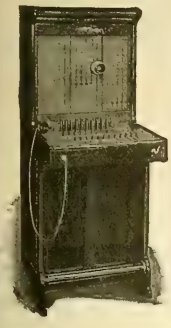

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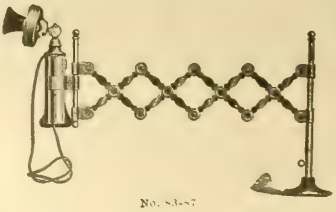

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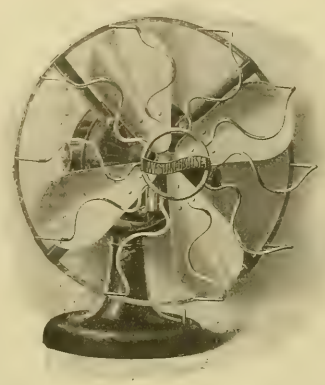

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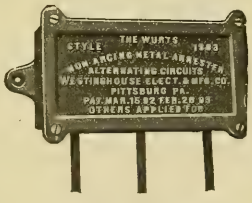

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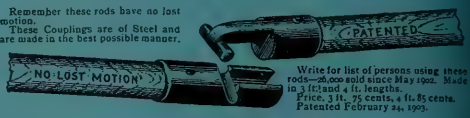


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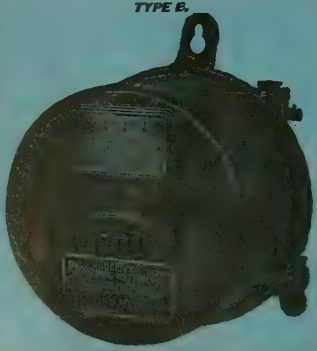

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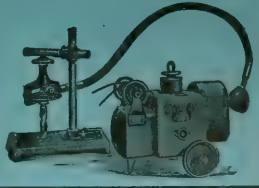
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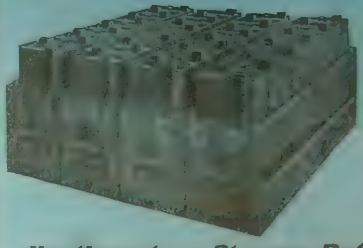
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**Motors, Switches, Arc Lamps, Circuit Breakers, Etc., Etc.**

ALWAYS IN STOCK.

MANUFACTURED BY

**G. E. Co.**

**CHICAGO EDISON COMPANY, 139 Adams Street. CHICAGO.**

U. S. AND FOREIGN PATENTS

# The "REFLECTRIC"

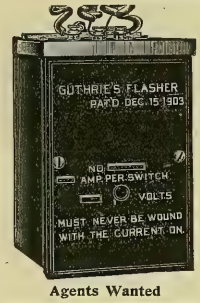
consumes less current and can be read at a greater distance than any other electric sign to-day on the market. Write for booklet.

**WESTERN DISPLAY COMPANY,** SOLE MANUFACTURERS

**ST. PAUL, - - MINN.**

## It Can't Be Beat—The Guthrie Flasher

A SIGN FLASHER WITHOUT A MOTOR




Agents Wanted

A FEW ADVANTAGES OF THIS FLASHER OVER ALL OTHERS:

*First.*—The Price is lower.
*Second.*—It has fewer parts and is therefore the simplest flasher on the market.
*Third.*—It has no motor to cause trouble and consume current.
*Fourth.*—It costs nothing to operate this flasher.
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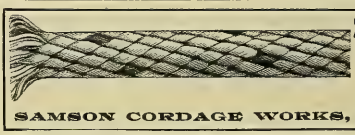
Any combination of lights, without motor or cylinder.
Simplest and best on the market.
Works on any current.
The disadvantage of a flasher was the motor question.
We have overcome this and are putting out an article that meets a long felt want.

**A. S. DOXSEE ELECTRICAL CO.**
1108-1110 Pine St., ST. LOUIS
General Agents for United States and Canada



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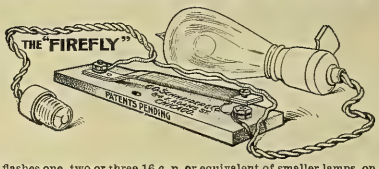
For
ARC LAMP and TROLLEY CORD
Send for Samples and Prices

SAMSON CORDAGE WORKS, - Boston, Mass.

## A MOTORLESS FLASHER




Automatically flashes one, two or three 16 c. p. or equivalent of smaller lamps, on either direct or alternating current. Contacts are heavy platinum and will wear indefinitely. Requires no attention and has nothing to get out of order. PRICE $2.00 EACH. Write for discount to the trade.

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"Flexduct" is that high standard required in all high-class work. It is very flexible, a high insulation and indestructible

# FLEXIBLE CONDUIT

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## Preeminently the Storage Battery

It costs no more than the Cell Type.
It has comparatively, considerably more active material and occupies less space (about half that required by Cell Type).
It is far more durable—is cleaner and more economical in operation and much less expensive in cost of maintenance.
Besides, this important fact must not be overlooked: There are no annoying and destructive fumes as with the Cell Type. The gas does not escape, therefore no corrosion of adjacent pipe or iron work or even the tarnishing of bright metal work.

**TRAY PLATE BATTERY CO.**
Successors Smith Storage Battery Co.
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OKONITE TRADE MARK

Our stock of OKonite Wires and Cables is again complete and we are shipping all orders with promptness and dispatch.
We hope you will put us to the test and let us prove the truth of this statement.

**OKONITE IS RECOGNIZED EVERYWHERE AS THE STANDARD FOR RUBBER INSULATION**

OKONITE IT NEVER DISAPPOINTS

## Central Electric Company,

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## "SAFETY" RUBBER COVERED WIRE AND CABLE

FOR EVERY ELECTRICAL SERVICE.

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**THE SAFETY INSULATED WIRE & CABLE CO.,**

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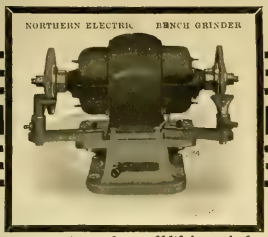


Save shop costs by saving time—the stuff life's made from—the intelligent use of which makes living better—increase and improve output.

SEE LEAFLET NO. 25,130. GRIND TOOLS, CASTINGS, ETC.

**NORTHERN ELECTRICAL MFG. CO.,** ENGINEERS MANUFACTURERS, Madison, Wis., U.S.A.

425 MONADNOCK BLOCK, CHICAGO, ILL.

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GLOBES AND REFLECTORS

NEW CHICAGO POST OFFICE

Over 1,500 Holophane Globes
" 6,500 Pagoda Reflectors
will be used in this building.
The Government wants the best.
Therefore they specified Holophane Globes and Pagoda Reflectors exclusively.

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CLACKNER BUILDING NEW YORK


The more money you spend in advertising the more money you have.
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GREAT BARRINGTON, MASS., U. S. A.

UNIVERSAL EXPOSITION ST. LOUIS 1904

## GOLD MEDALS

PAN-AMERICAN EXPOSITION BUFFALO 1901

THE HIGHEST AWARDS AT BOTH EXPOSITIONS FOR

# WATTMETERS

LUNDELL UNIVERSAL MOTORS

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Pittsburg, Farmers' Bank Bldg.
Atlanta, Ga., Empire Bldg.
New Orleans, La., Hibernia Bank Bldg.

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Stanley Elec. Mfg. Co.
Stow Manufacturing Co.
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Warren Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

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Western Electric Co.
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Wesco Supply Co.

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Central Tel. & El. Co.
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Western Electric Company.

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Fostoria Glass Specialty Co.
Fostoria Incan. Lamp Co.
Haller Machine Co.
Holophane Glass Co.
Phœnix Glass Co.
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Western Electric Co.

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New England Butt Co.

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Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
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Vulcanized Fibre Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

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Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
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Gregory Electric Co.
Hipwell Manufacturing Co
Manhattan Elec. Supply Co.
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Wesco Supply Co.
Western Electric Co.
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Bryan-Marsh Company.
Buckeye Electric Company.
Central Electric Co.
Chicago Edison Co.
Columbia Incan. Lamp Co.
Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
Fostoria Incand. Lamp Co.
Franklin Electric Mfg. Co.
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Nernst Lamp Co.
Sawyer-Man Elec. Co.
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Westinghouse El. & Mfg. Co.

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Inc. El. Lt. Manipulator Co.

**Lamps, Nernst.**
Nernst Lamp Co.

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Cooper, Hewitt Elec. Co.

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Richardson Lubricating Co.

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Pittsburg & L. S. Iron Co.
Porter Cedar Company.
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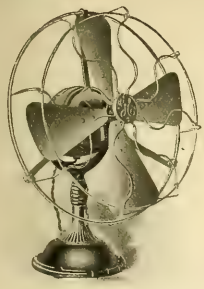

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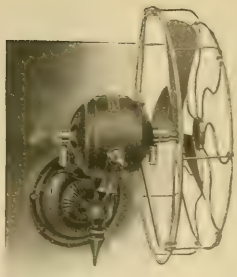

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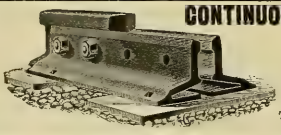

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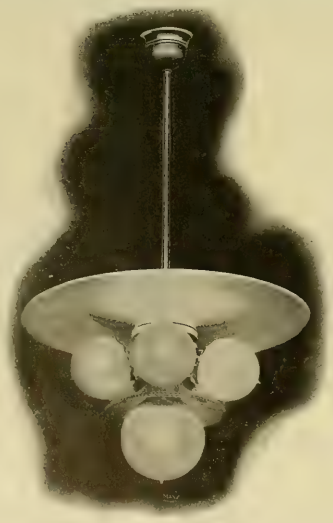

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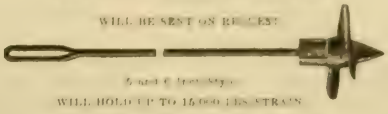

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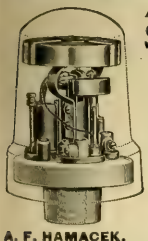

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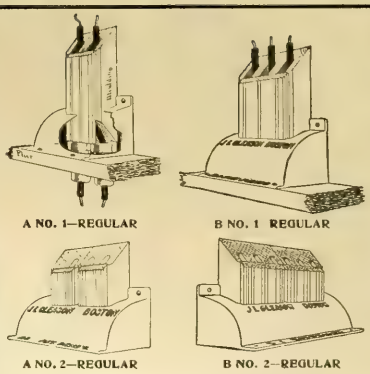

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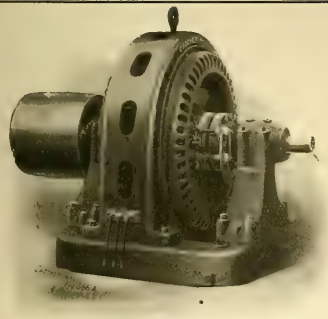

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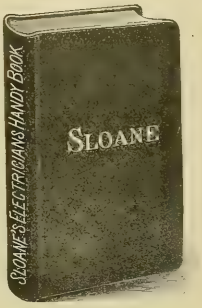


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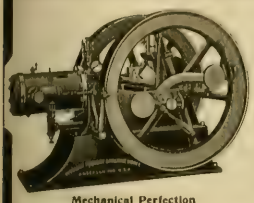

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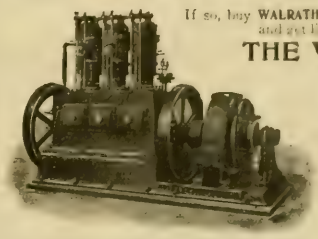

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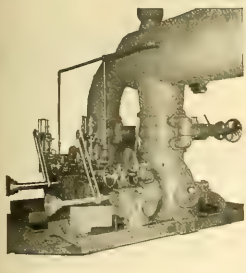

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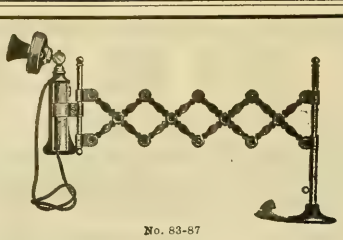

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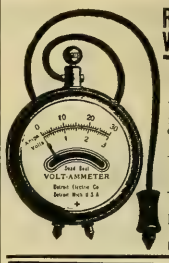

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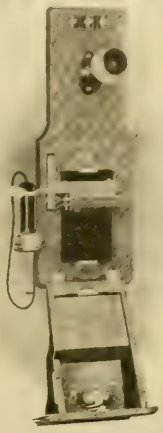

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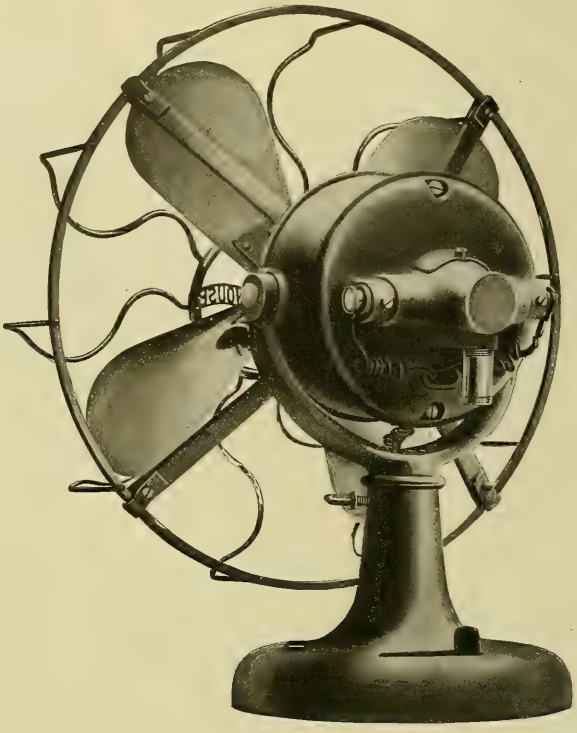

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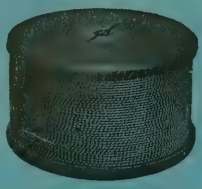

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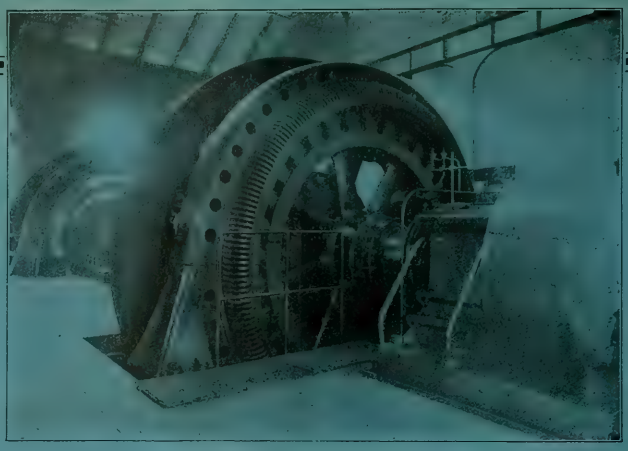

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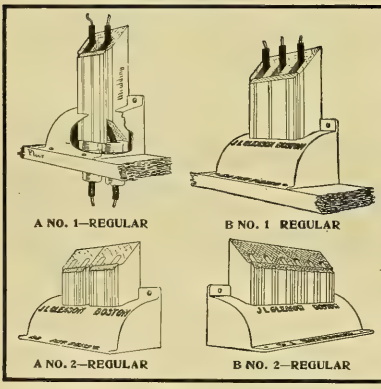

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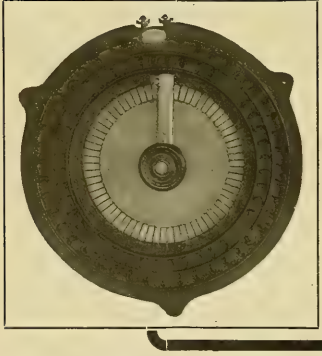

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General Elec. Co.
Gregory Electric Co.
Hobart Elec. Mfg. Co.
Mechanical Appliance Co.
National Electric Co.
Northern Electrical Mfg. Co.
Stanley Elec. Mfg. Co.
Stow Manufacturing Co.
Wagner Electric Mfg. Co.
Warren Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Economizers, Fuel.**
Green Fuel Economizer Co.

**Electric Heating Appl.**
Electric Appliance Co.
Simplex Elec. Heating Co.
Western Electric Co.

**Electric Railways.**
Crocker-Wheeler Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

**Electrical and Mechanical Engineers.**
Arnold Co., The
Badt, F. B.
Bailey, Fred. W. C.
Baker & Co., W. E.
Bryan, Wm. H.
Bylesby & Co., H. M.
Evans, Almirall & Co.
Hallberg, J. H.
Humphrey, Henry H.
Hunt & Co., Robt. W.
Jackson, D. C. & W. B.
Kemp, R. W.
Kohler Brothers.
Letheule, Paul
Newgard & Co., Henry.
Northern Electrical Mfg. Co.
Ruebel, Schwedtman, Wells.
Sargent & Lundy.
Schott, W. H.
Squire Electric Co.
Stanley Elec. Mfg. Co.
Stanton, LeRoy W
Underhill, Chas. R.

**Electrical Instruments.** (Recording and Testing.)
Bissell Co., The F.
Central Electric Co.
Diamond Meter Co.
Duncan Elec. Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Machado & Roller.
Pignolet, L. M.
Reliance Instrument Co.
Robert Inst. Co., The
Stanley Elec. Mfg. Co.
Stanley Instrument Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co
Weston Electrical Inst. Co.

**Electro-Plating Mach'y**
Crocker-Wheeler Company.
General Electric Co.

**Elevators-Conveyors.**
Jeffrey Mfg. Co.

**Engines, Gas and Gasoline.**
Allis-Chalmers Company.
Marinette Gas Engine Co.
Woolley Fdy. & Mach. Wks.

**Engines, Oil.**
American Diesel Engine Co.

**Engines, Steam.**
Allis-Chalmers Company.
Brownell Co., The

**Fans and Fan Motors.**
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Company.
Edison Mfg. Co.
General Electric Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Fibre.**
Kartavert Mfg. Co.
Vulcanized Fibre Co.

**Fittings.**
Faries Mfg. Co.

**Fixtures, Gas and Elec.**
Beardslee Chandelier Mfg.Co.

**Flashers.**
Bissell Co., The F.
Doxsee Elec'l. Co., A. S.
Haller Machine Co.
Reynolds El. Flasher Mfg.Co
Schneider & Co., C. O.
Wesco Supply Co.

**Flexible Shafts.**
Stow Mfg. Co.

**Fuses and Fuse Wire.**
Amer. Elec. Fuse Co.
Bissell Co., The F.
Central Electric Co.
Central Tel. & El. Co
Chicago Fuse Wire & Mfg.Co.
D. & W. Fuse Company.
Electric Appliance Co.
Johns-Manville Co., H. W.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Company.

**Globes, Reflectors and Shades.**
Fostoria Glass Specialty Co.
Fostoria Incan. Lamp Co.
Haller Machine Co.
Holophane Glass Co.
Phœnix Glass Co.
Wesco Supply Co.
Western Electric Co.

**Governors, Water Wheel.**
Replogle Governor Works.

**Graphite Specialties.**
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

**Guards, Lamp.**
Couch Co., Inc., S. H.

**Heating (Exhaust Steam).**
Amer. District Steam Co.

**Heating, Hot Water.**
Evans, Almirall & Co.

**Holders, Inc. Lamps.**
Electric Appliance Co.
Incandescent Electric Light Manipulator Co.

**Indicators.**
Robertson & Sons, Jas. L.

**Inspection & Insurance**
Hartford Steam Boiler Inspection & Insurance Co.

**Insulating Machinery.**
New England Butt Co.

**Insulators and Insulating Materials.**
American Electrical Works.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
Indiana Rub. & Ins. Wire Co.
Johns-Manville Co., H. W.
Kartavert Mfg. Co.
Manhattan Elec. Supply Co.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
Simplex Electrical Co.
Standard Underground C. Co.
Sterling Varnish Co.
Vulcanized Fibre Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Lamps, Arc.**
Bissell Co., The F.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Gregory Electric Co.
Hipwell Manufacturing Co
Manhattan Elec. Supply Co.
Stanley Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Lamps, Incandescent.**
Bay State Lamp Co.
Bissell Co., The F.
Bryan-Marsh Company.
Buckeye Electric Company.
Central Electric Co.
Chicago Edison Co.
Columbia Incan. Lamp Co.
Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
Fostoria Incand. Lamp Co.
Franklin Electric Mfg. Co.
General Electric Co.
Nernst Lamp Co.
Sawyer-Man Elec. Co.
Standard Elec'l Mfg Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Lamps, Incandescent—Replacers & Cleaners.**
Inc. El. Lt. Manipulator Co.

**Lamps, Nernst.**
Nernst Lamp Co.

**Lamps, Vapor.**
Cooper, Hewitt Elec. Co.

**Leather Specialties.**
Bunge, Otto.

**Letters, Metal, Sign.**
Haller Machine Co.

**Lightning Arresters.**
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Manhattan Elec. Supply Co.
Stanley Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.

**Linemen's Climbers.**
Klein & Sons, Mathias.

**Lubricating, Oil, Grease.**
Richardson Lubricating Co.

**Magnet Wires.**
(See Wires and Cables.)

**Mechanical Draft.**
Green Fuel Economizer Co.

**Mica.**
Chicago Mica Co.
Mica Insulator Co.
Munsell & Co., Eugene.

**Mining Apparatus, Elec.**
Allis-Chalmers Company.
Crocker-Wheeler Company.
General Electric Co.
Jeffrey Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Motors.** (See Dynamos and Motors.)

**Nippers and Pliers.**
Klein & Sons, Mathias.

**Nozzles.**
Faries Mfg. Co.

**Overalls.**
Carhartt & Co., Hamilton.

**Patent Attorneys.**
Bain, Foree.

**Phosphor Bronze.**
Phosphor Bronze Sm. Co. Ltd.

**Platinum, Wire and Sheet.**
Baker & Company Inc.

**Poles and Ties.**
Berthold & Jennings.
Brooks, Hall L.
Columbia Mfg. Co.
Fowler, John H.
Fowler-Jacobs Company.
Kellogg Switch. & Sup. Co.
Lindsley Bros. Co.
Loud's Sons Co., H. M.
Maltby Cedar Co.
Mueller Company, William.
Pacific Coast Pole Co.
Perrizo & Sons.
Phelan, D. W.
Pittsburg & L. S. Iron Co.
Porter Cedar Company
S. E. Missouri Cypress Co.
Sterling & Son, W. C.
Torrey Cedar Co.
Valentine-Clark Co., The.
Worcester Co., C. H.

**Polish (Metal).**
Hoffman, Geo. W.

**Portables.**
Faries Mfg. Co.

**Power Transmission Machinery.**
Jeffrey Mfg. Co.

**Rail Joints.**
Continuous Rail Joint Company of America.

**Railway Supplies.**
Wesco Supply Co.

**Re-Winding—Repairs.**
Chicago Edison Co.
Gregory Electric Co.

**Rheostats.**
Amer. Electric Fuse Co.
Cutler-Hammer Mfg. Co.
General Electric Co.
Union Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Rods, Conduit.**
Cope, T. J,

**Schools and Colleges.**
Electrical Engineer Inst.
Highland Park College

**Second-Hand Mach'y.**
Bissell Co., The F.
Cent. Stat. Improvement Co.
Ely & Co., Allen P.
Gregory Electric Co.
Matthews & Bro., W. N.
Walsh's Sons & Co.

**Shades, Lamp.**
Faries Mfg. Co.

**Signs, Electric.**
Haller Machine Co.
Western Display Co.
Zero Marx Sign Works.

**Silks, Insulating and Braiding.**
Sauquoit Silk Mfg. Co.

**Sockets & Receptacles.**
Pass & Seymour.
Yost Elec. Mfg. Co.

**Soldering Sticks, Salts and Paste.**
Chicago Solder Co.
Crollius & Son, E. R.
Moseley & Co., Geo. Welles
Western Electric Co.

**Speaking Tubes.**
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.

**Specialties, Electrical Mfrs. and Designers.**
Haller Machine Co.

**Speed Indicators.**
Weston Electrical Inst. Co.

**Storage Batteries.**
American Battery Co.
Electric Storage Battery Co.
Gould Storage Battery Co.

**Supplies, General Elec.**
Amer. Elec'l Supply Co.
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Chicago Edison Co.
Electric Appliance Co.
General Electric Co.
Manhattan Elec'l Supply Co
Wesco Supply Co.
Western Electric Co.

**Switchboards.**
Bissell Co., The F.
Gen. Incan. Arc Light Co.

**Telephones, Telephone Material and Switchboards.**
American El. Telephone Co
Arnold Elec. Mfg. Co.
Automatic Electric Co.
Bissell Co., The F.
Central Electric Co.
Central Tel. & El. Co.
Electric Appliance Co.
International Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co
Manhattan Elec. Supply Co
Stromberg-Carlson Tel. M.Co
Wesco Supply Co.
Western Electric Co.

**Time Switches.**
Bissell Co., The F.

**Tools.**
Klein & Sons, Mathias.
Western Electric Co.

**Transformers.**
Central Electric Co.
Crocker-Wheeler Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Gregory Electric Co.
Ruhlman Electric Co.
Manhattan Elec. Supply Co.
National Electric Co.
Stanley Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co

**Trucks, Electric Car.**
General Electric Co.
Westinghouse El. & Mfg. Co.

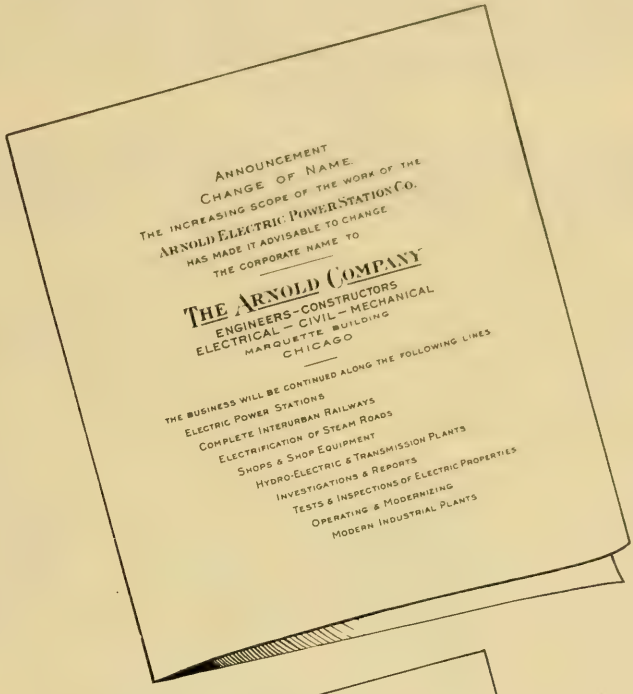
**Turbines, Steam.**
Allis-Chalmers Co.
General Electric Co.
Westinghouse El. & Mfg. Co

**Turbine Water Wheels**
Leffel & Co., Jas.

**Vulcanized Fibre.**
Vulcanized Fibre Co.

**Wires & Cables—Magnet Wires.**
American Electrical Works.
Belden Mfg. Co.
Bissell Co., The F.
Central Electric Co.
Crescent Ins. Wire & Cble. Co
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
Indiana Rub. & Ins. Wire Co
India Rubber & Gutta Percha Insulating Co.
Kellogg Switch. & Sup. Co.
Manhattan Elec. Supply Co.
Marion Ins. Wire & Rub. Co.
National India Rubber Co
New York Insulated Wire Co.
Northern Wire & Cable Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co
Roebling's Sons Co., J. A.
Runzel-Lenz Elec. Mfg Co.
Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Sparco Wire Co., Jas. A.
Standard Underground C. Co
Wesco Supply Co.
Western Electric Company.

For Alphabetical Index of Advertisements See Page 3.


ANNOUNCEMENT
CHANGE OF NAME.
THE INCREASING SCOPE OF THE WORK OF THE
ARNOLD ELECTRIC POWER STATION CO.
HAS MADE IT ADVISABLE TO CHANGE
THE CORPORATE NAME TO
THE ARNOLD COMPANY
ENGINEERS-CONSTRUCTORS
ELECTRICAL — CIVIL — MECHANICAL
MARQUETTE BUILDING
CHICAGO
THE BUSINESS WILL BE CONTINUED ALONG THE FOLLOWING LINES
Electric Power Stations
Complete Interurban Railways
Electrification of Steam Roads
Shops & Shop Equipment
Hydro-Electric & Transmission Plants
Investigations & Reports
Tests & Inspections of Electric Properties
Operating & Modernizing
Modern Industrial Plants

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THE ARNOLD COMPANY
THIS COMPANY HAS ACTED IN THE CAPACITY OF
ENGINEERS OR CONSTRUCTORS
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Bloomington, Pontiac & Joliet Electric Ry Co
W. B. Conkey Co
Chicago University
Chicago & Alton
Chicago & Eastern Illinois R. R. Co
Chicago & Milwaukee Electric R R Co
Chicago & Milwaukee Traction Co.
Chicago Electric Western Ry
Chicago Great Western Ry
Denver & Rio Grande R. R. Co.
Grand Rapids, Holland & Lake Michigan Rapid Ry Co
Imperial Lighting Co. of St. Louis
Lansing, St. Johns & St. Louis Ry
Missouri Pacific Ry Co.
New York Central & Hudson River R. R Co
Oregon Short Line R. R Co
Pere Marquette Railroad Co
Spring River Power Co.
St. Louis, Iron Mountain & Southern Ry Co
Union Pacific R. R. Co
Wisconsin Central Ry Co

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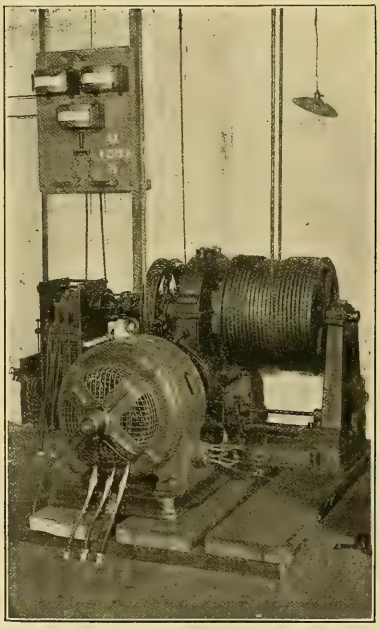
## A SINGLE-PHASE ELEVATOR MOTOR

After many years of continuous experimental work and diligent observations of all important motor improvements in this country and abroad, we are finally able to announce the development of a PERFECT SINGLE-PHASE POWER MOTOR for Elevator and Hoist Work. This new motor promises all the advantageous torque, current and other performance characteristics of the best direct-current motors for the same class of service, and we invite immediate correspondence looking to the installation of such equipments as you may require.

We are prepared to supply on short notice motors of 10 H. P. or less capacity, for 60-cycle service, and will shortly be prepared to deliver units of 25 H. P. capacity or less for this and other frequencies.

Write for circulars and prices.



We are prepared to undertake the adaptation of this form of motor at once to the following kinds of service:

ELEVATORS
(Rope control, direct coupled or belted.)

HOISTS
of all kinds.

TRAVELING CRANES

VARIABLE SPEED DRIVE
Where 40 per cent speed regulation will be satisfactory.

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**General Offices and Factory**

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CLEVELAND, OHIO, New England Bldg.
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DENVER, COLO., Gilbert Wilkes & Co., 435 Seventeenth St.
KANSAS CITY, MO., E. M. Reed & CO., 717 Delaware St.
NEW YORK, N. Y., St. Paul Bldg.
NEW ORLEANS, LA., Spranley & Reed, Hibernia Bank Bldg.
PHILADELPHIA, PA., Real Estate Trust Bldg.
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BUILT IN ALL CAPACITIES

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Detroit, Miller-Selden Electric Co.
St. Louis, 320 Chemical Bldg.
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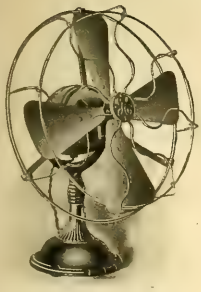
Seattle and San Francisco, Kilbourne & Clark Co.

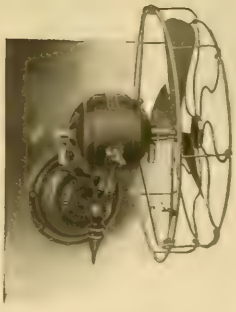
# General Electric Company



16-inch Convertible Swivel & Trunnion Desk Fan.

## 1905 Fan Motors

Low current consumption.
No scattering of oil.
Adaptable for use on either desk or bracket.



16-inch Wall Bracket Fan.

Send for our descriptive catalogue.

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## Merit Marks of the Packard Lamp

HIGH QUALITY OF LIGHT
LOW COST OF OPERATION

And it toes these marks all through
A USEFUL LIFE of 600 to 800 hours

**ELECTRIC APPLIANCE COMPANY**
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MADE RIGHT
PRICED RIGHT
ARE RIGHT

WESCO

THE WESCO SUPPLY CO., ST. LOUIS, MO.
"EVERYTHING ELECTRICAL"

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*Reduces the working capacity of a motor or dynamo, wears out the commutator, wastes power and may cause a fire. All this may be avoided if you use . . . . . .*

The only article that will PREVENT SPARKING. Will keep the Commutator in good condition and PREVENT CUTTING.

**Absolutely Will Not Gum The Brushes.**

It will put that high gloss on the Commutator you have so long sought after.

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*SEND FOR FREE SAMPLE STICK*
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MANUFACTURERS OF THE CELEBRATED

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FOR CENTRAL LIGHTING, POWER AND ISOLATED PLANTS.

ALSO AN IMPROVED CELL TYPE BATTERY IN ALL GENERAL STYLES FOR ELECTRIC VEHICLES, SPARKING BATTERIES, ETC.

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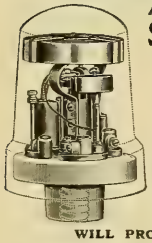

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Regular Multiple Lamps.

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LOOK FOR THE LICENSE LABEL
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WE WILL SHIP ON 5 DAYS TRIAL
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**STOMBAUGH GUY ANCHORS**
OVER TWELVE
IF SATISFACTORY PAY FOR THEM, OTHERWISE, RETURN CHARGES COLLECT.
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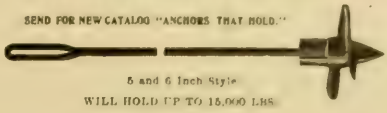

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ARE THE BEST. Send for descriptive Circular.
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LONG LIFE
GUARANTEED CANDLEPOWER,
HIGHEST EFFICIENCY.
MADE BY THE MOST SKILLED WORKMEN.
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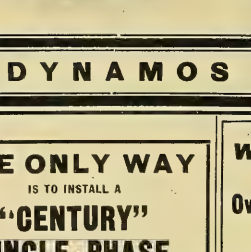

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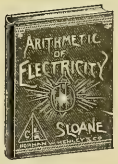


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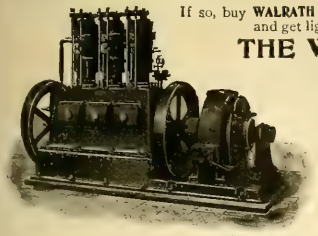

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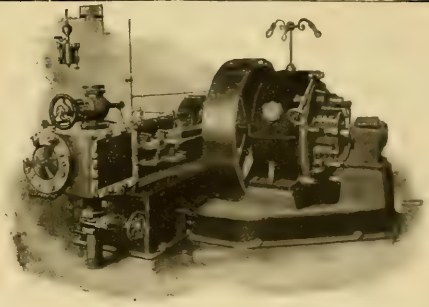

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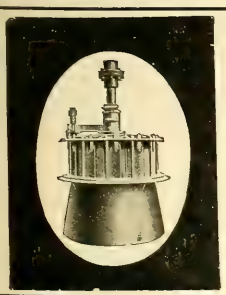

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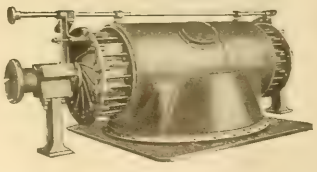

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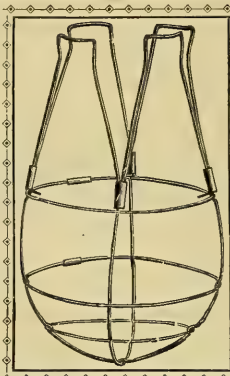

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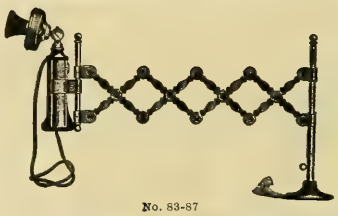

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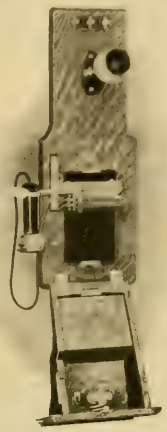

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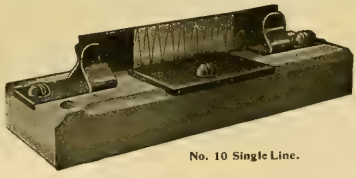

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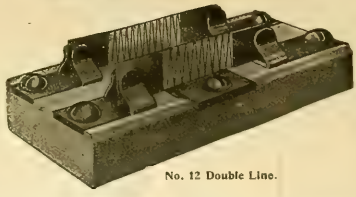

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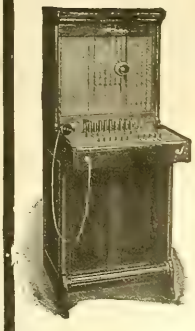

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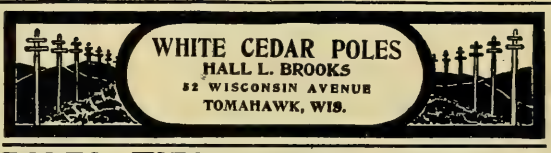


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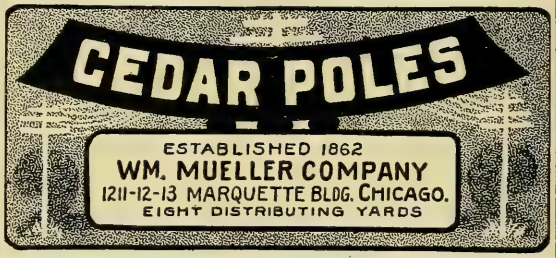


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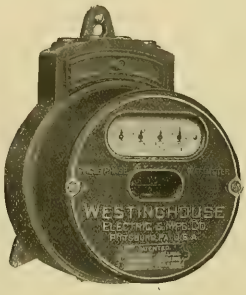


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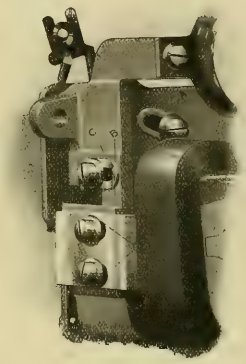

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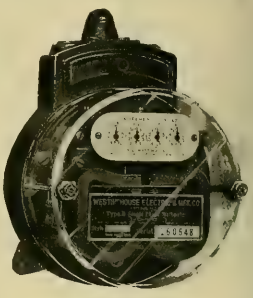

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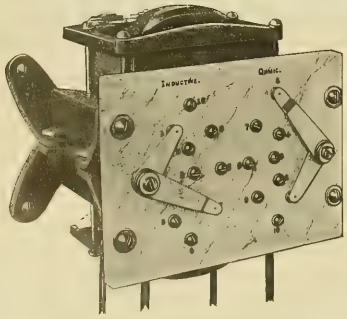

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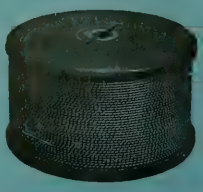

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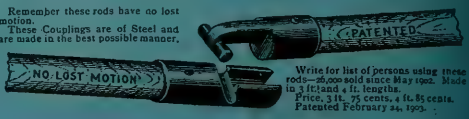


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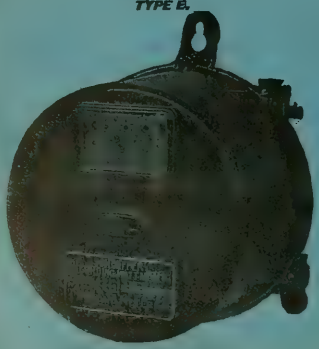

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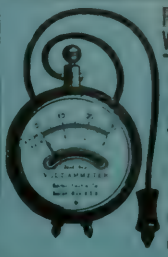
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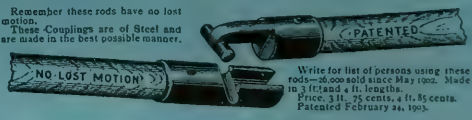

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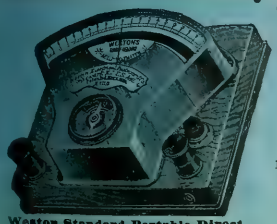
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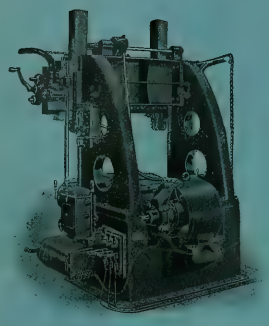

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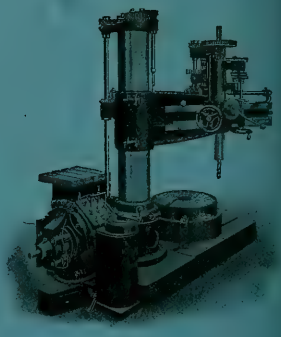

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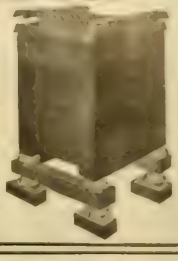

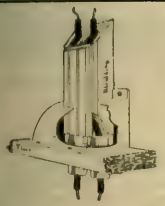

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If you want Wires or Cables insulated with the HIGHEST CLASS INDIA RUBBER INSULATION you should buy . . . . . .

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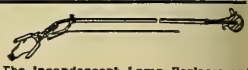
Complete stock of all sizes constantly on hand and for sale at lowest market prices by

CHICAGO EDISON COMPANY,

WRITE FOR PRICES. 139 ADAMS STREET, CHICAGO.

WE BUY OLD BELTS
OR SCRAPS, ANY SIZE OR CONDITION.
WE CLEAN, REPAIR AND RENEW OLD BELTS.
*LEATHER PRESERVER MFG. CORP.*
27 W. MONROE ST., CHICAGO

SINGLE AND POLYPHASE
TRANSFORMERS
KUHLMAN ELECTRIC CO., - - Elkhart, Ind.



The Incandescent Lamp Replacer and Cleaner replaces and cleans any c. p. lamp at any height or angle.
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consumes less current and can be read at a greater distance than any other electric sign to-day on the market. Write for booklet.

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For all Classes of Electrical Work

Patented May 2, 1899
601. One piece

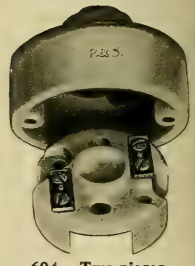
THE LINE IS COMPLETE.

Patented August 30, 1892
06. Two pieces

THE PRICES ARE RIGHT.

Patented May 2, 1899
602. One piece

WHY NOT USE THEM?



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For concealed work

PASS & SEYMOUR, Inc.
SOLVAY, N. Y.
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Continuous and judicious advertising is the magic wand which converts a little business into a big business.

"Flexduct" is that high standard required in all high-class work. It is very flexible, a high insulation and indestructible

# FLEXIBLE CONDUIT

"Flexduct" the National Code Standard. It does not deteriorate, always usable to highest degree

OSBURN FLEXIBLE CONDUIT COMPANY,
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# EVERYTHING IN CARBON

BATTERIES BRUSHES CARBONS

NATIONAL CARBON COMPANY, Cleveland, O.

OKONITE
TRADE MARK

# THEY FILL THE BILL

That is the verdict of every electrician who has used OKONITE Tape and MANSON Tape. They are the standards and to make a perfect insulation, all wire joints should be taped first with OKONITE Rubber Tape and second with MANSON Friction Tape

**No Dead or Reclaimed Rubber Used in Okonite Tape** ⋇ ⋇ **No Shoddy or Rags used in Manson Tape**

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Single and Polyphase, for all purposes. Adaptable for floor, wall and ceiling installation. Simple, compact and rigid construction. Bearings self-oiling and self-aligning.

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THE SKC SYSTEM

STANLEY ELECTRIC MANUFACTURING COMPANY

Pittsfield, Mass.

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Are the Standard

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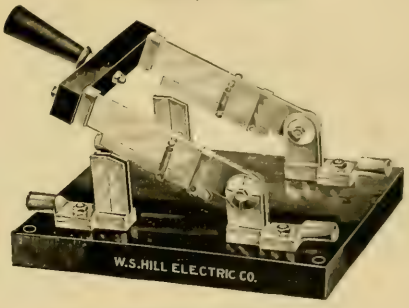


Bulletin 104

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New Bedford, Mass.

# AUTOMOBILE SPARK COILS

and all classes of electrical instruments repaired and recalibrated. Satisfaction guaranteed. Time and money saved by having your repairs done by the

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For ARC LAMP and TROLLEY CORD

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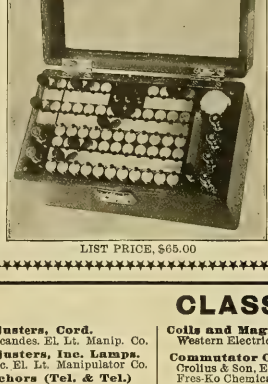
THE HIGHEST AWARDS AT BOTH EXPOSITIONS FOR

# WATTMETERS



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Range, .001 ohm to 11 megohms. Reversing plugs done away with. Only four plugs to be manipulated in rheostat. New form combination keys. Fitted for Murray and Varley tests. External batteries and galvanometer can be used when desired. Batteries self-contained.

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Trade H Mark

**This Trade-Mark guarantees quality.**

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Mechanical Appliance Co.
National Electric Co.
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Stanley Elec. Mfg. Co.
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Western Electric Co.
Westinghouse El. & Mfg. Co.

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Central Electric Co.
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Ft. Wayne Elec. Wks. Inc.
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Manhattan Elec. Supply Co.
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American Battery Co.
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Gould Storage Battery Co.

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Chicago Edison Co.
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American El. Telephone Co
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Bissell Co., The F.
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Central Tel. & El. Co.
Electric Appliance Co.
International Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co.
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Western Electric Company.


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# CARHARTT OVERALL FACTORY MADE CO-OP-

***Hamilton Carhartt, Manufacturer, (Incorporated,) One of the Strongest and Most Prosperous American Industrial Institutions, Offers to take into Partnership in his Business, his Employees, his Agents and the Men who Wear his Goods.***

## Send for Prospectus and Option Certificate.

Stock in Hamilton Carhartt, Manufacturer, (Incorporated), of Detroit, Michigan, preferred for 7% is offered to his Employees, Agents and the men who wear his goods.

**Details.** The capitalization of Hamilton Carhartt, Manufacturer, (incorporated), is $500,000. Of this, two-thirds is common stock owned by Mr. Carhartt. One-third is preferred stock for 7% and is now being sold to interested parties at par, $10 per share. Under the laws governing corporations, Mr. Carhartt cannot receive a dollar in dividends from the Company until preferred stockholders have been paid their 7% dividends.

**Reasons.** This is now the greatest business of its kind in the world, and Mr. Carhartt naturally desires that it so remain for an indefinite period. Therefore, it has been necessary to incorporate the business in order to insure its perpetuation, and at the same time carry out Mr. Carhartt's idea of taking into partnership those who have helped him build up his gigantic business. In this manner the organization will become a stable, corporate entity, unaffected by individual changes. In this manner the ability, capital and experience of many widely differing classes of people will be available—yet all will be bound together by the common purpose of increasing the power and prestige of this business. Experience has shown that this is the only method of insuring the permanency and rapid growth of a commercial institution manufacturing an article of universal consumption.

**Security.** The entire capitalization of the preferred stock is more than covering by actual, tangible assets —real estate, plant, equipment, stock, etc. Leaving the business of the Company altogether out of consideration, the stockholder is absolutely protected against loss by the property of the Company upon which preferred stock is by law in the position of a first mortgage after indebtedness is paid.

**Dividends.** The 7% dividends upon the preferred stock cannot fail to be paid even in times of financial stringency. For fifteen years this business has not failed to pay more than 7% on the entire capital involved, and the business is increasing and becoming more profitable every day, becoming stronger and stronger in its position as the merits of the Hamilton Carhartt Overalls become known, and this increasing prosperity Mr. Carhartt is willing to share with those who have helped him.

**Large Profits.** We feel this preferred stock is as safe as any investment in America, but at the same time it pays double the dividends of other investments of similar soundness. The savings bank is no better, and savings banks pay but 3 or 3½%. Remember that this stock, although offered at par is, on the basis of actual earnings, worth a great deal more, and will increase in value.

**Investigation.** The affairs of this Company, its books and records, are open to the investigation of the prospective purchaser of this stock. Nothing is hidden and nothing is left unexplained. The investor may satisfy himself thoroughly upon every possible point, and will have the full and cheerful assistance of this Company in so doing

**Promptness.** As this stock not only represents safety, but large dividends, it will be very attractive to the shrewdest investors, and it is difficult to say how long the opportunity to purchase will remain open. Promptness is, therefore, necessary The matter should not be deferred.

**Option.** By filling out the attached coupon, stating the number of shares desired, and giving name and address, the Company will grant an option of thirty days and forward a certificate to that effect This will give time for thought and investigation No obligation is incurred by the coupon or the certificate

**Prospectus of the Company explains all these matters in detail. Write for it, and read it.**

**Address for prospectus, option certificate, and full information, and send subscriptions and certified checks to**

**Hamilton Carhartt, Manufacturer,**
(INCORPORATED.)
DETROIT, MICHIGAN, U. S. A.

(COUPON.)
Hamilton Carhartt, Manufacturer, Inc.,
Detroit, Michigan.
Please send prospectus of the Hamilton Carhartt Manufacturer, (Incorporated), and special option as stated in letter to purchase ... shares ... days ... of the ... preferred stock of the Company at $10 per share. It is understood that this ... questionnaire to which I am to make reply, unless after ... I notify you to the contrary.
NAME .....
STREET ADDRESS .....
CITY OR TOWN .....
STATE .....

Money begins to draw interest the day it is received Dividends are paid January 15th and July 15th If you do not want to wait for the prospectus, send the money and certificates of stock will be sent you by return mail

# LUNDELL UNIVERSAL MOTORS

National

TRADE MARK

## National Electric Company

Milwaukee.

**District Offices**

New York, 135 Broadway.
Chicago, Old Colony Bldg.
Philadelphia, 1509 Land Title Bldg.
Pittsburg, Farmers' Bank Bldg.
Atlanta, Ga., Empire Bldg.
New Orleans, La., Hibernia Bank Bldg.

**Sales Offices**

Cleveland, Barton, Stevenson & Co.
Detroit, Miller-Seldon Electric Co.
St. Louis, 320 Chemical Bldg.
Denver, Hendrie & Bolthoff Mfg. and Supply Co.
Seattle and San Francisco, Kilbourne & Clark Co.

Grimshaw WHITE CORE INSULATED WIRE

Grimshaw

Raven White Core

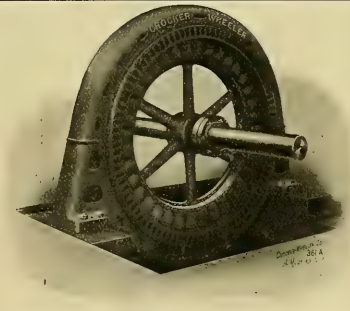
Raven Black Core

**ALL OUR WIRES** pass inspection and carry the above **TRADE-MARKS** on our tags. We also manufacture **Grimshaw** and **Competition Tapes** and **Splicing Compounds.**

# NEW YORK INSULATED WIRE COMPANY,

MAIN OFFICE: 114, 116 & 118 Liberty St., New York.

BRANCHES: CHICAGO: 192 Desplaines St. BOSTON: 7 Otis St. SAN FRANCISCO: 32 Second St.



*Standard Crocker-Wheeler Revolving Field Engine Type Alternator*

# ALTERNATORS

**FOR EVERY SERVICE**

**ANY TYPE ALL SIZES**

**Among other A. C. Generators we are building are**
**Four 4,000 K. V. A. for Chicago Sanitary District.**
**Three 4,000 K. V. A. for California Gas & Electric Corporation.**
**Two 2,000 K. V. A. for The Huronian Company.**
**One 1,200 K. V. A. for Los Angeles Pacific Ry. Company.**

SEND FOR BULLETIN NO. 50.

**Crocker-Wheeler Company**

Manufacturers and Electrical Engineers

Ampere, N. J.

Chicago Office, Old Colony Bldg.

WHITE PORCELAIN LETTERS — FIREPROOF

# FOR ELECTRIC SIGNS

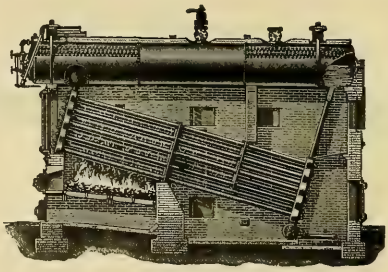
AGENTS WANTED WHEREVER THERE ARE CENTRAL STATIONS.

COLONIAL SIGN AND INSULATOR CO., - - - AKRON, O.

# THE BABCOCK & WILCOX CO., 85 LIBERTY ST., N. Y.

**BRANCH OFFICES:**

BOSTON, 35 FEDERAL STREET.
PHILADELPHIA, 1110-1112 NORTH AM. BLDG.
SAN FRANCISCO, 63 FIRST STREET.
PITTSBURG, 1218 FRICK BUILDING.
NEW ORLEANS, 339 CARONDELET STREET.
CHICAGO, 1215 MARQUETTE BLDG.
ATLANTA, EMPIRE BLDG.
CLEVELAND, 706 NEW ENGLAND BLDG.
MEXICO CITY, 7 AVENIDA JUAREZ.
HAVANA, CUBA, 116 1-2 CALLE DE LA HABANA



200 Pounds Working Pressure

# WATER TUBE STEAM BOILERS

# STEAM SUPERHEATERS

**Our Book, STEAM, mailed free on application.**

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**The Highest Possible Award**

**Has Been Given to**

ELECTRA

TRADE MARK

## HIGHEST GRADE NUERNBERG CARBONS

**By the International Jury of Awards, of the Louisiana Purchase Exposition, St. Louis, 1904.**

**HUGO REISINGER, Sole Importer, 11 BROADWAY, NEW YORK**

## Preeminently the Storage Battery

It costs no more than the Cell Type.

It has comparatively, considerably more active material and occupies less space (about half that required by Cell Type).

It is far more durable—is cleaner and more economical in operation and much less expensive in cost of maintenance.

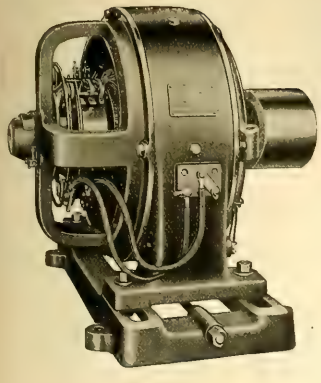
Besides, this important fact must not be overlooked: There are no annoying and destructive fumes as with the Cell Type. The gas does not escape, therefore no corrosion of adjacent pipe or iron work or even the tarnishing of bright metal work.

## TRAY PLATE BATTERY CO.

**Successors Smith Storage Battery Co.**

**New York Office, 39 Cortlandt St.** **5-11 FREDERICK ST., BINGHAMTON, N. Y.**

# General Electric Company



## New Slow Speed Motor

**Made in Sizes from 20 H. P. to 150 H. P.**

General Electric Motors have always been distinguished by the highest merit. This one sets the standard still higher.

WRITE FOR FURTHER INFORMATION

PRINCIPAL OFFICE: SCHENECTADY, N. Y.

**Chicago Office, Monadnock Block** **Sales Offices in All Large Cities**

## "99" Reasons why you should use the

# "FEMCO" Incandescent Lamp

1. Highest quality.
2. Highest average of candle power.
3. Intelligent selection of voltages.
4. Uniform efficiency.
5. Thorough factory tests.
6. Economical consumption of current.
7. Prompt shipments.
8. Prices lowest consistent with standard lamps.

The other ninety-one reasons you will easily discover by a trial of the lamp itself. Once you use "FEMCO" you will never be satisfied with any other. If you want the best of everything in a lamp, you must use the "FEMCO."

Our New Catalogue Just Issued
Write for it

The Label of Quality

Selling Agents Wanted in Western Territory

## THE FRANKLIN ELECTRIC MFG. CO.

Factory and General Office:
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New York
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Baltimore, Md.
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Southwestern Representative
The Sachs Electric Co.
St. Louis, Mo.

# J. L. SCHUREMAN CO.

**Beg to announce their removal from**

**The old location at 133-139 South Clinton Street to**

**Larger and more commodious quarters at 70-86 West Jackson Boulevard.**

Our factory and offices were almost totally destroyed by fire on February 13, 1905. Ten days later we were shipping goods from our new location. We are now running both a day and a night force and will soon have filled all back orders. Our increased facilities will enable us to serve our customers better than ever, and we therefore bespeak a continuance of their patronage.

# J. L. SCHUREMAN CO.

**Automatic Motor-Controlling Devices**

**70-86 West Jackson Boulevard**

**CHICAGO**

**European Agents**
**GEIPEL & LANGE**
**72a St. Thomas St., London, E. C.**

# LOST!

LOOK FOR THE LICENSE LABEL IN THE STEM

## —WASTED LIGHT—

**By using the ordinary incandescent lamp you lose at least 50 per cent. of light delivered through the sides—just where you don't want it.**

**WHY INSIST UPON WASTING HALF YOUR LIGHT?**

**Pay for light delivered on your work, and we guarantee you will see the things you want to see fully 50 per cent. better than with any other lamp.**

BRANCHES ALL CITIES

## THE SHELBY ELECTRIC CO.

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BARE AND INSULATED ELECTRIC WIRE,

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INCANDESCENT AND FLEXIBLE CORDS,
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MONTREAL BRANCH, Eugene F. Phillips Electrical Works
MAIN OFFICES AND FACTORIES, PHILLIPSDALE, R. I.

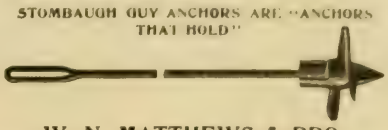
A FIVE-INCH

**Stombaugh Guy Anchor**

WILL HOLD 12,500 LBS.

Costs 21 cents installed including [illegible] protruding from the [illegible] give or skip. It is in [illegible]

STOMBAUGH GUY ANCHORS ARE "ANCHORS THAT HOLD"



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**Engineering** MECHANICAL, ELECTRICAL, STEAM, CIVIL.
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*Sockets, Wall Sockets, Weatherproof Sockets, Rosettes, Receptacles, Cord Adjusters.*

*Catalogue for the asking.*

THE YOST ELECTRIC MFG. CO.
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**CONTINUOUS RAIL JOINT CO. OF AM.**
NEWARK, N. J.
**OVER 20,000 MILES IN USE**
The St. Louis Exposition, 1904, awarded us the only gold medal for rail joint products.

**A MOTORLESS FLASHER**

Automatically flashes one, two or three 16 c. p. or equivalent of smaller lamps, on either direct or alternating current. Contacts are heavy platinum and will wear indefinitely. Requires no attention and has nothing to get out of order. PRICE $2.00 EACH. Write for discount to the trade
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LONG LIFE
GUARANTEED CANDLEPOWER,
HIGHEST EFFICIENCY.

MADE BY THE MOST SKILLED WORKMEN

STANDARD ELECTRICAL MFG. COMPANY, : Niles, Ohio.

**Security Cable Distributing Panels**

**Are Safe and Handy and Cheap**

THESE are suitable for use in any ordinary pole box, or can be placed on the walls of an exchange or elsewhere, as may be desired. They are generally used in pairs. The panels are oak, highly finished, with a front of hard rubber on which the contacts are mounted. The cables may enter from below or from above and the copper wires will spread to the inner rows of contacts on both sides. The connection is made by a screw, threaded into metal and provided with a washer. This joint should of course be soldered permanently. The spider wires attach to the outer rows of contacts and are connected in the same way and should also be soldered. By so doing permanent results are reached, which is not the case in boards where there are no washers nor solder and where the screws go into wood instead of into metal. These boards can be used for metallic circuits or grounded or common return. There is nothing made which is so compact, convenient nor as economical. An electrician can make a good part of the price in the time he will save in first connecting the cables, not counting the subsequent convenience of making cross-connections, should they be desired.

Prices, including fuses of any amperage from ½ to 5, **10c per conductor, or 20c per pair.** A discount of 5 per cent. on orders of 750 or more conductors.

MADE BY
THE F. BISSELL COMPANY
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WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Ideal Wire.

**Prices and Samples on Application.**

**Phillips Insulated Wire Co.**
Office and Factory: PAWTUCKET, R. I.

***Cords, Cables, Wires***

We Manufacture

***Cords for Telephones and Switchboards. Cables and Wires for Switchboards. Cables for Interior Purposes.***

Write us concerning our No. 100 Switchboard Cord

*Secure Our Prices*

***RUNZEL-LENZ ELECTRIC MFG. COMPANY***
*97-101 So. Clinton St.* *CHICAGO, ILL.*

The name of the immediate predecessor of the last governor of your state appeared in every issue of every paper in the state for many weeks prior to his election, and frequently during the time he occupied the gubernatorial chair.

What was his name?

What was the name of his chief opponent for the office?

One swallow does not make a summer.

One ad does not constitute an advertising campaign.

If those who read ads had better memories, advertising appropriations could be materially reduced.

But the average man forgets.

Talking to him on the same subject 52 times a year will, however, burn it into his memory.

He could not forget if he would.

By running your ad in every issue of the Western Electrician you can compel its readers to remember who you are, where you are and what you make.

**WANTED, FOR SALE** *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 3c each.* **POSITION WANTED** *advertisements (50 words or less), $1.00 an insertion; additional words 2c each.*

## POSITION WANTED.

As superintendent or manager of an electric-light plant; have had years' experience and am familiar with all modern methods of installing machinery, construction and interior wiring; prefer a new system to install; can go at once. Address BOX 457, care Western Electrician, 510 Marquette bldg., Chicago.

## POSITION WANTED.

Mechanical and electrical engineer desires position as engineer with manufacturer, large power user, or mining company. Record of first class technical training and experience forwarded on application. Age 34; foreign country no objection; good salary required. Address BOX 459, care Western Electrician, 510 Marquette Bldg., Chicago.

## POSITION WANTED.

A graduate electrical engineer of 1895 who has had nine years' experience, mostly in central station work, of operation and installation, desires a position as superintendent or some such responsible position. Married and 33 years old; can give good references from past employers as to ability and character. Address BOX 460, care of Western Electrician, 510 Marquette Bldg., Chicago.

## WANTED

On or before July 1 next, a second-hand 75 to 100-K. W. 60-cycle 1,100 volt direct connected unit in first class operating condition. State make, type and age, whether right or left hand, floor space required and if it can be seen in operation. Address BOX 454, care Western Electrician, 510 Marquette Building, Chicago.

## WANTED.

City of Boscobel, Wis.

Wanted—An electrician and a fireman for a Municipal Lighting Plant. For particulars address CITY CLERK, Boscobel, Wis. Propositions considered April 5th, 1905.

## FOR SALE.

Consulting electrical and mechanical engineering firm of Chicago desires to sell out its established engineering business. Address BOX 448, care of Western Electrician, 510 Marquette bldg., Chicago.

## FOR SALE.

One 25-H. P. Nash gas engine, direct-connected to 15 K. W. Crocker-wheeler dynamo; can be used for 115 or 230 volts. This would be a first-class outfit for automobile charging station. GRAHAM BROS. CO., 662 Hudson St., New York City.

## FOR SALE.

The city of Coffeyville, Kansas, has for sale the following described machinery, to wit:

2 tubular boilers of 80 horsepower each.

2 ideal engines of 80 horsepower each, speed of same 265.

2 Westinghouse alternators, 60 K. W., 60 cycle, 1,100 volt.

All of the above described machinery is in first-class condition and in use every day. Same can be bought cheap if taken at once as we are about to install a new and much larger equipment. Address all communications to E. L. ROSSITER, Light Commissioner.

## FOR SALE.

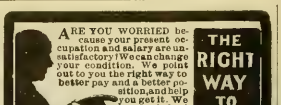
**Electric lighting plant in Western Kentucky, town of 2,000. Business increased 35% last year and still growing; cheap fuel; generators not loaded; good reasons for wishing to sell; easy terms. For full particulars address BOX 458, care Western Electrician, 510 Marquette Building, Chicago, Ill.**

## FOR SALE CHEAP.

4—200 to 330 H. P. 16x27x16-in. WESTINGHOUSE COMPOUND ENGINES.
1—150 to 250 H. P. 14x24x14-in. WESTINGHOUSE COMPOUND ENGINE.
1—400 H. P. BRASS TUBE HEATER.
1—150 H. P. BRASS TUBE HEATER.
2—72-in.x18-ft. BOILERS.
1—66-in.x16-ft. BOILER.
1—8 H. P. OTTO GAS ENGINE

ALSO MANY OTHERS, LET US KNOW YOUR WANTS AND **SAVE MONEY.**

**F. E. PFANNMUELLER & CO.**
No. 733 ROOKERY BUILDING, CHICAGO.



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**THE RIGHT WAY TO BETTER PAY**

## FACTORY FOR SALE

**NEAR CHESTER, PA., WITH DEEP WATER FRONT ON DELAWARE RIVER,** and intersected by three **TRUNK LINES** and two trolley lines; extensive buildings, Foundry, Machine shop, etc., with traveling cranes and machinery, and well adapted for any kind of heavy business; abundance of cheap labor of all kinds in the immediate vicinity. Large engines, boilers, electric plant; good water supply and sewerage. For full particulars apply to,

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**150 Broadway, New York**

Real Estate and Factory Brokers.

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Direct connected to Gates' Engine.

Send for our **Monthly Bargain Sheet** with complete list and net prices.

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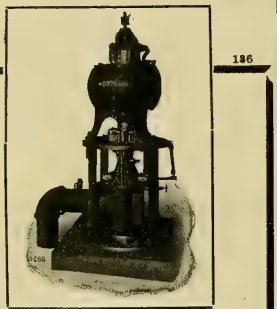

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Built in a wide range of sizes for operation where a vertical shaft is required, enabling operation of machine without the use of bevel gears, etc.

**WE SHOW A NORTHERN VERTICAL MOTOR AS APPLIED TO A DEEP WELL PUMP.**

Leaflet No. 10125 shows a novel application of the Northern Vertical Motor.

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**Engineers, Manufacturers MADISON, WIS., U. S. A.**
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On receipt of
**10 CENTS**
we will send you a
**Western Electrician Moonlight Schedule**
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Every lighting man should have one.

Electrician Publishing Company,
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Adapted to soldering Electrical Connections without injury to insulation, producing clean, perfect joints on all metals. Will not rust or corrode, therefore increases durability of all sheet metal work. A time saver in construction of roofing, leaders, gutters, refrigerators, ornamental work, and all branches of the canning industry. Large package in fluid, paste or stick form, prepaid by mail, **25 cents.** Satisfaction Guaranteed. Liberal discount to dealers. Special prices to those desiring to use Flux in large quantity. THE UNIVERSAL CO., 537 West 149th St., New York.

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Civil War Relics and Curios
***$1.00 each***
or in exchange for scrap lead, copper, brass, iron, paper, etc.
Write for catalogue.
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**Publishers and dealers of electrical books**

WORKS QUICK AND EASY. KEEPS ITS LUSTER. HOLDS OLD TRADE AND MAKES NEW. DOES NOT DETERIORATE. ESTABLISHED 16 YEARS. SOLD BY AGENTS AND DEALERS ALL OVER THE WORLD

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**Write Now for Free Sample of above Stick**
**Convenient—Non-Corrosive—Effective**
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**E. R. CROLIUS & SON**
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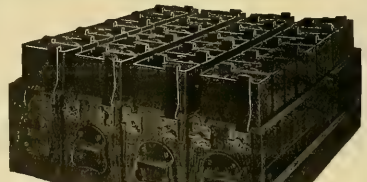

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***NORTHWESTERN STORAGE BATTERY***

on all low-tension work

***Great Capacity, Light, Efficient and Compact.***

Send for catalogue. Let us figure with you.

***Northwestern Storage Battery Co.,***
***285 Madison St., - - - Chicago, Ill.***

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Be sure and go

**Over the Far Famed Loop**
(Denver to Silver Plume and return)

VIA THE

**COLORADO & SOUTHERN RY.**

It is the finest one-day trip in the country. Takes you through one of the grandest canyons in the State and over the most marvelous feat of engineering in the Rocky Mountains. We have many other fascinating one-day trips. Handsome illustrated literature sent to any address on receipt of three cents postage.

**T. E. FISHER, General Passenger Agent**
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When a man's electrical ideas flow freely; when he discusses electrical subjects intelligently and glibly, you will be pretty safe in assuming that he keeps in touch with electrical progress by perusing the Western Electrician 52 times a year.

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**76 MARKET STREET, CHICAGO. TELEPHONE MAIN 1280.**

Machine and Carpenter Work of All Kinds
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**OPEN DAY AND NIGHT.**

FIRST-CLASS EQUIPMENT THROUGHOUT.

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Engineers, Contractors for Complete Electric Plant. Recent Commercial
SOUTH END MARQUETTE BLDG. CHICAGO.
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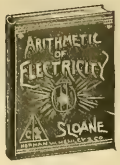


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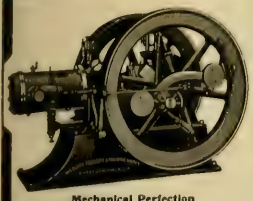

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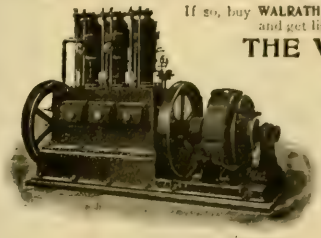

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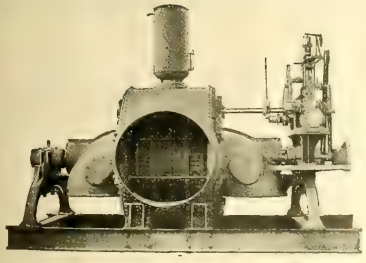

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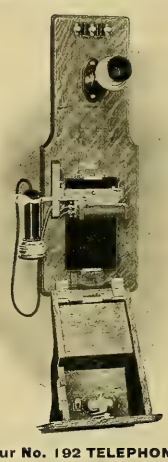

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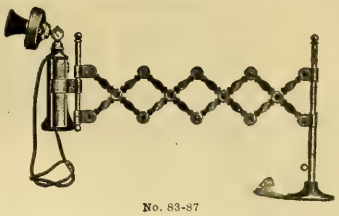

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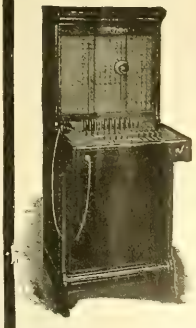

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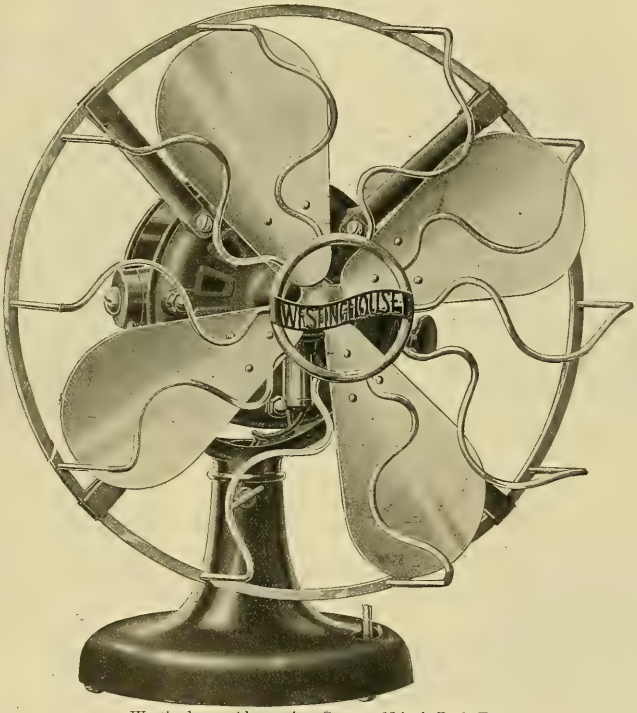


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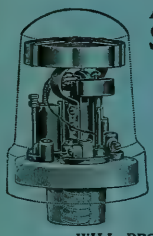

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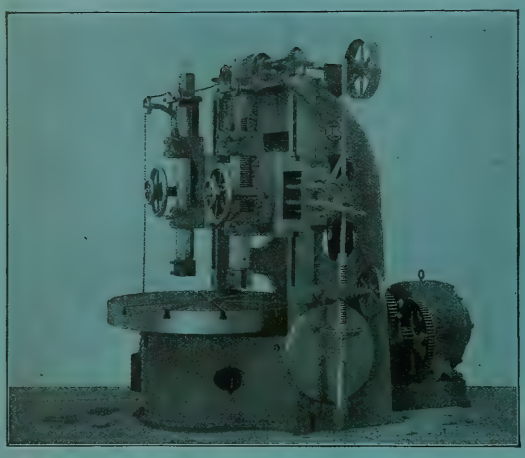

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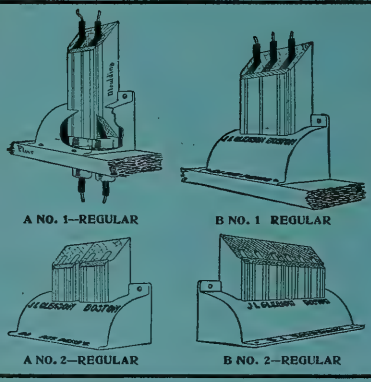

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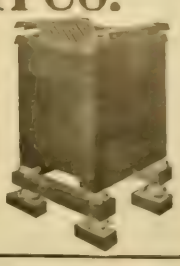

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ST. LOUIS, 1904


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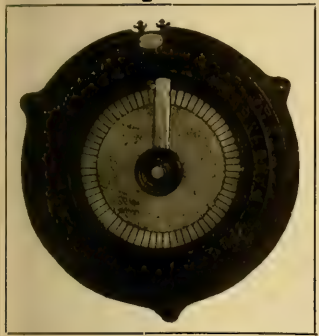

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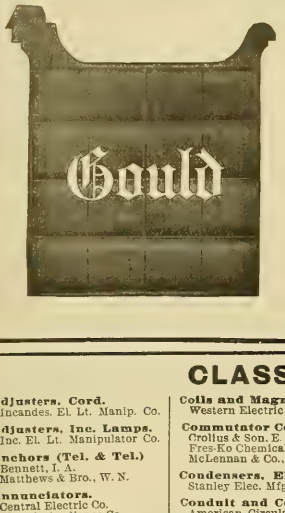


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Western Electric Co.
Westinghouse El. & Mfg. Co.

**Lamps, Arc.**
Bissell Co., The F.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Gregory Electric Co.
Hipwell Manufacturing Co
Manhattan Elec. Supply Co.
Stanley Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Lamps, Incandescent.**
Bay State Lamp Co.
Bissell Co., The F.
Bryan-Marsh Company.
Buckeye Electric Company.
Central Electric Co.
Chicago Edison Co.
Columbia Incan. Lamp Co.
Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
Fostoria Incan. Lamp Co.
Franklin Electric Mfg. Co.
General Electric Co.
McClintock & Co., H. W.
Nernst Lamp Co.
Sawyer-Man Elec. Co.
Shelby Electric Co.
Standard Elec'l Mfg. Co.
Sunbeam Incan. Lamp Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Lamps, Incandescent—Replacers & Cleaners.**
Inc. El. Lt. Manipulator Co.

**Lamps, Nernst.**
Nernst Lamp Co.

**Lamps, Vapor.**
Cooper, Hewitt Elec. Co.

**Leather Specialties.**
Bunge, Otto.

**Letters, Metal, Sign.**
Haller Machine Co.

**Lightning Arresters.**
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Manhattan Elec. Supply Co.
Stanley Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.

**Linemen's Climbers.**
Klein & Sons, Mathias.

**Magnet Wires.**
(See Wires and Cables.)

**Mechanical Draft.**
Green Fuel Economizer Co.

**Metaphones.**
Anderson & Nachman.

**Mica.**
Chicago Mica Co.
Mica Insulator Co.
Munsell & Co., Eugene

**Mining Apparatus, Elec.**
Allis-Chalmers Company.
Crocker-Wheeler Company.
General Electric Co.
Jeffrey Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Motors.** (See Dynamos and Motors.)

**Nippers and Pliers.**
Klein & Sons, Mathias.

**Overalls.**
Carhartt & Co., Hamilton

**Patent Attorneys.**
Bain, Foree.

**Phosphor Bronze.**
Phosphor Bronze Sm. Co. Ltd.

**Platinum, Wire and Sheet.**
Baker & Company Inc.

**Poles and Ties.**
Berthold & Jennings.
Brooks, Hall L.
Columbia Mfg. Co.
Fowler, John H.
Fowler-Jacobs Company.
Kellogg Switch. & Sup. Co.
Lindsley Bros. Co.
Loud's Sons Co., H. M.
Maltby Cedar Co.
Mueller Company, William.
Pacific Coast Pole Co.
Perrizo & Sons.
Phelan, D. W.
Pillsbury Watkins Co.
Pittsburg & L. S. Iron Co.
Porter Cedar Company.
S. E. Missouri Cypress Co.
Sterling & Son, W. C.
Torrey Cedar Co.
Valentine-Clark Co., The.
Worcester Co., C. H.

**Pole Hole Diggers.**
Western Steel Gate Co.

**Polish (Metal).**
Hoffman, Geo. W.

**Portables.**
Plume & Atwood Mfg. Co.

**Power Transmission Machinery.**
Jeffrey Mfg. Co.

**Rail Joints.**
Continuous Rail Joint Company of America.

**Railway Supplies.**
Wesco Supply Co.

**Re-Winding—Repairs.**
Chicago Edison Co.
Gregory Electric Co.

**Rheostats.**
Amer. Electric Fuse Co.
Cutler-Hammer Mfg. Co.
General Electric Co.
Union Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Schools and Colleges.**
Electrical Engineer Inst.
Highland Park College

**Second-Hand Mach'y.**
Bissell Co., The F.
Cent. Stat. Improvement Co.
Chicago House Wrecking Co.
Ely & Co., Allen P.
Gregory Electric Co.
Matthews & Bro., W. N.
Walsh's Sons & Co.

**Signs, Electric.**
Haller Machine Co.
Western Display Co.
Zero Marx Sign Works.

**Silks, Insulating and Braiding.**
Sauquoit Silk Mfg. Co.

**Sockets & Receptacles.**
Pass & Seymour.
Yost Elec. Mfg. Co.

**Soldering Sticks, Salts and Paste.**
Chicago Solder Co.
Crollus & Son, E. R.
Universal Co., The
Western Electric Co.

**Speaking Tubes.**
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.

**Specialties, Electrical Mfrs. and Designers.**
Haller Machine Co.

**Speed Indicators.**
Weston Electrical Inst. Co.

**Stage Lighting, Electric**
Universal Elec. Stage Lighting Co.

**Storage Batteries.**
American Battery Co.
Electric Storage Battery Co.
Gould Storage Battery Co.

**Supplies, General Elec.**
Amer. Elec'l Supply Co.
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Chicago Edison Co.
Electric Appliance Co.
General Electric Co.
Manhattan Elec'l Supply Co
Wesco Supply Co.
Western Electric Co.

**Switchboards.**
Bissell Co., The F.
Gen. Incan. Arc Light Co.

**Telephones, Telephone Material and Switchboards.**
American El. Telephone Co
Arnold Elec. Mfg. Co
Automatic Electric Co.
Bissell Co., The F.
Central Electric Co.
Central Tel. & El. Co.
Electric Appliance Co.
International Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co
Manhattan Elec. Supply Co
Stromberg-Carlson Tel. M.Co
Wesco Supply Co.
Western Electric Co.

**Time Switches.**
Bissell Co., The F.

**Tools.**
Klein & Sons, Mathias.
Western Electric Co.

**Transformers.**
Central Electric Co.
Crocker-Wheeler Co.
Electric Appliance Co.
Ft. Wayne Elec. Works, Inc.
General Electric Co.
Gregory Electric Co.
Kuhlman Electric Co.
Manhattan Elec. Supply Co.
National Electric Co.
Stanley Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Trucks, Electric Car.**
General Electric Co.
Westinghouse El. & Mfg. Co.

**Turbines, Steam.**
Allis-Chalmers Co.
General Electric Co.
Westinghouse El. & Mfg. Co

**Turbine Water Wheels**
Leffel & Co., Jas.

**Vulcanized Fibre.**
Vulcanized Fibre Co.

**Wires & Cables—Magnet Wires.**
American Electrical Works.
Bissell Co., The F.
Bissell Co., The F.
Central Electric Co.
Crescent Ins. Wire & Cble. Co
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
Indiana Rub. & Ins. Wire Co
India Rubber & Gutta Percha Insulating Co.
Kellogg Switch. & Sup. Co.
Manhattan Elec. Supply Co.
National India Rubber Co
New York Insulated Wire Co.
Northern Wire & Cable Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co
Roebling's Sons Co., J. A.
Runzel-Lenz Elec. Mfg. Co.
Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Spargo Wire Co., Jas. A.
Standard Underground C. Co
Wesco Supply Co.
Western Electric Company.

For Alphabetical Index of Advertisements See Page 3.

# COLUMBIA LAMPS

## GIVE MOST LIGHT

**A RECORD OF 15 YEARS** of success in maintaining our lamps on a plane above that of all competitors insures the continued supremacy of Columbia Lamps. ¶Most light with least current, uniformly long life, have been and always will be Columbia Lamps' characteristics. ¶You'll never regret ordering Columbia Lamps. Try them next. ¶Send for our catalogue of Crystal Lamps (Meridian type). ¶We are prepared to furnish a complete list of Pagoda Reflectors and Holophane Globes. Write for prices.

*Copy of our "Wallet Full of Wisdom" mailed on request.*

## THE COLUMBIA INCANDESCENT LAMP CO.

**ST. LOUIS, MO., U. S. A.**

LOOK FOR THE LICENSE LABEL IN THE STEM

**Branch Offices—Lamps in Stock**

**ST. LOUIS, MO., U. S. A.**

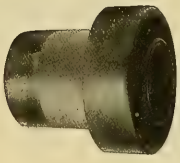
NEW YORK: 1311 Havemeyer Bldg.
CHICAGO: Central Electric Co.
SAN FRANCISCO: Paul Seiler Elec. Works.
PHILADELPHIA: 1227 Real Estate Trust Bldg.
MINNEAPOLIS: 638 Boston Block.
MEMPHIS: 302 Scimitar Bldg.
MEXICO: Monterey, Van Voorhis Hnos.

LOOK FOR THE LICENSE LABEL IN THE STEM

**Columbia Lamps are manufactured under a License to use the Chemical Exhaust Process of exhausting lamps. This process is vitally necessary in the production of the highest quality of lamp. Every package of Columbia Lamps carries a lable reading: Licensed Under**

Patent No. 537,693, April 16, 1895.
Patent No. 723,293, April 28, 1903.
Patent No. 444,530, Jan. 13, 1891
Patent No. 532,760, Jan. 22, 1895.

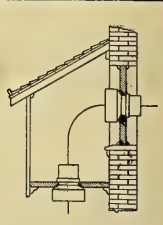
# GOLD MEDAL FOR VICTOR INSULATORS



This is No. 651 Wall Insulator, a cure for all Wall Entrance Insulation Troubles. This style is made for Voltages from 5,000 to 100,000 Volts. :: ::

Send for THE INSULATOR BOOK

It is Mailed Upon Request and Its Contents May Help You. The product Described Will Help Any Engineer With Transmission Troubles.



This is one method of application of our Wall Insulators. Those Insulators are used many places, in Power Houses, Substations, etc. They are Mechanically and Electrically strong. :: :: ::

THE LOCKE INSULATOR MFG. CO. VICTOR, N.Y.

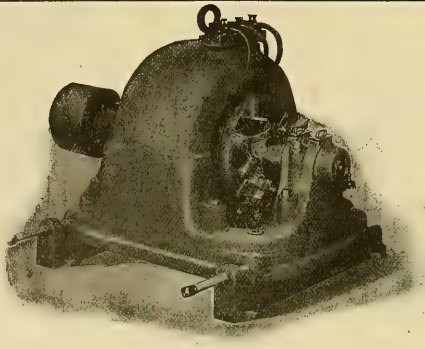
"Flexduct" is that high standard required in all high-class work. It is very flexible, a high insulation and indestructible

# FLEXIBLE CONDUIT

"Flexduct" the National Code Standard. It does not deteriorate, always usable to highest degree

OSBURN FLEXIBLE CONDUIT COMPANY,

NEW YORK CHICAGO SAN FRANCISCO



*CENTRAL STATION MANAGERS*

## Don't Be Afraid

of the Gas Plant

WORK UP A MOTOR LOAD

We can furnish you

## SINGLE PHASE MOTORS

that will start under full load in sizes ranging from 1/8 to 35 H. P.

*Wagner Electric Mfg. Co.*

*ST. LOUIS, MO., U. S. A.*

"FRES-KO" SOLDERING STICK

ABSOLUTELY NON-CORROSIVE

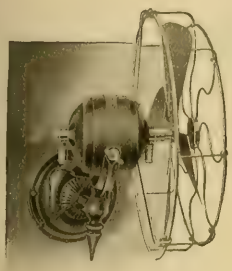
SOMETHING FOR NOTHING IS BETTER THAN NOTHING FOR SOMETHING

SEND FOR FREE SAMPLE

FRES-KO CHEMICAL CO. - Fort Wayne, Ind.

# General Electric Company

## 1905 FAN MOTORS



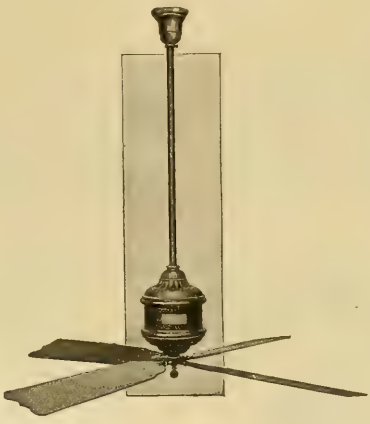
16-in. Wall Bracket Fan (D. C.)

**The thoughtful dealer always remembers that the customer looks for** **on his fan motor just as he does for "sterling" on his silver.**

12-in. Convertible Swivel and Trunnion Frame Desk Fan (A. C.). Low frequency for 25 and 40 cycles, commutating type.

### Direct-Current Fan Motors

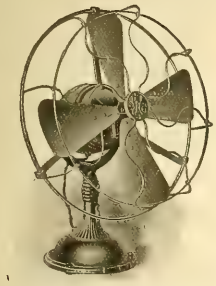
Are for operation on 115 and 230 volt circuits. They have three speeds. They are finished in black enamel, and the fan guard and the trimmings are of lacquered brass.



Three-Speed 58-in. Ceiling Fan (D. C.). Bipolar Type.

### Alternating Current Fan Motors

Are for operation on 100/115 and 190/220 volts, and 25, 40, 60 and 125/140 cycle circuits. The finish, guard and trimmings are identical with those of the direct-current fans.



16-in. Convertible Swivel and Trunnion Frame Desk Fan (D. C.).

**A few of the many good points of the General Electric Desk Fan:**

**Extremely low-current consumption.**

**Continuous operation without overheating.**

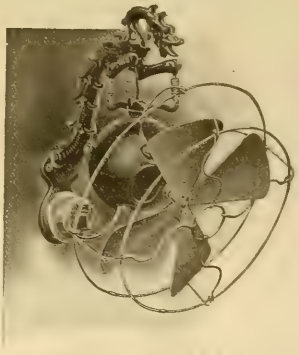
**Oil-catching device to prevent any scattering of oil.**

**Adaptability for use on either desk or bracket.**

**Ample trunnion adjustment.**

**A STOCK OF FAN MOTORS IS CARRIED IN ALL OUR LOCAL STOREROOMS.**

**If you are interested in THE BEST in desk, wall bracket, exhaust and ceiling fans and ventilating outfits, why not write us for our new descriptive catalogue?**



Telephone Booth Fan (A. C. or D. C.).

## PRINCIPAL OFFICES, SCHENECTADY, N. Y.

New York Office, 44 Broad Street — Sales Offices in all Large Cities

# WHEN YOU SEE RIBBONS

ON LINE WIRE
**YOU KNOW**
IT IS NOT OK

After ten years' use, O K Weatherproof will be as good as the day it was put up. We carry the largest stock of weatherproof wire west of New York.

**ELECTRIC APPLIANCE COMPANY**
CHICAGO AND SAN FRANCISCO

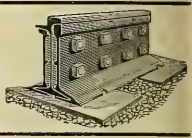
The insulation is the most important part of your machine—be sure you buy only the best. Cheap insulation cannot be good insulation.
IF IT'S MICABOND, YOU CAN BE SURE YOU HAVE THE BEST—OUR GUARANTEE IS BEHIND IT
**CHICAGO MICA CO. : : : Valparaiso, Ind.**

**MICA** Of all Qualities, in any Form at Lowest Prices
EUGENE MUNSELL AND CO.
NEW YORK and CHICAGO
**INSULATION** That Is.
Micanite, Linotape, M. I. C. Compound, Empire Cloth and Paper. For Years the Standard.
**MICA INSULATOR CO., Originators**
NEW YORK and CHICAGO

**BOSSERT'S BOXES**
Drawn steel. One blow of a hammer gives clean round hole. No filing.
SAVE TIME, BOXES AND MONEY
Be up to date. Use them. Write for bulletin giving full particulars.
Bossert Electric Construction Co., UTICA N.Y.

# LAMPS
Get acquainted with the
**PEERLESS**—MONEY SAVERS
MADE RIGHT
PRICED RIGHT
ARE RIGHT
WESCO
**THE WESCO SUPPLY CO., ST. LOUIS, MO.**
"EVERYTHING ELECTRICAL"

**CONTINUOUS RAIL JOINT CO. OF AM.**
NEWARK, N. J.
**OVER 20,000 MILES IN USE**
Highest Award at Paris Exposition, 1900, Buffalo, 1901, and St. Louis, 1904.



# Bituminized Fibre Conduit
## For Underground Construction
**COMBINES** the **GOOD FEATURES** of other conduits.
**ELIMINATES** the **BAD FEATURES** existing in many kinds.
**HAS VALUABLE FEATURES** not found in any other duct.

The American Conduit Company has a corps of experts in underground construction and is prepared to furnish supervision of work if desired. We would prefer to co-operate with contractors in underground construction, but if desired will submit estimates and bids and take contracts for completed underground systems in any part of the United States or Canada.

**AMERICAN CONDUIT COMPANY**
Main Offices
1005-6 MANHATTAN BUILDING
CHICAGO.
Other Offices
170 Broadway, New York
336 Macy Street, Los Angeles

# WANTED
***You Who are Troubled with Sparking and Cutting of Commutators to Use***

The only article that will PREVENT SPARKING. Will keep the commutator in good condition and PREVENT CUTTING.
***Absolutely Will Not Gum The Brushes . . .***
It will put that high gloss on the commutator you have so long sought after.
***50 Cts. per Stick. $5.00 per Dozen***
For Sale by all Supply Houses, or
***FREE, Sample Stick.***
***K. McLENNAN & CO.,***
Sole Manufacturers,
909 Title and Trust Bldg., CHICAGO, ILL.

**VOLT - AMMETERS**
**POCKET SIZE**
For testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.
RELIABLE. - ACCURATE.
Send for Circular.
**L. M. PIGNOLET**
78-80 Cortlandt St., NEW YORK, N. Y.

# The JAMES A. SPARGO WIRE CO.
JAMES A. SPARGO, Pres. and Gen'l Mgr.
Manufacturers of
BARE AND TINNED COPPER WIRE
FINE SIZES A SPECIALTY Chicago Office, 1501 Monadnock Bldg. ROME, N. Y.

**CENTURY ELECTRIC CO.**
MANUFACTURERS OF
**SINGLE-PHASE SELF-STARTING MOTORS AND CEILING FANS**
ST. LOUIS, MO.

# YOST SPECIALTIES.

***Sockets, Wall Sockets, Weatherproof Sockets, Rosettes, Receptacles, Cord Adjusters.***
***Catalogue for the asking.***
**THE YOST ELECTRIC MFG. CO.**
TOLEDO, OHIO.

# Edison Miniature Lamps
..FOR..
# NOVELTY DEVICES

For use in electric flashlights, candlesticks, pocket lanterns, carriage and bicycle lamps, clock lights for bedrooms, ruby lanterns for photography and for optical, dental and surgical instruments.

Telephone Lamps
Candelabra Lamps
Decorative Lamps

All types supplied—accurately rated—carefully selected

EDISON DECORATIVE AND MINIATURE LAMP DEPARTMENT
**General Electric Company, Harrison, N. J.**
(512)

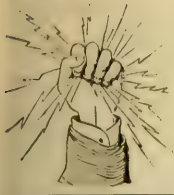
**DON'T BUY ELECTRICAL SUPPLIES**
**Until you have seen our new Catalogue and new Price List.**
**Free to the trade.**
**Manhattan Electrical Supply Co.**
NEW YORK: 32 Cortlandt St.
CHICAGO: 188 Fifth Ave.

**"AMERICAN" STORAGE CELLS**
ARE THE BEST. Send for descriptive Circular.
**AMERICAN BATTERY CO.,**
ESTD 1889. 171 S. Clinton St., Chicago.

FRANK N. PHILLIPS, Pres. E. ROWLAND PHILLIPS, V. P. C. H. WAGENSEIL, Treas. C. R. REMINGTON, Jr., Sec.

# AMERICAN ELECTRICAL WORKS,

PROVIDENCE, R. I.



BARE AND INSULATED ELECTRIC WIRE,

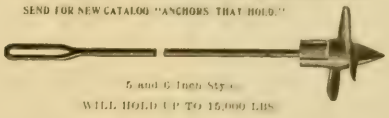
ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,
**Railway Feeder and Trolley Wire,**
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
CABLES FOR AERIAL AND UNDERGROUND USE.

NEW YORK STORE, W. J. Watson, 26 Cortlandt St.
CHICAGO STORE, F. E. Donohue, 82 Lake St.
MONTREAL BRANCH, Eugene F. Phillips' Electrical Works.
MAIN OFFICES AND FACTORIES, PHILLIPSDALE, R. I.

**EXPERT IN** ELECTRICITY MECHANICS PATENT CAUSES
SOLICITOR OF **PATENTS**
U. S. & FOREIGN
FOREE BAIN, 1852-3 Monadnock Blk., CHICAGO

**EMPIRE MINIATURE LAMPS**
Send for Circular
H. W. McCANDLESS & CO.
67 & 69 Park Pl
NEW YORK

OUR PROPOSITION.
WE WILL SHIP ON 5 DAYS' TRIAL
ANY NUMBER OF
**STOMBAUGH GUY ANCHORS**
OVER TWELVE
IF SATISFACTORY PAY FOR THEM, OTHERWISE, RETURN CHARGES COLLECT.
WE PREPAY FREIGHT ON INITIAL ORDERS.
SEND FOR NEW CATALOG "ANCHORS THAT HOLD."



5 and 6 Inch Style
WILL HOLD UP TO 15,000 LBS
W. N. MATTHEWS & BRO.
MANUFACTURERS
603 Carleton Building ST. LOUIS, MO.

Crimshaw

Raven White Core

Raven Black Core

**ALL OUR WIRES** pass inspection and carry the above **TRADE-MARKS** on our tags. We also manufacture **Crimshaw** and **Competition Tapes** and **Splicing Compounds.**

# NEW YORK INSULATED WIRE COMPANY,

MAIN OFFICE: 114, 116 & 118 Liberty St., New York.
BRANCHES: CHICAGO: 192 Desplaines St. BOSTON: 7 Otis St. SAN FRANCISCO: 32 Second St.

## American Electrical Supply Company

Manufacturers and Wholesale Dealers in all kinds of

**Electrical Supplies**

83-85-87 FIFTH AVENUE
CHICAGO

**INSULATED WIRES**
COTTON AND SILK
NORTHERN WIRE & CABLE CO.
OFFICES: Milwaukee, 740-742 Wells Bldg. Chicago, 1202 Marquette Bldg.
MAGNET WIRES
South Milwaukee Wis.

## NATIONAL CODE STANDARD

"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Ideal Wire.
**Prices and Samples on Application.**

## Phillips Insulated Wire Co.

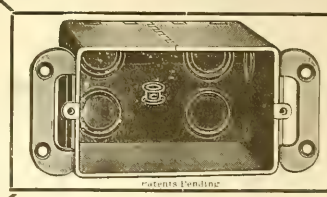
Office and Factory: PAWTUCKET, R. I.

SAUQUOIT SILK MFG. COMPANY
INSULATING and BRAIDING SILKS

**MILLS:**
BETHLEHEM, PA.
PHILADELPHIA, PA.
SCRANTON, PA.
NEW YORK REPRESENTATIVES:
WILLIAM RYLE & COMPANY
54 Howard St.
PHILADELPHIA OFFICE:
4015 Clarissa St.
CHICAGO OFFICE:
210 Monroe St.
BOSTON OFFICE:
78 Chauncy St.

## "UNION" SWITCHBOX.

This Box will fit all standard switches and receptacles and has been approved by the Underwriters National Electric Association




Gangs of 2 3 4, 5 and 6 carried in stock, provided with clamps for holding Sprague Cable. Tandem Boxes made to order.

CHICAGO FUSE WIRE & MFG. CO.,
CHICAGO. NEW YORK. BUFFALO.

## Electric Heating Apparatus

SEND FOR 62-PAGE CATALOGUE.

**UNIT" ENAMELED RHEOSTATS**
SIMPLEX ELECTRIC HEATING CO.,
Cambridgeport, Mass.

The cumulative feature of advertising is ofttimes overlooked. This is the case more especially with a man who is entering upon his first advertising campaign. He frequently expects immediate and large returns; and if the returns are not as prompt and as great as he thinks they should be he is tempted to throw the entire blame upon the advertising medium.

Assuming that his ad occupies a reasonable amount of space, is attractive, and in the right medium, it will bring returns later if not earlier. The seed is being sown. The harvest time will come in the future.

It is necessary to make your name and your product familiar to the readers of the journal or journals in which you are advertising. Seeing your ad repeatedly they gradually acquire confidence in your business stability and in the goods you make.

They memorize your name unconsciously. When they are in the market for your class of goods they will write you, or they will give the order to your representative when he calls.

It takes time to educate the buyer. Advertising in the Western Electrician will educate an army of buyers at one and the same time.

**WANTED, FOR SALE** *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 3c each.* **POSITION WANTED** *advertisements (50 words or less), $1.00 an insertion; additional words 2c each.*

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By first-class steam and electrical engineer with 28 years' experience in the operation of power plants. Wishes to invest $1,000 and take position on official or operating forces in either lighting, power, manufactory or electrical machine shop; thoroughly understand handling financial and technical part of work. Strictly sober and educated. Address BOX 461, care Western Electrician, 510 Marquette Bldg., Chicago, Ill.

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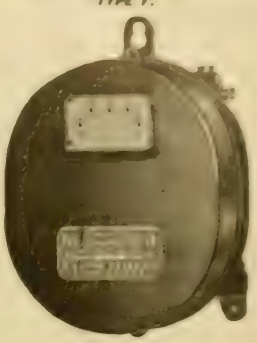

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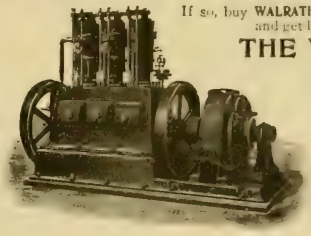

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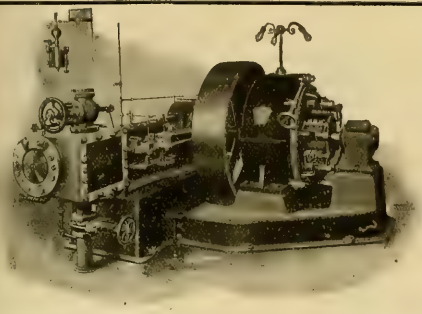

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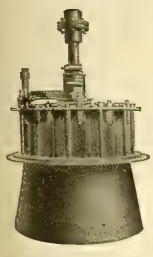

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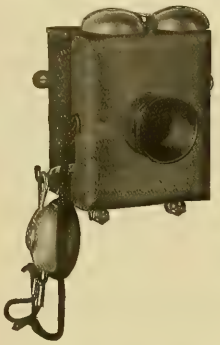

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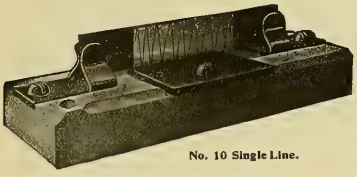

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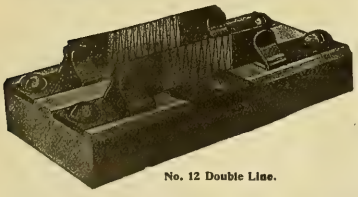

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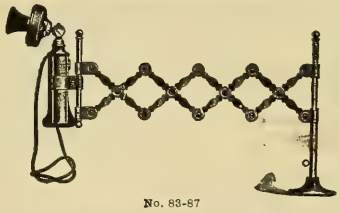

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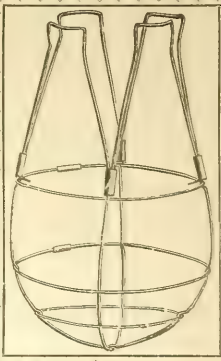

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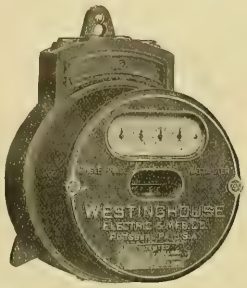


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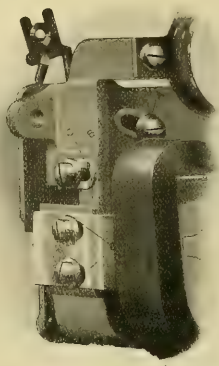

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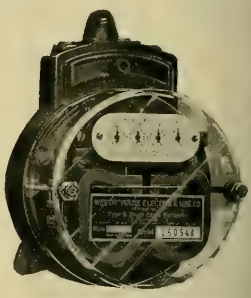

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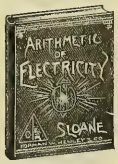


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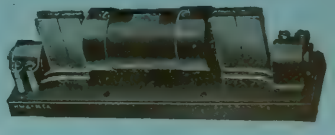

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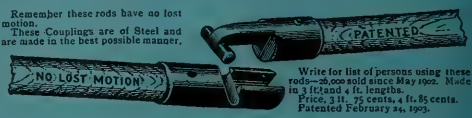

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Manufacturers and Electrical Engineers
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Chicago Office, Old Colony Bldg.

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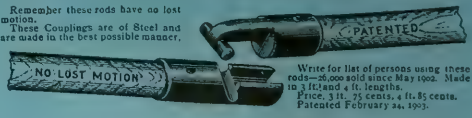


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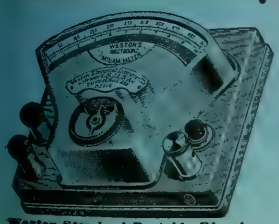

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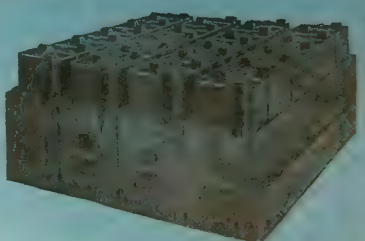

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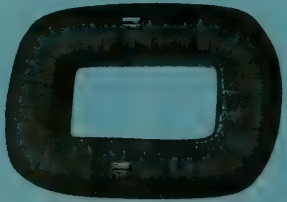

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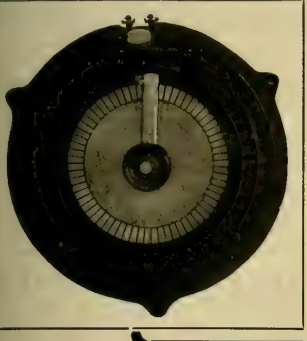

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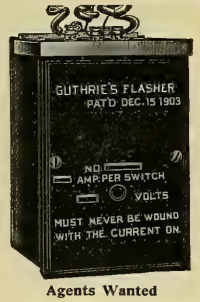
A SIGN FLASHER WITHOUT A MOTOR

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*First.*—The Price is lower.
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Any combination of lights, without motor or cylinder.
Simplest and best on the market.
Works on any current.
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FOR ELECTRICIANS

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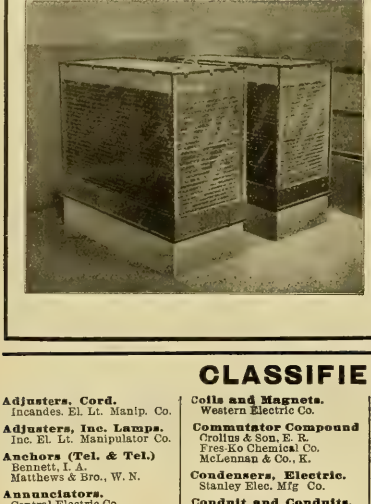

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It costs no more than the Cell Type.

It has comparatively, considerably more active material and occupies less space (about half that required by Cell Type).

It is far more durable—is cleaner and more economical in operation and much less expensive in cost of maintenance.

Besides, this important fact must not be overlooked: There are no annoying and destructive fumes as with the Cell Type. The gas does not escape, therefore no corrosion of adjacent pipe or iron work or even the tarnishing of bright metal work.

## TRAY PLATE BATTERY CO.

Successors Smith Storage Battery Co.

New York Office, 39 Cortlandt St. 5-11 FREDERICK ST., BINGHAMTON, N. Y.


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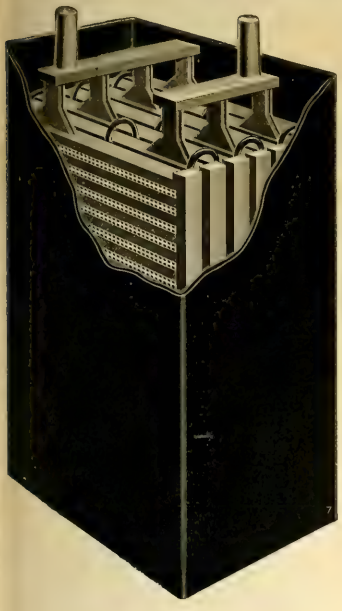

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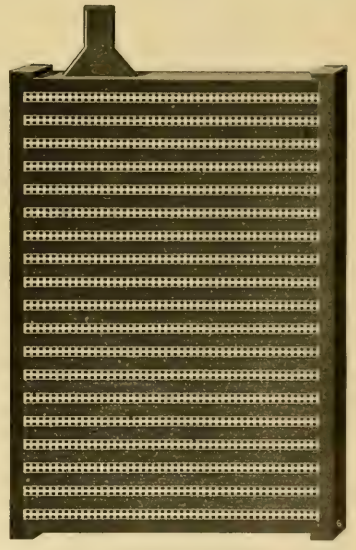
***The weight efficiency is conservatively 14 watts per pound total weight, and electrical efficiency unsurpassed.***



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**Factory: 472-478 Carroll Avenue**

**Chicago, Illinois**

## SMALL MOTORS for SMALL POWER REQUIREMENTS

*The line of Crocker-Wheeler Form L MOTORS Outputs ¼ to 3 H. P. See Bulletin No. 42.*

STURDY, COMPACT, SERVICEABLE, CONVENIENT.
FOR WALL OR CEILING SUSPENSION.
CAN BE RENDERED DUSTPROOF.
***CARRIED IN STOCK IN CHICAGO.***

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On receipt of
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we will send you a
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Every lighting man should have one.

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Simple and substantial construction; excellent speed regulation; perfect ventilation; low temperature maintained in operation. :: ::

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This Trade-Mark guarantees quality.

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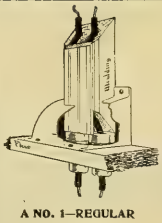

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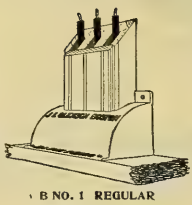

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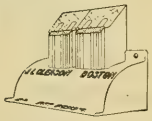

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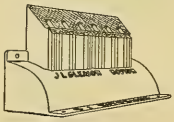

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**The Highest Possible Award**
**Has Been Given to**

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**By the International Jury of Awards, of the Louisiana Purchase Exposition, St. Louis, 1904.**

**HUGO REISINGER, Sole Importer, 11 BROADWAY, NEW YORK**

"Nature Smiles Through Sunbeams"

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THE LAMP OF QUALITY

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CHICAGO NEW YORK

DISTRIBUTING AGENTS

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# *General Electric Company*

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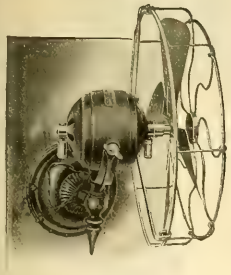

The General Electric Desk Fan is very economical in current consumption, operates continuously without overheating, has ample trunnion adjustment, and cannot scatter oil. It may be used on either desk or bracket.

A full stock is carried in all local storerooms.

Descriptive catalogue mailed on request.

16-in. Wall Bracket Fan (D. C.)

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NEW YORK OFFICE
**44 BROAD STREET**

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**SCHENECTADY, N. Y.**

SALES OFFICES
**ALL LARGE CITIES**

(514)

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ON LINE WIRE
**YOU KNOW**
IT IS NOT OK

After ten years' use, O K Weatherproof will be as good as the day it was put up. We carry the largest stock of weatherproof wire west of New York.

**ELECTRIC APPLIANCE COMPANY**
CHICAGO AND SAN FRANCISCO

**VOLT - AMMETERS**
POCKET SIZE
For testing Batteries and Battery Circuits. Locating Faults, Grounds, etc.
RELIABLE. - ACCURATE.
Send for Circular.
**L. M. PICNOLET**
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OR SCRAPS, ANY SIZE OR CONDITION.
WE CLEAN, REPAIR AND RENEW OLD BELTS.
*LEATHER PRESERVER MFG. CORP.*
27 W. MONROE ST., CHICAGO

LET
# EDISON LAMPS
*Do Your Lighting*

They cost less than all others in the end.

LOOK FOR THE LICENSE LABEL

**GENERAL ELECTRIC COMPANY**
All types and varieties.
Regular Multiple Lamps.
Street Series Lamps.
Miniature Lamps.
Main Lamp Sales Office,
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(511)

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**GAS & ELECTRIC FIXTURES** FOR THE TRADE.
*CATALOG SENT PREPAID TO DEALERS* MENTION THIS PAPER

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***Reduces the working capacity of a motor or dynamo, wears out the commutator, wastes power and may cause a fire. All this may be avoided if you use . . . . . .***

The only article that will PREVENT SPARKING. Will keep the Commutator in good condition and PREVENT CUTTING.

**Absolutely Will Not Gum The Brushes.**

50 Cents per Stick. $5.00 per Dozen.
*SEND FOR FREE SAMPLE STICK*
For sale by all supply houses, or

It will put that high gloss on the Commutator you have so long sought after.

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Of all Qualities, In any Form at Lowest Prices
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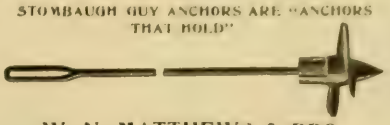

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|---|---|---|---|
| 26,500 | 300 M.C. M. | 3 | 6,600 |
| 9,500 | 4 -0 | 3 | 6,600 |
| 4,700 | 3—0 | 3 | 6,600 |
| 7,500 | 2—0 | 3 | 6,600 |
| 14,500 | 1—0 | 3 | 6,600 |
| 18,500 | No. 1 | 3 | 6,600 |
| 11,500 | No. 2 | 3 | 6,600 |
| 4,700 | No. 3 | 3 | 6,600 |
| 7,100 | No. 4 | 3 | 6,600 |
| 11,500 | No. 6 | 3 | 6,600 |
| 25,000 | 4—0 | 1 | 2,200 |
| 1,900 | 2—0 | 1 | 2,200 |
| 11,600 | 1 0 | 1 | 2,200 |
| 9,000 | No. 1 | 1 | 2,200 |
| 11,000 | No. 2 | 1 | 2,200 |
| 18,000 | No. 4 | 1 | 2,200 |
| 48,000 | No. 6 | 1 | 2,200 |
| 1,900 | No. 8 | 1 | 2,200 |
| 25,000 | 500 M-C. M. | 1 | 500 |
| 60,000 | 4 -0 | 1 | 500 |
| 11,000 | 3—0 | 1 | 500 |
| 11,000 | 2—0 | 1 | 500 |
| 3,700 | No. 1 | 1 | 500 |
| 2,900 | No. 6 | 1 | 500 |
| 180,000 | No. 6 | 1 | 8,000 |
| 14,500 | No 14 | 6 | Fire Alarm |
| 29,000 | No. 14 | 4 | " " |
| 29,000 | No. 14 | 3 | " " |
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200,000 Lamps, used a short time, and in good condition for further service. Have been tested. They are 104 voltage, Edison base, 8 candlepower. In lots of 1,000, each 5 cents.

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20,000 No. 8 Standard Porcelain Knobs.
200,000 Single Wire glazed Porcelain Cleats.
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26,000 Plugs.
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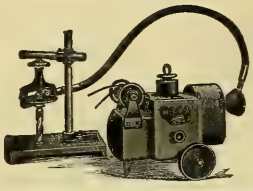

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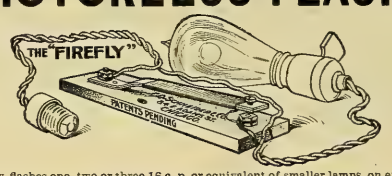


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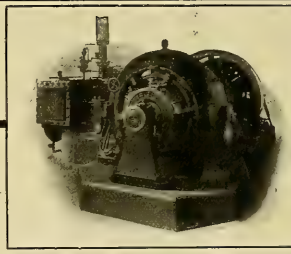

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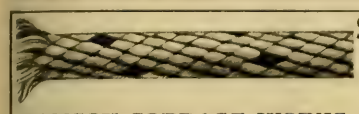

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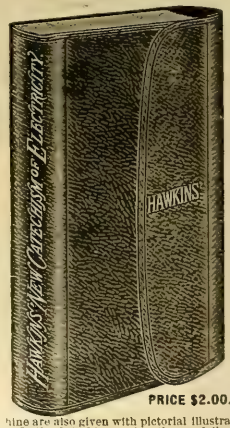


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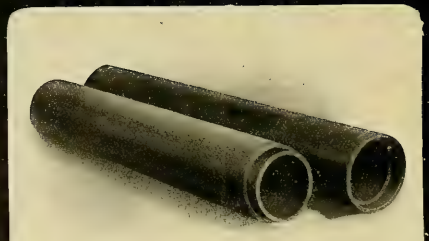

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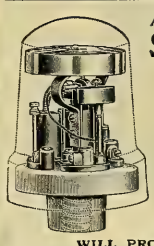

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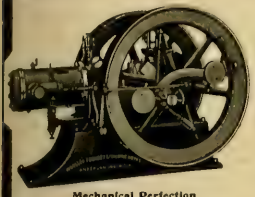

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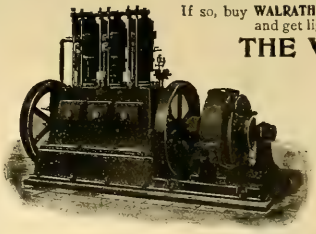

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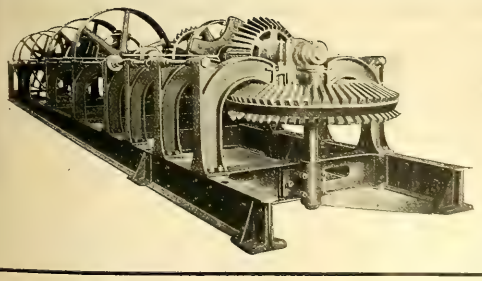

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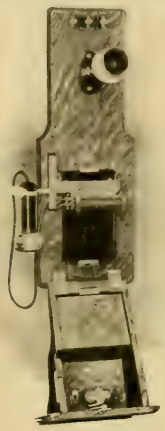

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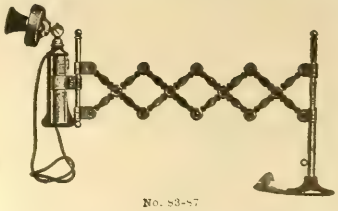

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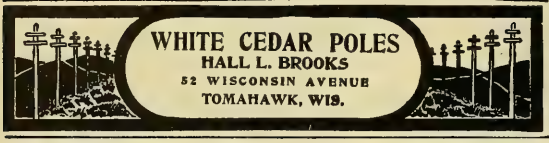


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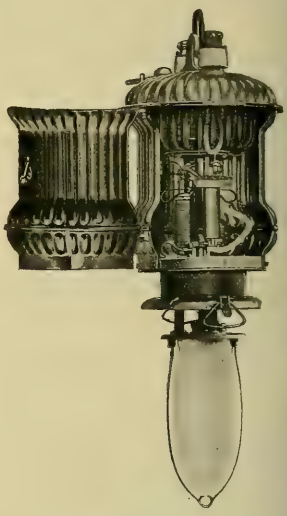

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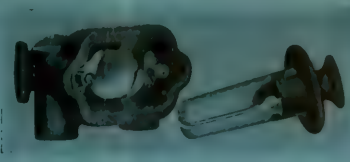

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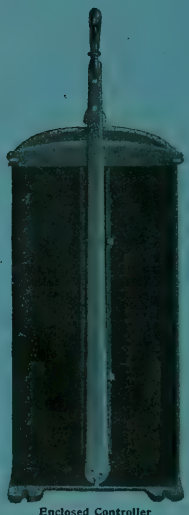

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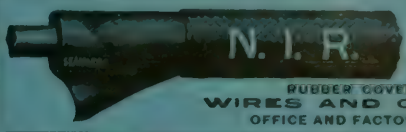

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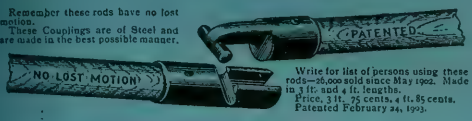

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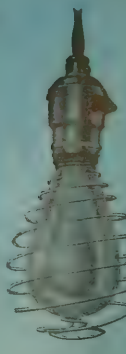
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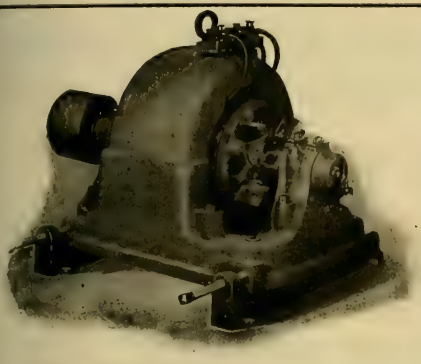

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The seven years success of PITTSBURGH TRANSFORMERS cannot possibly be due to two or three features however excellent. Transformers see some pretty [illegible] and if they are not good all through they cannot hold their place in the market essentially unchanged, for seven years.

*STICK TO PITTSBURGH AND BE ON THE SAFE SIDE.*

OKONITE IT NEVER DISAPPOINTS

**Central Electric Company,**

*GENERAL WESTERN AGENTS*

207-209-211 East Jackson Boulevard, CHICAGO

OKONITE IT NEVER DISAPPOINTS

# LUNDELL UNIVERSAL MOTORS

STANDARD VARIABLE SPEED MOTORS HAVE A RANGE OF 3 TO 1 BY FIELD CONTROL

**National Electric Company**

**Milwaukee, U. S. A.**

**District Offices**

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Philadelphia, 1509 Land Title Bldg.
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# Allen Bradley Electric Controllers

Standard Controller

Enclosed Controller

MADE IN ALL SIZES

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Chicago New York

**Cutter's "Ebony" Wire Rope**



The only wire rope really pliable enough to work freely with standard types of pulleys.

**George Cutter Co.**
525 Notre Dame St.,
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GREAT BARRINGTON, MASS., U. S. A.

UNIVERSAL EXPOSITION ST. LOUIS 1904

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*Complete Storage Battery Plants*

*Railway Line and Regulating*
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Gould Storage Battery Co.
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Chicago Edison Co.
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Electric Appliance Co.
General Electric Co.
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Western Electric Co.

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Anderson & Nachman.
Arnold Elec. Mfg. Co.
Automatic Electric Co.
Bissell Co., The F.
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Central Tel. & El. Co.
Electric Appliance Co.
International Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co.
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Standard Underground C. Co
Wesco Supply Co.
Western Electric Company.

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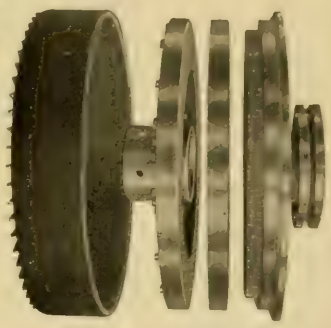
# The C-H Accelerator

## *WHAT IT IS AND WHAT IT DOES*



Parts in their proper relation. Beginning from the left-Oil Casing, Field Magnetizing Coil, and Back Plate with flange to which Oil Casing is attached.

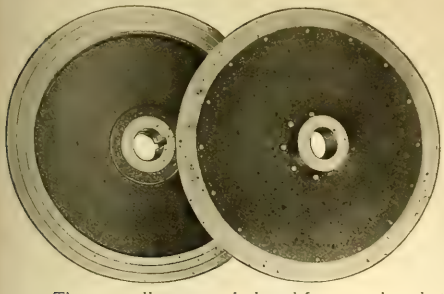
THE Cutler-Hammer Accelerator is a form of magnetic clutch, but different from any magnetic clutch thus far produced, for the reason that it will uniformly accelerate a load from rest to synchronism, run at high speeds, transmit any H. P., and take hold and release immediately.

It is dependable, durable, simple in construction, compact in size, neat in appearance, has no links nor loose parts, and runs in oil.

It can be operated from the switchboard, or any other point or points of convenience, by push buttons, and can be applied to almost any form of apparatus or condition of service.

It has ample wearing surfaces and requires no adjustment for that purpose.

It is self-oiling, the only attention required being the occasional renewing of oil in the casings, and the replacing of worn-out brushes.



The coil construction prohibits the possibility of open or short circuits, it being enclosed mechanically and thoroughly insulated electrically.

There is no guess work in this device. We have experimented, without stinting expense, for several years, and for nearly that length of time we have had practically the same device we now offer you in successful operation in our own factory.

## The C-H Magnetic Couplings

These couplings are extremely simple in construction, being composed of two steel plates, the field member of which is fitted with the energizing coil, as shown in the illustration.

When the coil circuit is closed, the plates spring together and are held by an enormous pressure. When the current is interrupted they spring apart.

These couplings were designed for use where both shafts are at rest, or where they are running at the same speed. They are applicable for power station work, for quick release to prevent accidents in mills, and for the automatic protection of machinery. The magnetizing current is small, in the larger sizes being but a fraction of 1 per cent. of the power transmitted.

They are made of the best material throughout, and special precaution is taken to guard against grounds and heating.

Send to-day for our catalogue, describing both our Accelerators and Couplings.

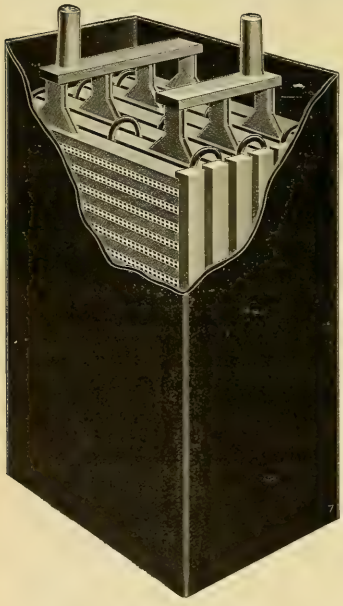
# Cutler-Hammer Clutch Company

MILWAUKEE, WISCONSIN

| NEW YORK | BOSTON | CHICAGO | PITTSBURG |
|---|---|---|---|
| 136 Liberty St. | 176 Federal St. | Monadnock Bldg. | Farmers Bank Bldg. |

# THE NEW "MORRISON" STORAGE BATTERY

## Just What the World Has Been Waiting For.

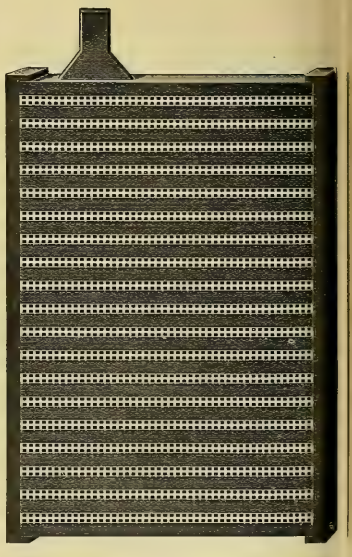


THE CELL

**This plate is so strong electrically and mechanically that no amount of electrical abuse or of vibration in traction service can dislodge even the slightest particle of its active material.**

**Lowest internal resistance of any storage battery in the world.**

***The weight efficiency is conservatively 14 watts per pound total weight, and electrical efficiency unsurpassed.***



THE PLATE

# Universal Electric Storage Battery Co.

*INCORPORATED*

**Office: 1355 Railway Exchange Building**

**Factory: 36-38 Union Park Place**

**Chicago, Illinois**

# GRAND PRIZE

**The Highest Possible Award**

**Has Been Given to**

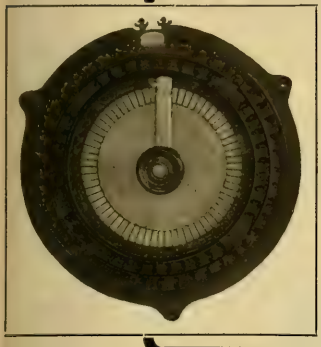
ELECTRA

·TRADE MARK·

## HIGHEST GRADE NUERNBERG CARBONS

**By the International Jury of Awards, of the Louisiana Purchase Exposition, St. Louis, 1904.**

**HUGO REISINGER, Sole Importer, 11 BROADWAY, NEW YORK**



## CONSTANT USE OF THE C-H. FIELD REGULATOR HAS PROVEN

That the material of which its base is made does not allow grounding; that overloads do not disintegrate it; that it readily radiates and conducts heat, and is a perfect insulator. Its construction is such that no trouble can exist from small parts or contacts. Bulletin 32 explains in detail.

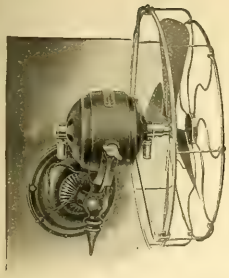
THE CUTLER-HAMMER MFG. CO.

MILWAUKEE, WIS.

NEW YORK CHICAGO PITTSBURG BOSTON

# *General Electric Company*

## FAN MOTORS



16-in. Wall Bracket Fan (D. C.)

The General Electric Company furnishes a complete line in desk, wall bracket, exhaust and ceiling fans and ventilating outfits.

A full stock is carried in all local storerooms.

Descriptive catalogue mailed on request.

12-in. Convertible Swivel and Trunnion Frame Desk Fan (A. C.)

NEW YORK OFFICE
**44 BROAD STREET**

PRINCIPAL OFFICES
**SCHENECTADY, N. Y.**

SALES OFFICES
**ALL LARGE CITIES**

(515)

## *The Lamp and the Lily*

The Prismo Zenith Lamp and the Easter lily are both things of beauty.

But the lamp has the advantage, as it will remain a joy all summer.

For a combination of usefulness and beauty the Packard Prismo Zenith Lamp is IT.

**Electric Appliance Company**
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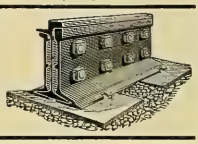

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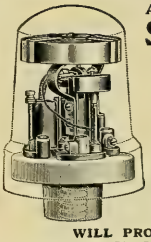

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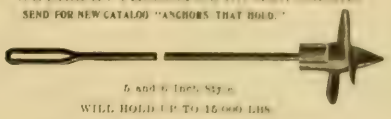

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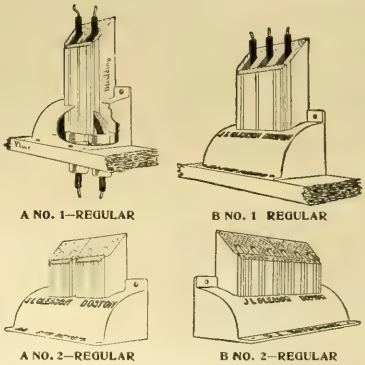

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| 9,0 0 | No. 1 | 1 | 2,200 |
| 11,0 0 | No. 2 | 1 | 2,200 |
| 18,400 | No. 4 | 1 | 2,200 |
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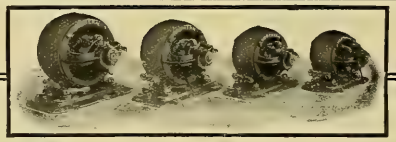

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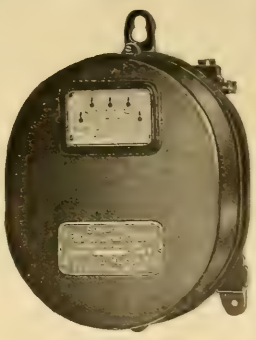

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**To the User,** because of its promptness, its accuracy, its secrecy;

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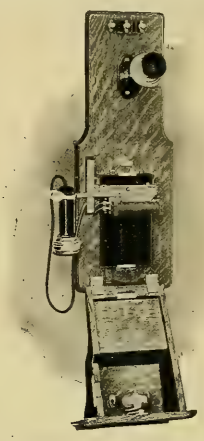

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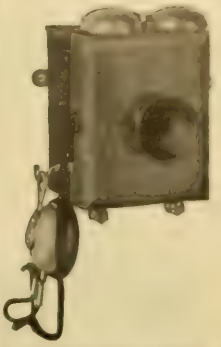

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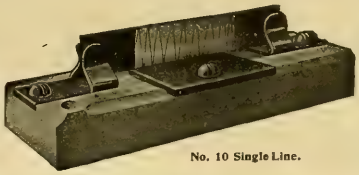
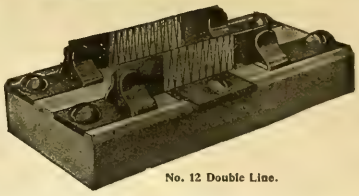


No. 10 Single Line.



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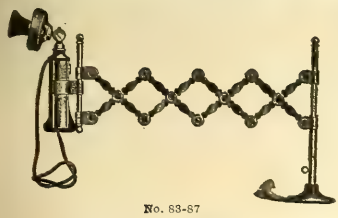

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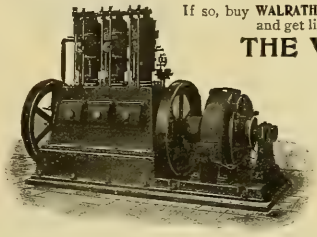

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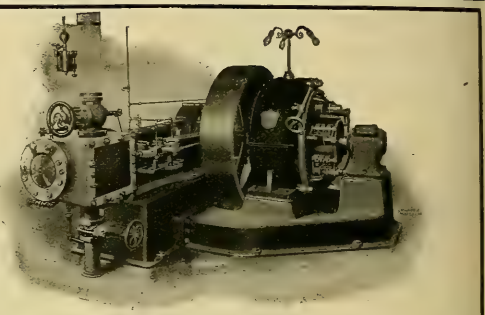

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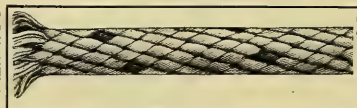

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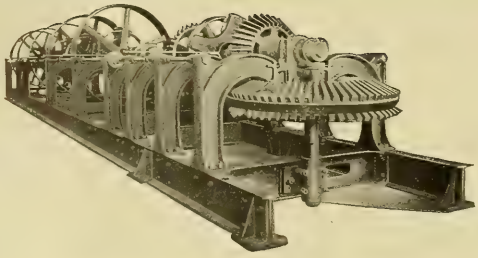

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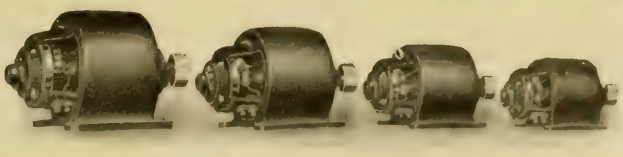

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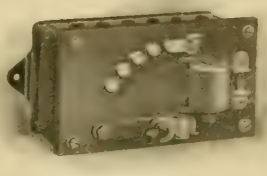

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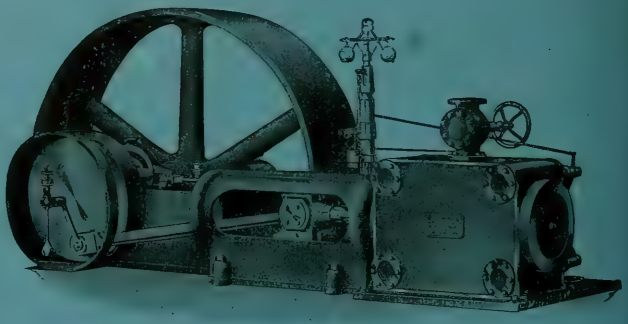

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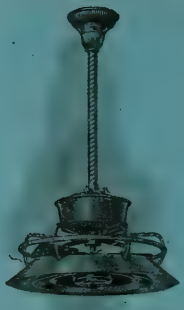

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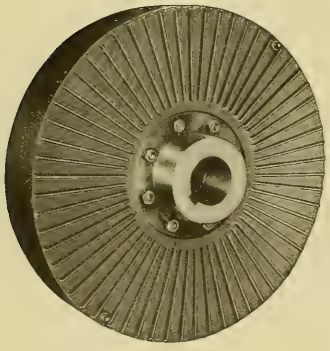

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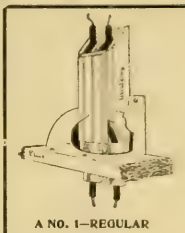

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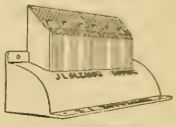

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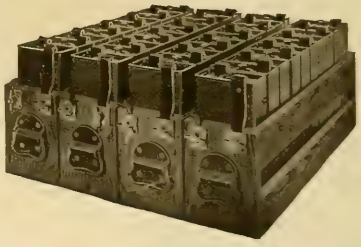

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***CARRIED IN STOCK IN CHICAGO.***

# Crocker-Wheeler Company

Sixteen Branch Offices **Ampere, N. J.** Chicago Office, Old Colony Bldg.


# CLASSIFIED INDEX OF ADVERTISEMENTS.

**Adjusters, Cord.**
Incandes. El. Lt. Manip. Co.

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Wesco Supply Co.
Western Electric Co.

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Wesco Supply Co.
Western Electric Company.

**For Alphabetical Index of Advertisements See Page 8.**

# THE NEW "MORRISON" STORAGE BATTERY

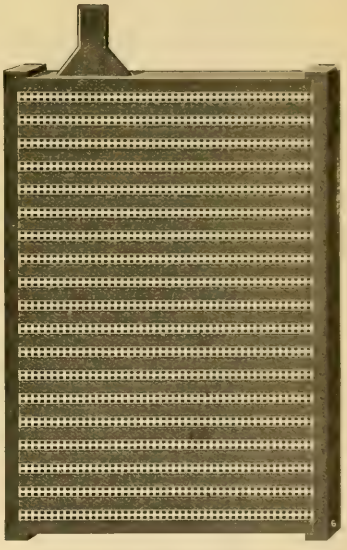
## Just What the World Has Been Waiting For.

THE CELL

This plate is so strong electrically and mechanically that no amount of electrical abuse or of vibration in traction service can dislodge even the slightest particle of its active material.

Lowest internal resistance of any storage battery in the world.

***The weight efficiency is conservatively 14 watts per pound total weight, and electrical efficiency unsurpassed.***



THE PLATE

# Universal Electric Storage Battery Co.

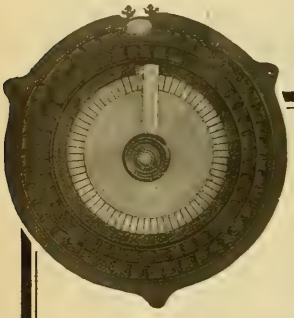
*INCORPORATED*

**Office: 1355 Railway Exchange Building**

**Factory: 36-38 Union Park Place**

**Chicago, Illinois**

# No Trouble from Loose Parts



THE current carrying parts of the Cutler-Hammer Field Regulator are solidly imbedded in the base by a compound, the nature of which causes it to become part of the base itself. This compound will not separate from the base, no matter to what degree the wires are heated. White hot wire tests have thoroughly demonstrated this fact. By such a construction the trouble incident to loose parts is eliminated.

The base itself is a perfect insulator; radiates and conducts heat properly; does not allow grounds, and will not disintegrate from overloads.

The handle is easily moved, but is not affected by jar of machinery.

For rear of board mounting we furnish an all-copper hand wheel, polished and lacquered, and insulated by a single piece of fibre.

Our convertible type is equipped with all-copper wheel on one side and a hard rubber handle on the reverse side, and can be operated from either front or rear of board.

LET US SEND YOU BULLETIN 32
WHICH DESCRIBES IT

## The Cutler-Hammer Mfg. Co.

MILWAUKEE, WISCONSIN

NEW YORK BOSTON CHICAGO PITTSBURG
136 Liberty Street 176 Federal Street Monadnock Bldg. Farmers Bank Bldg.

# "ARC BURST" CLUSTER

## THE POPULAR STORE LIGHT

AND ARC LIGHT DISPLACER. TRY THEM AND CUT DOWN YOUR LIGHT BILL 25 PER CENT.

A practical grouping of highest efficiency meridian type lamps with **Benjamin Wireless Clusters** made doubly effective by reflectors, scientifically arranged to radiate and distribute perfectly all available light.

The first cost is much lower and the cost of operation is 25 to 40 per cent. less than an ordinary enclosed arc lamp, while the general effect is a steady, soft light evenly diffused, which is most agreeable to the eyes and especially applicable to effective display of colors.

**BETTER AND CHEAPER THAN ARC LAMPS**

**Economical, Reliable, Durable**

A light particularly adapted for Stores of all kinds. Art Galleries, Restaurants and all public buildings.

**NATIONAL CODE STANDARD**

Our New Catalogue -Just off the Press. GET ONE

## BENJAMIN ELECTRIC MFG. CO.,

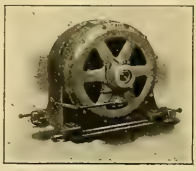
MANUFACTURERS OF

BENJAMIN WIRELESS CLUSTERS AND LIGHTING SPECIALTIES

Address Dept D., 42 West Jackson Blvd., CHICAGO NEW YORK SAN FRANCISCO

# THE SKC SYSTEM Single-Phase and Poly-phase Induction Motors

Simple and substantial construction; excellent speed regulation; perfect ventilation; low temperature maintained in operation. :: ::



**Send for Bulletins**

## Stanley Electric Mfg. Company

Pittsfield, Mass. Chicago, Monadnock Block

# GRAND PRIZE

**The Highest Possible Award**

**Has Been Given to**

ELECTRA

TRADE MARK

## HIGHEST GRADE NUERNBERG CARBONS

**By the International Jury of Awards, of the Louisiana Purchase Exposition, St. Louis, 1904.**

**HUGO REISINGER, Sole Importer, 11 BROADWAY, NEW YORK**

THE **METAPHONE** TRADE MARK

**Intercommunicating Telephone System,**

**AUTOMATIC and without cross talk.**

**The METAPHONE the easiest to install.**

MADE IN DIFFERENT FINISHES

The Metaphone is the best for any telephone installation.

GET OUR CATALOG AND PRICES

**Anderson & Nachman**

356 Dearborn Street

**CHICAGO**

Phone, Harrison 4968 Suite 208

THE BEST **BRAZING TORCH**

FOR ELECTRICIANS

**HOTTEST ON EARTH**

The Turner 4B Gasoline Brazing Torch is used by all mechanics for light work in brazing, annealing, tempering and drawing temper of small tools, etc. This torch produces an intensely hot, pointed flame of over 3,000° Fahr. Burns 4 hours from one filling.

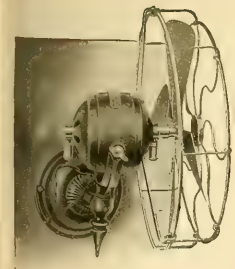
**PRICE $4.50 NET**

**THE TURNER BRASS WORKS**

**23 N. Franklin St., Chicago**

# *General Electric Company*

## FAN MOTORS



16-in. Wall Bracket Fan (D. C.)

The General Electric Company furnishes a complete line in desk, wall bracket, exhaust and ceiling fans and ventilating outfits.

A full stock is carried in all local storerooms.

Descriptive catalogue mailed on request.

12-in. Convertible Swivel and Trunnion Frame Desk Fan (A. C.)

NEW YORK OFFICE
**44 BROAD STREET**

PRINCIPAL OFFICES
**SCHENECTADY, N. Y.**

SALES OFFICES
**ALL LARGE CITIES**

(515)

# The Western Electric Light Convention

THE National Electric Light Convention to be held at Denver, June 6th, 7th and 8th and at Colorado Springs, June 9th, 10th and 11th, will be the largest and the most important in the history of the association.

The issues of the Western Electrician of June 3d, 10th and 17th will be of corresponding importance.

The issue of June 3d will be distributed at the convention and will be devoted largely to the electrical interests of Denver and Colorado Springs. It will contain portraits of leading central-station men, completely illustrated articles descriptive of commercial lighting plants, the full programme of the convention, and much other material of especial value to those interested in central-station work.

As the coming convention will be noteworthy as being the first national electrical gathering to be held so far west as Colorado, the issue of June 3d will describe the electrical interests of the Centennial State in a manner worthy of the western electrical journal.

The issues of June 10th and 17th will contain the full and complete report of the convention proceedings.

The consequent value of these three issues to the advertiser who wishes to reach the eyes of the buyers of electrical machinery and supplies is evident.

Send your order today for space of liberal size.

As this will be a *western* convention you should place your convention announcement in the Western Electrician.

**WESTERN ELECTRICIAN**

510 Marquette Building CHICAGO

# The Western Electrical Journal

FRANK N. PHILLIPS, Pres. E. ROWLAND PHILLIPS, V. P. C. H. WAGENSEIL, Treas. C. R. REMINGTON, Jr., Sec.

**AMERICAN ELECTRICAL WORKS,**

PROVIDENCE, R. I.

BARE AND INSULATED ELECTRIC WIRE,

ELECTRIC LIGHT LINE WIRE, INCANDESCENT AND FLEXIBLE CORDS,

**Railway Feeder and Trolley Wire,**

AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.

CABLES FOR AERIAL AND UNDERGROUND USE.

New York Store, W. J. Watson, 26 Cortlandt St.
Chicago Store, F. E. Donohoe, 82 Lake St.
Montreal Branch, Eugene F. Phillips' Electrical Works.

MAIN OFFICES AND FACTORIES, PHILLIPSDALE, R. I.

**A Stombaugh Guy Anchor**

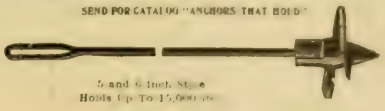
CAN BE INSTALLED IN FROM 10 TO 15 MINUTES.

A STOMBAUGH GUY ANCHOR WILL HOLD 12,000 TO 30,000 LBS

Depending upon the nature of the soil in which it is placed.

IT COSTS NOTHING IF THEY ARE NOT SATISFACTORY.

SEND FOR CATALOG "ANCHORS THAT HOLD"



5 and 6 Inch Size
Holds Up To 15,000 lbs

W. N. MATTHEWS & BRO.
Manufacturers
603 Carleton Building ST. LOUIS

**EXPERT IN** ELECTRICITY MECHANICS PATENT CAUSES
SOLICITOR OF U. S. & FOREIGN **PATENTS**
FORÉE BAIN, 1652-3 Monadnock Blk., CHICAGO

**CENTURY ELECTRIC CO.**
MANUFACTURERS OF
SINGLE-PHASE SELF-STARTING
**MOTORS AND CEILING FANS**
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**NATIONAL CODE STANDARD**

WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

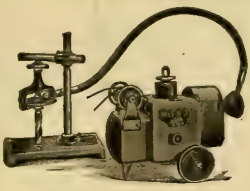
"O. K." Weatherproof Wire.
Slow - Burning Weatherproof and Ideal Wire.
Prices and Samples on Application.

**Phillips Insulated Wire Co.**
Office and Factory: PAWTUCKET, R. I.

**Marline Cable Hangers**
"SECURITY" BRAND

Our hooks are heavily galvanized and will stand long exposure, and our kind of Marline will outlive any hook. Prices very low for any quantity.

MADE BY
THE F. BISSELL COMPANY. TOLEDO O.



ESTABLISHED 1875.
COMBINATION OF
**Stow Flexible Shaft**
AND
**MULTI-SPEED MOTOR**
Practically dust and water proof. For Portable Drilling, Tapping, Reaming, Emery Grinding, etc. Write for Catalogue and Prices.
**STOW MFG. CO., Binghamton, N. Y.**
Gen'l European Agents, Selig, Sonnenthal & Co., 85 Queen Victoria Street, London, England

**PRICE $10 LIST**

From 0 to 60 Amperes.
Also made up to 400 Amperes.
FOR A. C. and D. C. WORK.
DISCOUNT TO THE TRADE.
WRITE FOR CIRCULARS

**RELIANCE INSTRUMENT CO.**
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**Engineering** MECHANICAL, ELECTRICAL, STEAM, CIVIL.
Complete and short courses. Thoroughly equipped engineering shops. Shop work from the beginning. Short courses in Steam and Electrical Engineering. Expenses low. Accommodations the best. School all year. Students may enter any time. Correspondence steam and electrical courses. Send for catalogue. Mention course in which interested.
HIGHLAND PARK COLLEGE, DES MOINES, IOWA.

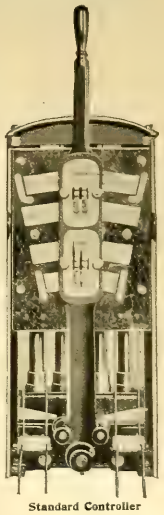
**YOST SPECIALTIES.**

*Sockets, Wall Sockets, Weatherproof Sockets, Rosettes, Receptacles, Cord Adjusters.*

*Catalogue for the asking.*

**THE YOST ELECTRIC MFG. CO.**
TOLEDO, OHIO.

**Allen Bradley Electric Controllers**



Standard Controller

Enclosed Controller

MADE IN ALL SIZES

***American Electric Fuse Co.***
Chicago New York

When you advertise be sure—be VERY sure—that you are in the medium that reaches most thoroughly and surely the possible purchasers of your product. Then spend your money as if every dollar were a leaf, and you were the owner of boundless forests.

Don't spend it grudgingly. Don't spend it timorously. Spend it boldly, and with the absolute knowledge that advertising is an INVESTMENT which will positively build up your business by making your name, your address and your product known throughout the world of electrical buyers.

Remember that you have competitors who are up and doing, with a heart for any fate.

Don't forget that the only effective advertising is continuous advertising.

Bear in mind that advertising in the WESTERN ELECTRICIAN educates the buyers of electrical machinery and supplies, that it brings direct inquiries, and that it paves the way for calls by your road men.

**WANTED, FOR SALE** *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 3c each* **POSITION WANTED** *advertisements (50 words or less), $1.00 an insertion; additional words 2c each.*

## POSITION WANTED.

By first-class steam and electrical engineer with 23 years' experience in the operation of power plants. Wishes to invest $1,000 and take position on official or operating forces in either lighting, power, manufactory or electrical machine shop; thoroughly understand handling financial and technical part of work. Strictly sober and educated. Address BOX 461, care Western Electrician, 510 Marquette Bldg., Chicago, Ill.

## WANTED.

To employ in every city in the United States and Europe, a responsible, intelligent, temperate man, as agent for the sale of a no-acid, non-corrosive Soldering Flux. THE UNIVERSAL CO., 537 West 149th St., New York.

## WANTED.

Man for armature winding and general motor repair work; permanent position for right man. Address C. A. BARNEY, Kewanee, Ill.

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Traveling salesman for electrical supplies in territory where trade is established. Address BOX 466, care Western Electrician, 510 Marquette Bldg., Chicago.

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Good wiremen for single and polyphase work. Three to four years' experience. Permanent positions for reliable and sober men. Apply ELECTRIC SERVICE COMPANY, 208 N. Main St., South Bend, Ind.

## WANTED.

Salesmen or engineers calling on electrical engineers to sell or take orders for

**"NON-MAGNETIC WATCHES"**

Factory prices and special inducements

**W. F. DOLL MFG. CO., 175 Broadway, New York.**

## BUSINESS FOR SALE.

Well-established electrical specialty business. Patented articles. Will sell at a bargain. Reason for selling—compelled to devote all time to other and much larger business. Address BOX 467, care Western Electrician, 510 Marquette Building, Chicago, Ill.

## FOR SALE.

One 25-H. P. Nash gas engine, direct-connected to 15 K. W. Crocker-wheeler dynamo; can be used for 115 or 230 volts. This would be a first-class outfit for automobile charging station. GRAHAM BROS. CO., 662 Hudson St., New York City.

## FOR SALE

| | | | | | |
|---|---|---|---|---|---|
| 1-360 | K. W. | General Electric | Alternator, | Three | Phase |
| 1-240 | " | Westinghouse | " | Single | " |
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| 1-150 | " | Westinghouse | " | " | " |
| 1-150 | " | Wood | " | " | " |
| 1-150 | " | Stanley | " | " | " |
| 1-120 | " | General Electric | " | Three | " |
| 1-120 | " | General Electric | " | Single | " |
| 1 120 | " | Westinghouse | " | " | " |
| 1- 90 | " | General Electric | " | " | " |
| 1- 75 | " | Westinghouse | " | Two | " |
| 1- 75 | " | Westinghouse | " | Single | " |
| 1- 75 | " | Westinghouse | " | Two | " |

Direct connected to Gates' Engine.

Send for our **Monthly Bargain Sheet** with complete list and net prices.

**GREGORY ELECTRIC CO.**

**54-62 S. Clinton St., Chicago, Ill.**

## Galvanometers

**$5.00 EACH**

**WALSH'S SONS & CO.**

260 WASHINGTON ST. NEWARK, N. J.

## ELECTRICAL BOOKS

**All Kinds**

**ELECTRICIAN PUBLISHING COMPANY,**

**Suite 510 Marquette, CHICAGO.**

# ELECTRICAL MATERIAL FROM THE WORLD'S FAIR, ST. LOUIS, 1904

**An opportunity to secure rare bargains** in everything used in this line. This material that we are offering has seen but limited service and is practically as good as new for further use.

### LEAD COVERED CABLES.

| Feet. | Size. | Conductor. | Voltage. |
|---|---|---|---|
| 26,000 | 300 M.C. M. | 3 | 6,600 |
| 9,500 | 4—0 | 3 | 6,600 |
| 4,700 | 3—0 | 3 | 6,600 |
| 7,500 | 2—0 | 3 | 6,600 |
| 14,000 | 1—0 | 3 | 6,600 |
| 18,500 | No. 1 | 3 | 6,600 |
| 11,500 | No. 2 | 3 | 6,600 |
| 4,700 | No. 3 | 3 | 6,600 |
| 7,100 | No. 4 | 3 | 6,600 |
| 11,500 | No. 6 | 3 | 6,600 |
| 25,900 | 4—0 | 1 | 2,200 |
| 1,900 | 2—0 | 1 | 2,200 |
| 11,000 | 1—0 | 1 | 2,200 |
| 9,000 | No. 1 | 1 | 2,200 |
| 11,000 | No. 2 | 1 | 2,200 |
| 18,000 | No. 4 | 1 | 2,200 |
| 48,000 | No. 6 | 1 | 2,200 |
| 1,900 | No. 8 | 1 | 2,200 |
| 25,000 | 500 M.C. M. | 1 | 500 |
| 50,000 | 4—0 | 1 | 500 |
| 11,000 | 3—0 | 1 | 500 |
| 11,000 | 2—0 | 1 | 500 |
| 3,700 | No. 1 | 1 | 500 |
| 2,300 | No. 6 | 1 | 500 |
| 180,000 | No. 6 | 1 | 8,000 |
| 14 500 | No. 14 | 6 | Fire Alarm |
| 39,000 | No. 14 | 4 | " " |
| 29,000 | No. 14 | 3 | " " |
| 9,500 | No. 14 | 2 | " " |

### Weatherproof and Rubber Covered Wire.

All sizes from No. 14 to 600,000 C. M.

### INCANDESCENT LAMPS

200,000 Lamps, used a short time, and in good condition for further service. Have been tested. They are 104 voltage, Edison base, 8 candlepower. In lots of 1,000, each 5 cents.

150,000 brand new Incandescent Lamps in original cases of 200, 250 and 400 Lamps, ranging from 100 to 110 voltage, 8 and 16 candlepower, General Electric make. Price each in case lots, 12½ cents.

20,000 Colored Incandescent Lamps, brand new, never used, General Electric make, 104 voltage, Edison base; colors, Amber, Green, Opal and Ruby; put up 200 in a case. Price each, 22 cents; are worth 35 cents each.

20,000 Incandescent Lamps, voltages 100 to 120, Edison. T. H. and Westinghouse base; 8, 10, 16, 20 and 25 candlepower; put up 250 in a case, second selection. Price each in case lots, 10½ cents.

### WOOD CONDUIT.

**100,000 Feet, Size 4½ x 4½.**

### MISCELLANEOUS

300,000 No. 9171 Porcelain, Edison Base Receptacles.
50,000 Weatherproof "Bryant" Sockets.
1,000,000 split glazed B. & D. Wiring Knobs.
300,000 Glazed Porcelain B. & D. Wiring Knobs, sizes 3½, 4½ and 5½.
20,000 No. 8 Standard Porcelain Knobs.
200,000 Single Wire glazed Porcelain Cleats.
15,000 Porcelain Cut-outs.
26,000 Plugs.
2,000,000 Unglazed Porcelain Tubes.
40,000 Glass Insulators.
20,000 Porcelain Cleats.
All kinds of switches and instruments.

**Ask for our Special Catalogue No. 567.**

**CHICAGO HOUSE WRECKING COMPANY, 35th and Iron Sts., CHICAGO.**

# AMERICAN ELECTRICAL SUPPLY CO

Chicago's New Supply House

New and well assorted stock.
New and up-to-date method of handling orders.
New and interesting prices.

IF ELECTRICAL AND GOOD WE SELL IT

**83-85-87 FIFTH AVE CHICAGO**

# ECONOMICAL ELECTRIC LIGHTING

219

**NORTHERN DYNAMOS** **SIMPLE COMPACT**

We build them for direct connection to any type of engine, or to be driven by belt. Northern Apparatus readily adapted to any service

**Bulletin No. 2530**

**NORTHERN ELECTRICAL MFG. CO., - Madison, Wis., U. S. A.**
**Engineers Manufacturers**
425 MONADNOCK BLOCK, CHICAGO, ILL.

WORKS QUICK AND EASY. KEEPS ITS LUSTER. HOLDS OLD TRADE AND MAKES NEW. DOES NOT DETERIORATE. ESTABLISHED 16 YEARS. SOLD BY AGENTS AND DEALERS ALL OVER THE WORLD

# U.S. METAL POLISH

3 OUNCE BOX 10 CENTS
SAMPLES SENT FREE
GEO. W. HOFFMAN

POLISHES ALL METALS. BRANCHES: NEW YORK, CHICAGO, SAN FRANCISCO. 295 E. WASHINGTON ST. INDIANAPOLIS, IND.
HIGHEST AWARD. CHICAGO WORLD'S FAIR, 1893. LOUISIANA PURCHASE EXPOSITION 1904.

Motor Starter with Automatic Release. Manufactured under our own patents.

# MOTOR STARTERS
# SPEED REGULATORS
# FIELD REGULATORS

**EQUIPPED WITH RENEWABLE SEGMENTS WITHOUT EXTRA CHARGE**

And Special Controlling Devices of all kinds. Send for catalogue and discounts.

**UNION ELECTRIC MFG. CO.**
**Milwaukee, Wis.**

## A Perfect Soldering Flux

adapted to soldering electrical connections without injury to insulation, producing clean, perfect joints on all metals. Will not rust or corrode, therefore increases durability of all sheet metal work. A time-saver in construction of roofing, leaders, gutters, refrigerators, ornamental work, and all branches of the canning industry. Large package in fluid, paste or stick form, prepaid by mail, 25c. Satisfaction guaranteed Liberal discount to dealers. Special prices to those desiring to use Flux in large quantity.

**THE UNIVERSAL CO.,**
**537 WEST 149th ST., NEW YORK**

# SAVES
# $14.00 Per 1,000 KNOBS.

Our No. 1 Insulators.

**NO TIE WIRE—NO HALF HITCH—NO WRAPPING THE KNOB—HERE'S THE SAVING:**

One tie wire measures 8 inches and 1,000 knobs take 8,000 inches—666 feet or more, depending on size of wire used, costing more than $7.00. The time spent in cutting and tying the wire costs another $5.00 per thousand at the least.

The slanting screw or nail hole on the side (see cut) makes it mere play to attach knobs to joist or studding, in one-third of the time formerly required, saving an additional $2.00 Total saving at least $14.00 per thousand knobs.

One screw does the work, too, and prevents the knob from turning.

*Ask your jobber for it or write us.*

**SNYDER & HUNT CO.**

**BELLE PLAINE, IA.**

We ship from either Iowa or New Jersey.

# CHICAGO EDISON COMPANY REPAIR SHOPS

**76 MARKET STREET, CHICAGO. TELEPHONE MAIN 1280.**

Machine and Carpenter Work of All Kinds
Correspondence Solicited.

**OPEN DAY AND NIGHT.**

FIRST-CLASS EQUIPMENT THROUGHOUT.

Dynamos Armatures, Motors, Arc Lamps, Fans, Instruments.

# CLEAN BOILERS

**Dearborn Water Treatment** made to suit the case takes off the scale, keeps it off, stops corrosion and foaming. Send gallon of water for analysis. :: :: ::

**DEARBORN DRUG & CHEMICAL WORKS,**

27-34 RIALTO BUILDING, CHICAGO, ILL. WM. H. EDGAR, President Telephones: Harrison 3930 and 3931.

New Light On an Old Subject.
AN INTERESTING TREATISE ON GREASE LUBRICATION.
*FREE ON REQUEST. SEND FOR IT.*
JOSEPH DIXON CRUCIBLE CO., Jersey City, N. J.

**There's No Friction**
with the Fibre-Graphite Commutator Brush. Being 90 per cent. pure graphite, it insures low resistance, no sparking under a varying load, and longer wear. There is no greasing required. The Fibre-Graphite is therefore the most economic brush on the market. Send for price list.
HOLMES FIBRE-GRAPHITE MFG. CO.
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# DIESEL ENGINES

Operating on CRUDE or FUEL Oil

**Guaranteed Fuel Consumption**
on variable load, ranging from ¼ to full load
**12½ Gals. per 100 Kw. Hours**

SUITABLE FOR ALL STATIONARY POWER

For further information address
**AMERICAN DIESEL ENGINE COMPANY**
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# MAGNETIC CLUTCHES (2,000 H. P. down to ½ H. P.)

We are not planning to build them—WE ARE BUILDING THEM NOW.
Communicate your needs—also make Lifting Magnets, Motor Hoists, Motor Driven Grinders.
**WILLIAMS ELECTRIC MACHINE CO., AKRON, O.**

**WE BUY OLD BELTS**
OR SCRAPS, ANY SIZE OR CONDITION.
WE CLEAN, REPAIR AND RENEW OLD BELTS.
LEATHER PRESERVER MFG. CORP.
27 W. MONROE ST., CHICAGO

**REPAIRING RECALIBRATING ELECTRIC METERS.**
INTERNATIONAL ELECTRIC METER CO.
330 W. RANDOLPH STREET, CHICAGO.

**JEFFREY** DETACHABLE STEEL-ROLLER SPECIAL **CHAINS** FOR CATALOGUE, ADDRESS THE JEFFREY MFG. CO COLUMBUS, OHIO.

# "Diamond H" Switches

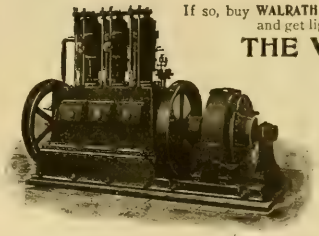
Trade H Mark

This Trade-Mark guarantees quality.

The Hart Mfg. Co., Hartford, Conn.
New York Boston Chicago Toronto, Ont.

# ARE YOU LOOKING FOR MONEY?

If so, buy WALRATH GAS OR GASOLINE ENGINES and get light on the subject.



**THE WALRATH**
Received the Highest Award at the Pan-American Exposition.
It will produce as good a commercial light as that of an automatic steam engine, either belted or direct-connected generator. Simple, Economical and Reliable
Send for Catalogue W
**MARINETTE GAS ENGINE CO.,**
CHICAGO HEIGHTS, ILL.

AGENCIES:
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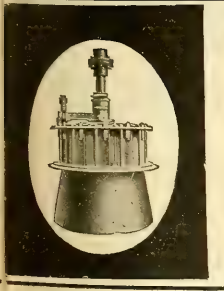
REG. TRADE MARKS
"Phosphor Bronze"
DELTA

THE PHOSPHOR BRONZE SMELTING CO. LIMITED.
2200 WASHINGTON AVE., PHILADELPHIA.
"ELEPHANT BRAND PHOSPHOR-BRONZE"
INGOTS, CASTINGS, WIRE, RODS, SHEETS, ETC.
— DELTA METAL —
CASTINGS, STAMPINGS AND FORGINGS
ORIGINAL AND SOLE MAKERS IN THE U.S.



# SAMSON TURBINE

We show below a record of tests made in the official testing flume at Holyoke, of a 35-inch SAMSON TURBINE which was built from the same patterns as those we sell to our customers.

| Gateage. | Head | R. P. M. | Cu. Ft. Per Sec. | H. P. | Efficiency. |
|---|---|---|---|---|---|
| Full | 15.29 | 194 | 102 | 143 | 81.08 % |
| ⅞ | 16.56 | 188 | 92 | 147 | 84.78 % |
| ¾ | 17.33 | 178 | 84 | 138 | 85.88 % |
| ⅝ | 17.54 | 176 | 69 | 110 | 80.09 % |

**THE JAMES LEFFEL & CO.**
307 LAGONDA ST. Springfield, Ohio, U. S. A.

## The ARNOLD TELEPHONE

is a handsome steel enclosed telephone. In the home from room of mistress to kitchen, library or laundry. Saves hundreds of steps, saves time, is a distinct convenience, not a luxury, but a necessity. Telephone is fitted up complete, ready for installation. Needs no adjustment. Steel clad. Cannot get out of order. Lasts forever. Made as illustrated, designed for separate batteries; also made complete with batteries mounted directly upon telephone back, enclosed in neat box.

Shipped ready for installation.

Full directions with each telephone.

Price, without batteries, **$2.50**
Price, with batteries, **3.25**

**Arnold Electric Manufacturing Co.**

MANUFACTURERS

95 Jackson Boulevard, CHICAGO

## Kellogg Express Switchboard Cabinet

The graceful Appearance comes from Simple Lines.

This Attractive Design has been so popular that it has been much copied by other manufacturers

**Fifty-Line Capacity** Quarter Sawed Oak for the entire Exterior of the Cabinet

Thoroughly seasoned wood

Finished in Light or Golden Oak

**Gold Medal** Highest Award Buffalo Exposition 1902

**Grand Prize** Highest Award St. Louis Exposition 1904

The Strongest, Longest Lived, Most Efficient Switchboards made. All telephone experts will tell you that.

**Kellogg Switchboard & Supply Co.**
**Congress & Green Streets**
**CHICAGO**

LOS ANGELES CLEVELAND PHILADELPHIA

## International Telephone Mfg. Co.

HIGH GRADE
**Telephone Apparatus**

*Harrison and Clinton Sts.*
*CHICAGO*

## "STAR" INCANDESCENT LAMPS

LONG LIFE
GUARANTEED CANDLEPOWER,
HIGHEST EFFICIENCY.

MADE BY THE MOST SKILLED WORKMEN.

**STANDARD ELECTRICAL MFG. COMPANY, : Niles, Ohio.**

"FOLLOW THE FLAG"

## WABASH Summer Tours

**Write today for a Free copy of WABASH Summer Tour Book—1905, outlining many very attractive summer vacation trips, with rates, etc.**

Write us about any tour you may have in contemplation. We shall be glad to assist you.

**C. S. CRANE,** G. P. & T. Agent, ST. LOUIS.
**F. A. PALMER,** A. G. P. Agent, CHICAGO.

## BOSSERT'S BOXES

Drawn steel. One blow of a hammer gives clean round hole. No filing.
**SAVE TIME, BOXES AND MONEY**
Be up to date. Use them. Write for bulletin giving full particulars.
**Bossert Electric Construction Co.,** UTICA N.Y.

## THE DENVER AND RIO GRANDE R. R.

**has more scenic attractions, mountain resorts, mineral springs, hunting and fishing grounds than any other railroad in the world.**

It reaches all points of interest in Colorado and Utah.

It is the only line passing through Salt Lake City en route to and from California and North Pacific Coast.

It is the most attractive line to the Portland Exposition.

It has the highest class modern equipment and through car service.

It has a superb dining car service.

**Low summer rates for the Epworth League and G. A. R. Conventions.**

**Write for free illustrated booklets.**

**S. K. HOOPER,** G. P. and T. A. Denver, Colo.
**R. C. NICHOL,** Com'l Agt. 242 Clark St., Chicago, Ill.

## *Locations for Industries*

***Erie Railroad***

***Chicago to New York***

The Erie Railroad Company's Industrial Department has all the territory traversed by the railroad districted in relation to resources, adaptability, markets and advantages for manufacturing, and can advise with manufacturers in relation to the most suitable locations. For full information address

**LUIS JACKSON**
Industrial Commissioner, Erie Railroad Company
**21 Cortlandt Street, New York**

## DON'T BUY ELECTRICAL SUPPLIES

**Until you have seen our new Catalogue and new Price List.**
**Free to the trade.**

**Manhattan Electrical Supply Co.**

NEW YORK: 32 Cortlandt St.
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Electrical book buyers buy electrical books from the Electrician Publishing Co., 510 Marquette Bldg., Chicago.

## They Always Work and Work at Their Best

Freedom from local action or polarization, and a decrease in internal resistance as the current is used are distinctive features of

# EDISON Primary Batteries

FORMERLY EDISON-LALANDE

The elements are so proportional that all are equally durable, insuring uniform strength of current during entire life of cell. Require no attention. Sure and saving. Write for Catalog 7.

TRADE Thomas A. Edison MARK

**EDISON MFG. CO.**
**Factory, ORANGE, N. J.**

NEW YORK: 31 Union Square
CHICAGO: 304 Wabash Avenue

# THE AUTOMATIC

Among the cities in which it has been adopted are:

| | |
|---|---|
| Chicago, Ill. | Augusta, Ga. |
| Grand Rapids, Mich. | Medford, Wis. |
| Columbus, Ohio | St. Marys, O. |
| Dayton, Ohio | Woodstock, N. B. |
| Lincoln, Neb. | Westerly, R. I. |
| Portland, Me. | Manchester, Ia. |
| Auburn, N. Y. | Princeton, N. J. |
| Lewiston, Me. | Albuquerque, N. M. |
| Auburn, Me. | Van Wert, O. |
| Fall River, Mass. | Battle Creek, Mich. |
| New Bedford, Mass. | Clayton, Mo. |
| Los Angeles, Cal. | Pentwater, Mich. |
| San Diego, Cal. | Toronto Junction, Can. |
| Hopkinsville, Ky. | Wilmington, Del. |
| Sioux City, Ia. | Riverside, Cal. |
| Cleburne, Tex. | Traverse City, Mich. |
| Columbus, Ga. | Hastings, Neb. |
| South Bend, Ind. | Wausau, Wis. |
| El Paso, Tex. | Berlin, Germany |

Is the telephone system that appeals to all.

**To the User,** because of its promptness, its accuracy, its secrecy;

**To the Operating Company,** because of its economy of operation and maintenance;

**To the Investor,** because it places the securities of a telephone company on a firm basis, and keeps them stable and profitable.

## Automatic Electric Company

Van Buren and Morgan Streets

CHICAGO, U. S. A.

## QUALITY

RECOGNIZED AND APPRECIATED

HAS MADE

Stromberg-Carlson Apparatus

First In Sales.

DOES QUALITY COUNT?

One Price

One Quality

Our No. 192 TELEPHONE

Our Bulletin No. 5-B Assists in Proving Our Statements. Can We Mail You a Copy?

STROMBERG-CARLSON TELEPHONE MFG. CO.,

General Offices, ROCHESTER, N. Y.

Western Sales Office, CHICAGO, ILL.

## The 20th Century Phone

Easy to connect up

Automatic, Simple,
Durable, Convenient.
It is a "Couch" product.
"Nuff Ced"

S. H. COUCH CO.,

BOSTON, MASS.

## BITUMINIZED FIBER CONDUIT

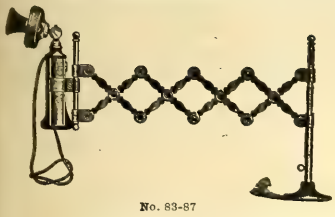
FOR UNDERGROUND CONSTRUCTION

The American Conduit Company has a corps of experts in underground construction and is prepared to furnish supervision of work if desired. We would prefer to co-operate with contractors in underground construction, but if desired will submit estimates and bids and take contracts for completed underground systems in any part of the United States and Canada.

American Conduit Co.

Main Offices: 1005-6 Manhattan Building, Chicago

Other Offices:
170 Broadway, New York. 336 Macy St., Los Angeles



## Burns' Adjustable Telephone

For Flat or Roll Top Desks

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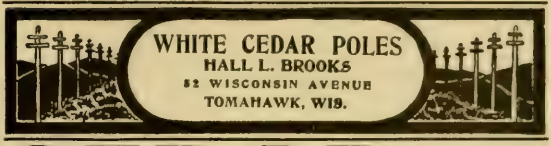


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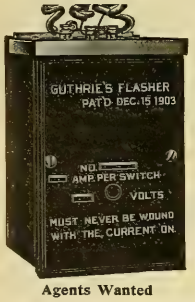


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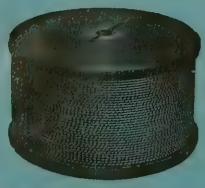

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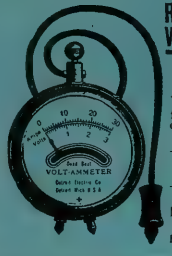

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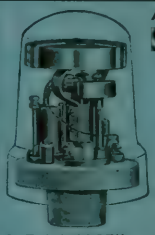

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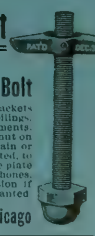


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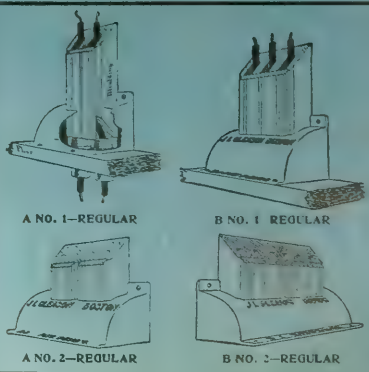

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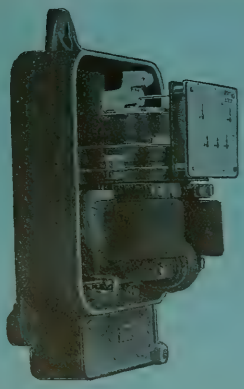

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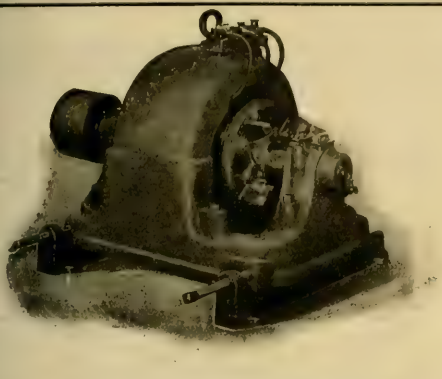

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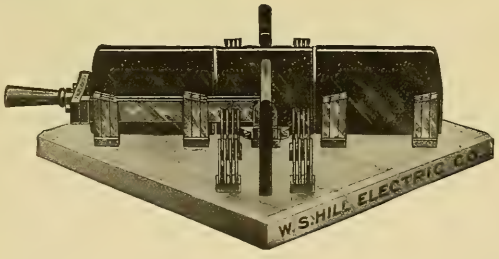


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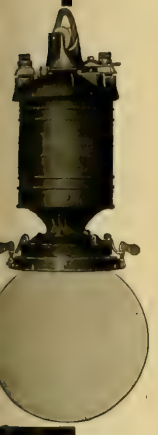

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Century Electric Co.
Chicago Edison Co.
Cutter Co., Geo.
Electric Appliance Co.
General Electric Co.
Manhattan Elect'l Supply C
Wesco Supply Co.
Western Electric Co.

**Switchboards.**
Bissell Co., The F.
Gen. Incan. Arc Light Co.

**Telephones, Telephon Material and Switch boards.**
American El. Telephone C
Anderson & Nachman.
Arnold Elec. Mfg. Co.
Automatic Electric Co.
Bissell Co., The F.
Central Electric Co.
Central Tel. & El. Co.
Electric Appliance Co.
International Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co
Manhattan Elec. Supply Co
Stromberg-Carlson Tel. M.C
Wesco Supply Co.
Western Electric Co.

**Time Switches.**
Bissell Co., The F.

**Toggle Bolts.**
Wrigley Co., Thos

**Tools.**
Klein & Sons, Mathias.
Western Electric Co.

**Transformers.**
Central Electric Co.
Crocker-Wheeler Co.
Electric Appliance Co.
Ft. Wayne Elec. Works, In
General Electric Co.
Gregory Electric Co.
Kuhlman Electric Co.
Manhattan Elec. Supply C
National Electric Co.
Stanley Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. C

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General Electric Co.
Westinghouse El. & Mfg. C

**Turbines, Steam.**
Allis-Chalmers Co.
General Electric Co.
Westinghouse El. & Mfg.

**Turbine Water Whee**
Leffel & Co., Jas.

**Vulcanized Fibre.**
Vulcanized Fibre Co.

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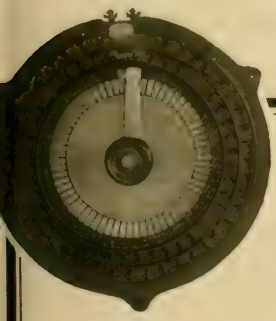
American Electrical Work
Belden Mfg. Co.
Bissell Co., The F.
Central Electric Co.
Cresson-Mas. Wire & Cble.
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
Indiana Rub. & Ins. Wire
India Rubber & Gutta Perc Insulating Co.
Kellogg Switch. & Sup. Co
Manhattan Elec. Supply C
National India Rubber Co
New York Insulated Wire
Northern Wire & Cable C
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co
Roebling's Sons Co., J. A.
Runzel-Lenz Elec. Mfg. C
Safety Ins. Wire & Cable
Simplex Electrical Co.
Spargo Wire Co., Jas. A.
Standard Underground C.
Wesco Supply Co.
Western Electric Company


**For Alphabetical Index of Advertisements See Page 3.**

# No Trouble from Loose Parts



THE current carrying parts of the Cutler-Hammer Field Regulator are solidly imbedded in the base by a compound, the nature of which causes it to become part of the base itself. This compound will not separate from the base, no matter to what degree the wires are heated. White hot wire tests have thoroughly demonstrated this fact. By such a construction the trouble incident to loose parts is eliminated.

The base itself is a perfect insulator; radiates and conducts heat properly; does not allow grounds, and will not disintegrate from overloads.

The handle is easily moved, but is not affected by jar of machinery.

For rear of board mounting we furnish an all-copper hand wheel, polished and lacquered, and insulated by a single piece of fibre.

Our convertible type is equipped with all-copper wheel on one side and a hard rubber handle on the reverse side, and can be operated from either front or rear of board.

LET US SEND YOU BULLETIN 32
WHICH DESCRIBES IT

## The Cutler-Hammer Mfg. Co.

MILWAUKEE, WISCONSIN

NEW YORK 136 Liberty Street — BOSTON 176 Federal Street — CHICAGO Monadnock Bldg. — PITTSBURG Farmers Bank Bldg.



# OUR NEW "STANDARD"

1905 MODEL

UNIVERSAL DESK OR BRACKET FANS

This is our new "Standard" Universal Desk or Bracket Fan. Combined in a single neat and ornamental structure the desirable features of both types as it may be mounted on either the desk or side wall, running equally well in any position. After being mounted, the direction of the air current may be adjusted as desired in either a vertical or horizontal plane, then fixed in position by means of thumb screws provided for the purpose.

**ONE VALUABLE FEATURE** No tools are needed for changing from desk to bracket, or for changing the direction of the air current.

Before buying send for our catalog descriptive of
9 OTHER TYPES OF DESK and CEILING FANS

## THE ROBBINS & MYERS CO.

Main Office and Works: SPRINGFIELD, OHIO, U. S. A.

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# JOHN A. ROEBLING'S SONS CO.

**Insulated Wire of All Kinds**

**Bare Copper Wire**

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# For Testing Consumers' Meters

The WHITNEY portable wattmeters are unquestionably the best standards.

They are dead beat, have scales 10 inches long, are extremely rugged and practically absolutely accurate. Moreover, they are self-calibrating. Send for prices.

**MACHADO & ROLLER**
203 Broadway
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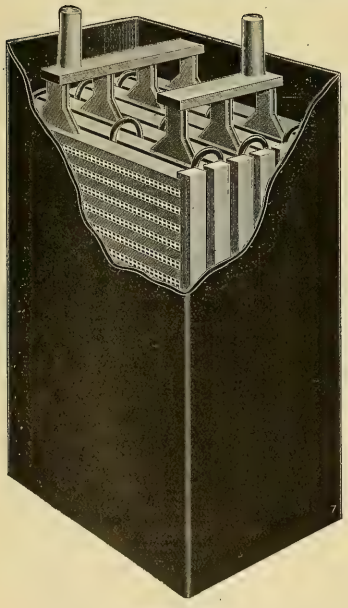
General Agents for Whitney Electrical Instrument Co.

STANDARD RANGES 300 TO 60,000 WATTS

# THE NEW "MORRISON" STORAGE BATTERY

## Just What the World Has Been Waiting For.



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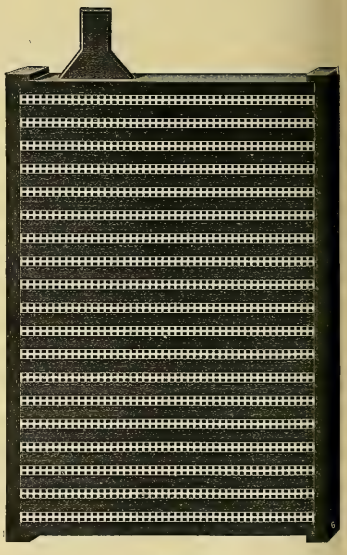
**This plate is so strong electrically and mechanically that no amount of electrical abuse or of vibration in traction service can dislodge even the slightest particle of its active material.**

**Lowest internal resistance of any storage battery in the world.**

***The weight efficiency is conservatively 14 watts per pound total weight, and electrical efficiency unsurpassed.***



THE PLATE

# Universal Electric Storage Battery Co.

*INCORPORATED*

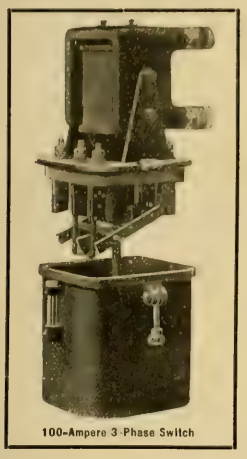
**Office: 1355 Railway Exchange Building**

**Factory: 36-38 Union Park Place**

**Chicago, Illinois**

# AMERICAN ELECTRIC & CONTROLLER CO.

## *MODERNIZING ENGINEERS*



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*We Equip*

**CENTRAL STATIONS**

With manual, electrically operated and automatic Switches, Motor Starters and Switchboard appliances.

**SHOPS**

With manual and electrically operated Motor Starters, Speed Regulators, Protective Devices for the powerhouse.

**MINES**

With electric controllers for conveyors, Ore Crushers, and Separators, Pumping and Ventilating Systems.

**Solenoids any capacity, any stroke for operating Breaks, Valves, Switches, Etc.**

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# *General Electric Company*

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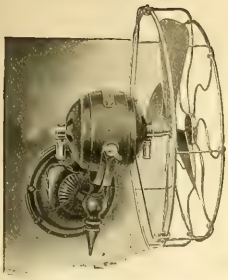
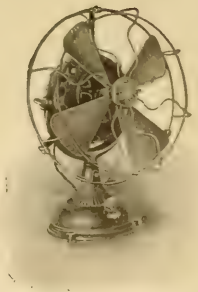


16-in. Wall Bracket Fan (D. C.)

The General Electric Company furnishes a complete line in desk, wall bracket, exhaust and ceiling fans and ventilating outfits.

A full stock is carried in all local storerooms.

Descriptive catalogue mailed on request.



12-in. Convertible Swivel and Trunnion Frame Desk Fan (A. C.)

NEW YORK OFFICE
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PRINCIPAL OFFICES
**SCHENECTADY, N. Y.**

SALES OFFICES
**ALL LARGE CITIES**

(515)

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ELECTRICAL — CIVIL — MECHANICAL
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Lighting Power Railways,
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Specialty — Designing Electromagnets and Solenoids for a given duty.
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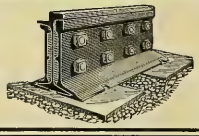
OVER 20,000 MILES IN USE
Highest Award at Paris Exposition, 1900, Buffalo, 1901, and St. Louis, 1904.



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A State institution located in and making use of an active mining district. Summer term begins June 12. For year book and record of graduates, apply to
PRESIDENT OR SECRETARY, Houghton, Mich.

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## OR MORE WILL ATTEND THE

# NATIONAL ELECTRIC LIGHT CONVENTION

### To be Held at Denver and Colorado Springs, June 6th to 11th Inclusive

This greatest and most important convention in the history of the Association will be covered fully, completely and in a manner befitting the **WESTERN ELECTRICIAN.**

Being a Western convention your advertisement should appear in the only western general electrical journal—the **WESTERN ELECTRICIAN;** and it should correspond in size and importance with the importance of the convention and of our convention issues of June 3rd, 10th and 17th.

Write us today reserving space in a select location.

## Western Electrician, 510 Marquette Bldg., Chicago

"Nature Smiles Through Sunbeams"

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THE LAMP OF QUALITY

LOOK FOR THE LICENSE LABEL ON THE SYSTEM

**Sunbeam Incandescent Lamp Co.**

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**WESTERN ELECTRIC CO.**

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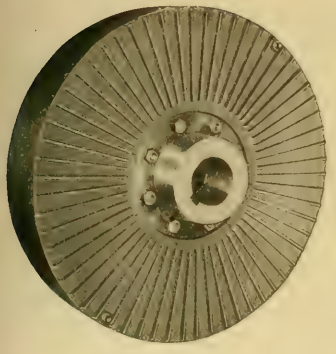
# Our Claims and Our Proof



We claim for the Cutler-Hammer Accelerator that it will start a load gradually and smoothly, that it will release instantly, that no adjustments are necessary for wear of faces, that all the attention it requires is to be kept oiled and carbons replenished, and that it can be operated either automatically or by means of push buttons.

Here's evidence of it:

In the Leetsdale plant of the Riter-Conley Mfg. Co., is an accelerator connected to a 100-H. P. induction motor used to drive a machine.

The motor is started in the morning and runs continuously all day.

By means of a pressure regulator the accelerator automatically starts and stops the pump from 200 to 250 times a day, using but 2 amperes of current at 110 volts.

It has been doing this for over three months, which is equal to a service under ordinary conditions of a score of years.

Notwithstanding that the accelerator has been energized over 20,000 times, no adjustments have been necessary for wear of faces, in fact it has been given no attention except to keep it supplied with oil.

Could you ask for more conclusive evidence than this?

We would like to send you catalog describing it.

# Cutler-Hammer Clutch Company

MILWAUKEE, WISCONSIN

NEW YORK 136 Liberty St. BOSTON 176 Federal St. CHICAGO Monadnock Bldg. PITTSBURG Farmers Bank Bldg.

TYPE B.

ALTERNATING CURRENT.

## SCHEEFFER INTEGRATING WATTMETER

Type E for Alternating Current Type F for Direct Current Circuits

***DUST AND BUG PROOF***
***IMPROVED CONSTRUCTION***

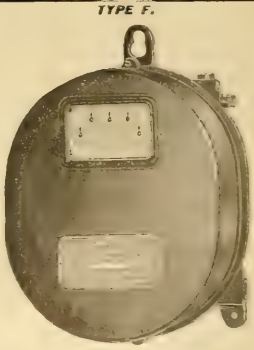
MOVING PARTS ARE EXTREMELY LIGHT, INSURING A HIGHLY SENSITIVE AND ACCURATE METER.

WRITE FOR PRICES AND DESCRIPTIVE LITERATURE.

**DIAMOND METER COMPANY,**

PEORIA, ILL., - - - - U. S. A.

TYPE F.



DIRECT CURRENT.

## *The Lamp and the Lily*

The Prismo Zenith Lamp and the Easter lily are both things of beauty.

But the lamp has the advantage, as it will remain a joy all summer.

For a combination of usefulness and beauty the Packard Prismo Zenith Lamp is IT.

**Electric Appliance Company**
CHICAGO ——and—— SAN FRANCISCO

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Get acquainted with the
**PEERLESS**—MONEY SAVERS
MADE RIGHT PRICED RIGHT ARE RIGHT
**THE WESCO SUPPLY CO.,**
ST. LOUIS, MO.
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ELECTRIC SIGN
**FLASHER**
**BEST IN THE WORLD**
Write for full particulars
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# SPARKING

***Reduces the working capacity of a motor or dynamo, wears out the commutator, wastes power and may cause a fire. All this may be avoided if you use . . . . . .***

The only article that will PREVENT SPARKING. Will keep the Commutator in good condition and PREVENT CUTTING.

**Absolutely Will Not Gum The Brushes.**

It will put that high gloss on the Commutator you have so long sought after.

**50 Cents per Stick. $5.00 per Dozen.**
*SEND FOR FREE SAMPLE STICK*
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**EUGENE MUNSELL AND CO.**
NEW YORK and CHICAGO

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Micanite, Linotape, M. I. C. Compound, Empire Cloth and Paper. For Years the Standard.
**MICA INSULATOR CO., Originators**
NEW YORK and CHICAGO

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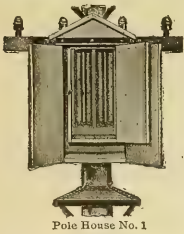
Drawn steel. One blow of a hammer gives clean round hole. No filing.
**SAVE TIME, BOXES AND MONEY**
Be up to date. Use them. Write for bulletin giving full particulars.
Bossert Electric Construction Co., UTICA, N.Y.

## Security Cable Pole House No. 1

THE local carpenter can make just as good a house as this if he is smart enough and has the tools, but he generally doesn't know how nor what is needed, and in no case can he compete with our machinery. These are made in cabinet style, and equal quality cannot be produced by hand at our prices. We have sold them for seven years, reducing the prices as our trade increased, and no one has been found to match them.


Pole House No. 1

These houses are dry. There are two compartments, both provided with doors, all doors closing against shoulders, and no communication is possible with the outside except through the bottom, where the cable and spider wires enter, and where joints can be and usually are made water tight.

They are suspended from iron straps which encircle them and are held by screws run into solid wood, and in no case entering the inside space.

At the bottom is an adjustable shoe, through which the cable passes. The shoe is lagged firmly to the pole, the house is then set perpendicularly and permanently bolted in place.

Eight sizes are made.

We recommend them because they are good, also cheap, and their convenience saves money, and they are permanent.

MADE BY
**THE F. BISSELL COMPANY**
TOLEDO, OHIO

TRADE MARK.

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INSTALLATIONS RENEWALS
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**VOLT - AMMETERS**
**POCKET SIZE**
For testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.
RELIABLE. - ACCURATE.
Send for Circular.
**L. M. PICNOLET**
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Send 2c stamp for new catalogue No. 6 of
**KLEIN'S TOOLS**
*For Electrical Workers and Line Builders.*
**MATHIAS KLEIN & SONS,**
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for ECONOMICAL LIGHTING
*RELIABLY LONG AND BRILLIANT LIFE*

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|---|---|---|---|
| 10 | C. P. | 31 & 36 & 42 | Watts |
| 8 | " | 25 & 28 & 33 | " |
| 6 | " | 24 & 22 | " |
| 5 | " | 21 | " |
| 4 | " | 19 | " |
| 3 | " | 14 | " |
| 2 | " | 13 | " |
| 2 | " | 9 | Watts (2 in series) |

LOOK FOR THE LICENSE LABEL
ON EVERY INCANDESCENT LAMP
IN THIS SYSTEM

**GENERAL ELECTRIC CO.**

All types and varieties
Regular Multiple Lamps
Street Series Lamps
Miniature Lamps

Main Lamp Sales Office
Harrison, N. J.
(493)

**LET US HAVE YOUR INQUIRIES WHEN IN NEED OF MICA OF ANY DESCRIPTION—WE CAN GIVE YOU WHAT YOU NEED QUICK AND AT THE RIGHT PRICES.**
**CHICAGO MICA CO., VALPARAISO, IND.**

# Warren Alternator

Do not be content with a tolerably good alternator.

**GET THE BEST**

When you have tried the
**"WARREN"**
you will be able to judge

**We Guarantee What We Sell and Sell What We Guarantee.**

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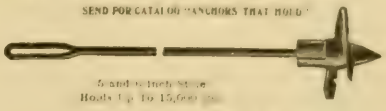
**A Stombaugh Guy Anchor**

A STOMBAUGH GUY ANCHOR WILL HOLD 12,000 TO 30,000 LBS.

SEND FOR CATALOG "ANCHORS THAT HOLD"



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"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Ideal Wire.
Prices and Samples on Application.

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Office and Factory: PAWTUCKET, R. I.

**AMERICAN ELECTRICAL SUPPLY CO**

Chicago's New Supply House
New and well assorted stock.
New and up-to-date method of handling orders.
New and interesting prices.

IF ELECTRICAL AND GOOD WE SELL IT.

83-85-87 FIFTH AVE CHICAGO

**"AMERICAN" STORAGE CELLS**
ARE THE BEST. Send for descriptive Circular.
AMERICAN BATTERY CO.,
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**Automatic Soldering Iron AND BLOW TORCH**

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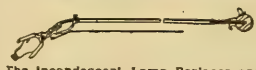

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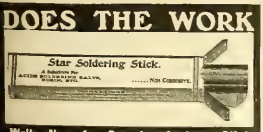


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| 1,000 | 2 0 | 1 | 500 |
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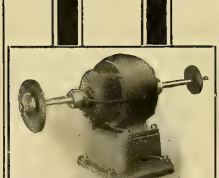

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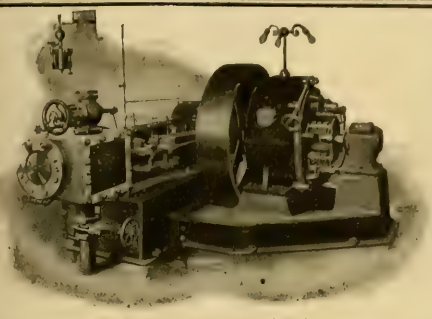

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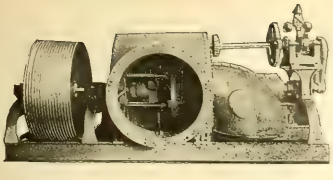

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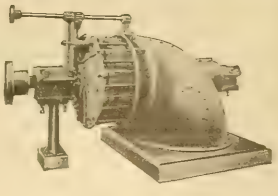

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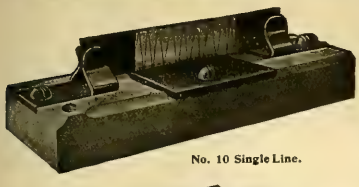

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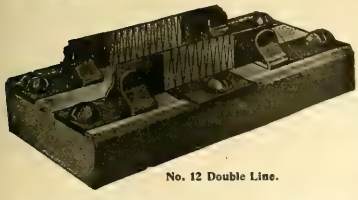

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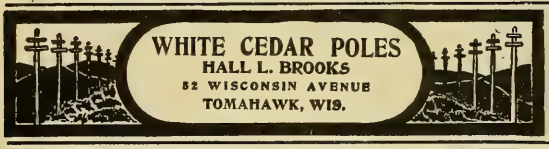

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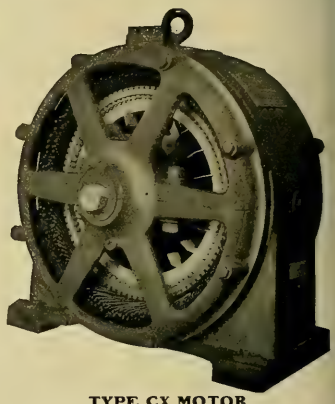
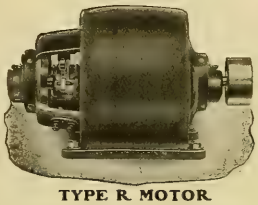


TYPE CX MOTOR



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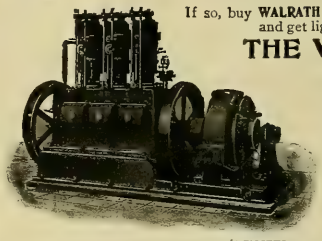

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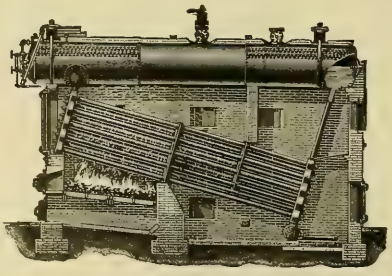

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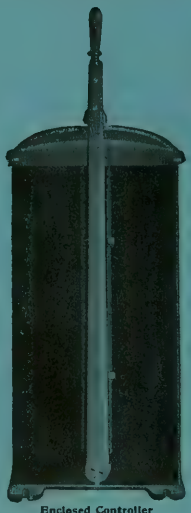

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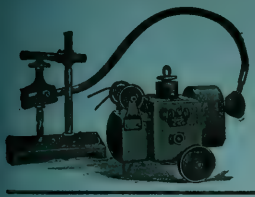
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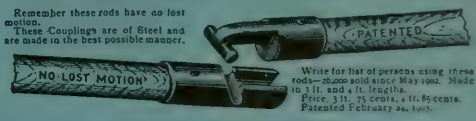
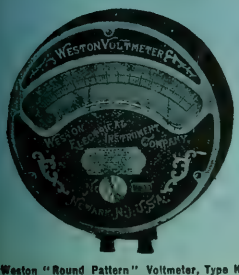
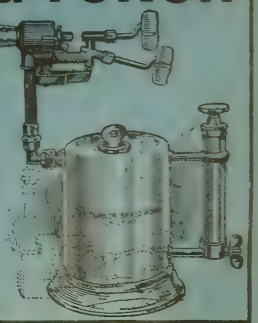
Remember these rods have no lost motion. These Couplings are of Steel and are made in the best possible manner.


Write for list of persons using these rods—25,000 sold since May 1902. Made in 3 ft. and 4 ft. lengths. Price, 3 ft. 75 cents, 4 ft. 85 cents. Patented February 24, 1903.
T. J. COPE
3244 North Fifteenth Street PHILADELPHIA, PA.

"Flexduct" is that high standard required in all high-class work. It is very flexible, a high insulation and indestructible
FLEXIBLE CONDUIT
"Flexduct" the National Code Standard. It does not deteriorate, always usable to highest degree
OSBURN FLEXIBLE CONDUIT COMPANY,
NEW YORK CHICAGO SAN FRANCISCO

WESTON ELECTRICAL INSTRUMENT CO.,
Main Office and Works, Waverly Park, NEWARK, N. J.


Weston "Round Pattern" Voltmeter, Type K.
We desire to call attention to a line of low priced but excellent Switchboard Instruments for Direct-Current Circuits, which we designate as
"ROUND PATTERN" TYPE K.
These instruments are particularly suitable for Isolated Plants and Feeder Circuits in Railway and Power Plants. All Weston Instruments are unsurpassed in excellence of workmanship, in accuracy and economy of operation.
BERLIN—European Weston Electrical Instrument Co., Ritterstrasse No. 88.
LONDON—Elliott Bros., Century Works, Lewisham.
PARIS, FRANCE—E. H. Cadiot, 12 Rue St. Georges.
New York Office—74 Cortlandt St.

THE BEST BRAZING TORCH FOR ELECTRICIANS
HOTTEST ON EARTH

The Turner 4B Gasoline Brazing Torch is used by all mechanics for light work in brazing, annealing, tempering and drawing temper of small tools, etc. This torch produces an intensely hot, pointed flame of over 3,000° Fahr. Burns 4 hours from one filling.
PRICE $4.50 NET
THE TURNER BRASS WORKS
23 N. Franklin St., Chicago

# Allis-Chalmers Co

Electrical Department

## The Bullock Electric Mfg. Co.

CINCINNATI, OHIO

Canadian representatives, Allis-Chalmers-Bullock, Ltd., Montreal

## Bullock Motors for Every Service

### Bullock Type "B" Motors

have been successfully applied to drive nearly every kind of machinery

### They Can Be—

Direct connected, belted or geared.
Arranged for operation on floor, ceiling or wall.
Supplied open, enclosed or with gauze covers.

Bullock Type "B," Open Motor.

## Warren Alternator

SIMPLE AS A GRINDSTONE

Sparkless as a

WATER WHEEL

We Guarantee What We Sell and Sell What We Guarantee.

WARREN ELECTRIC MFG. CO.

Sandusky, O.

USE

## "SAFETY" RUBBER COVERED WIRE AND CABLE

FOR EVERY ELECTRICAL SERVICE.

M. B. AUSTIN & CO.,

CHICAGO REPRESENTATIVE.

THE SAFETY INSULATED WIRE & CABLE CO.,

WORKS: Bayonne, N. J. 114-116 LIBERTY STREET, N. Y.

## Water-Wheel Governors

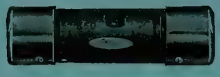
Our new mechanical governors co-operate with the inertia effect on the water and the momentum of the plant. They have cut the cost of good government in two. Guaranteed in every particular.

REPLOGLE GOVERNOR WORKS

AKRON, OHIO

WRITE FOR DESCRIPTIVE MATTER W.

## "UNION" ENCLOSED FUSES



OLD AND NEW CODE STYLES

New Code Blocks

Catalog No. 16 with illustrations is ready and is as plain as a primer. You see what you want at a glance

Our Trade Mark stands for good goods in all Electrical Fuses and Fuse Wire

CHICAGO FUSE WIRE & MFG. CO.

Chicago, Buffalo
New York

# THE ELECTRIC STORAGE BATTERY CO.

PHILADELPHIA

MANUFACTURER OF THE

## "Chloride Accumulator"

For Central Stations, Electric Railways, Isolated Lighting and Power Stations, Fire Alarm, Telegraph, Train Lighting, etc., etc.

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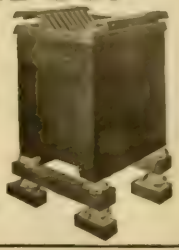
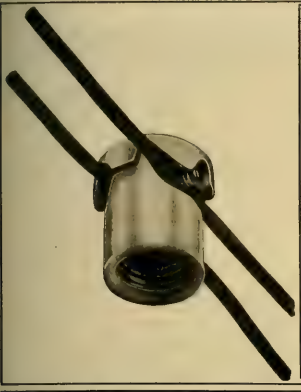
SAN FRANCISCO, Rialto Bldg. | CLEVELAND, Citizen's Bldg. | CANADA, Canadian General Electric Co., Ltd., Toronto





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THE

## P. & S. Decorative Socket No. 417

You don't have to take it apart to wire it up. Simply slip the wires in the slots and turn in the screw.

Your next order solicited.

**PASS & SEYMOUR, Inc., Solvay, N. Y.**

NEW YORK CHICAGO SAN FRANCISCO

# SPECIAL PORCELAIN PIECES

GET OUR PRICES ON THIS LINE OF WORK.

COLONIAL SIGN AND INSULATOR CO., SOUTH AKRON, O.

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Resistance wires to specifications. Protective fuses for small currents.
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**PLATINUM**
Ignition fuses for torpedo and mining operations. Special forms for wireless telegraphy.
**BAKER & CO., INC.**
C. O. BAKER, Pres. C. W. BAKER, Vice Pres.
408-414 N. J. R. R. Av., NEWARK, N. J.

**PLATINUM**
All forms of electrical contacts
**Grand Prize**
Universal Exposition
ST. LOUIS, 1904


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If you want Wires or Cables insulated with the HIGHEST CLASS INDIA RUBBER INSULATION you should buy . . . . . .

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Complete stock of all sizes constantly on hand and for sale at lowest market prices by

CHICAGO EDISON COMPANY,

WRITE FOR PRICES. 139 ADAMS STREET, CHICAGO.

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consumes less current and can be read at a greater distance than any other electric sign to-day on the market. Write for booklet.

WESTERN DISPLAY COMPANY, SOLE MANUFACTURERS

ST. PAUL, - - MINN.

Just What the World Has Been Waiting For.

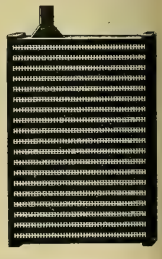
# NEW "MORRISON" STORAGE BATTERY

THE CELL

This plate is so strong electrically and mechanically that no amount of electrical abuse or of vibration in traction service can dislodge even the slightest particle of its active material.

Lowest internal resistance of any storage battery in the world.

The weight efficiency is conservatively 14 watts per pound total weight, and electrical efficiency unsurpassed . . . .



THE PLATE

UNIVERSAL ELECTRIC STORAGE BATTERY CO.

INCORPORATED

OFFICE: 1355 RAILWAY EXCHANGE BUILDING FACTORY: 36-38 UNION PARK PLACE

CHICAGO, ILLINOIS

Whitehall Bldg., N. Y. City Equipped with C.-W. Generators and Motors.

PUBLIC BUILDING without its own independent lighting and power plant is not considered modern.

Our generators are giving satisfactory service in numerous offices, public buildings and department stores.

The plant of the FIRST NATIONAL BANK Building of CHICAGO is one of our recent installations and consists of four 150-K. W. D. C. Generators which furnish current for 15,000 16-C. P. lamps and 400 H. P. of Crocker-Wheeler motors. These motors drive pumps, fans, elevators, compressors, etc.

Crocker-Wheeler Company

Ampere, N. J.

16 Branch Offices

Chicago Office: Old Colony Bldg.

UNEXCELLED FOR OVERLOADED MACHINES

AWARDED GRAND PRIZE ST. LOUIS.

# COLUMBIA BRUSHES

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NATIONAL CARBON COMPANY, - CLEVELAND, O.

# GRAND PRIZE

**The Highest Possible Award**

**Has Been Given to**

ELECTRA

·TRADE MARK·

## HIGHEST GRADE NUERNBERG CARBONS

**By the International Jury of Awards, of the Louisiana Purchase Exposition, St. Louis, 1904.**

**HUGO REISINGER, Sole Importer, 11 BROADWAY, NEW YORK**

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**CENTURY ELECTRIC CO.**

MANUFACTURERS OF

**SINGLE-PHASE SELF-STARTING MOTORS AND CEILING FANS**

**ST. LOUIS, MO.**

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**Robert Volt-Ammeter**

Dead Beat Accurate, Durable Guaranteed

List Price, $6.00 including leather case.

Send for Catalogue.

3 Volts.

30 Amperes.

THE ROBERT INSTRUMENT CO

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**WE BUY OLD BELTS**

OR SCRAPS, ANY SIZE OR CONDITION.

**WE CLEAN, REPAIR AND RENEW OLD BELTS.**

*LEATHER PRESERVER MFG. CORP.*

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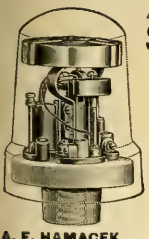

AUTOMATIC

**SERIES ARC CUT-OUT**

For Power, St. Ry., A. C. and D. C. Series Circuits.

**A. F. HAMACEK, CHICAGO, ILL.**

**2014 KENMORE AVE.**

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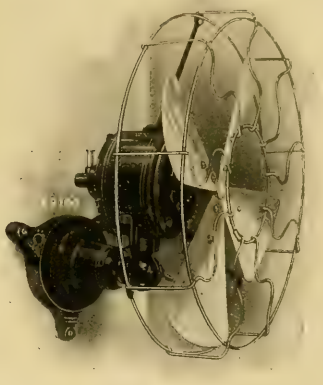
# OUR NEW "STANDARD"

1905 MODEL

## UNIVERSAL DESK OR BRACKET FANS



This is our new "Standard" Universal Desk or Bracket Fan. Combines in a single, neat and ornamental structure the desirable features of both types, as it may be mounted on either the desk or side wall, running equally well in any position. After being mounted the direction of the air current may be adjusted as desired in either a vertical or horizontal plane, then fixed in position by means of thumb screws provided for the purpose.

**ONE VALUABLE FEATURE** No tools are needed for changing from desk to bracket or for changing the direction of the air current.

Before buying send for our catalog descriptive of

9 OTHER TYPES OF DESK and CEILING FANS

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# SAVES $14.00 Per 1,000 KNOBS.

Our No. 1 Insulators.

**NO TIE WIRE—NO HALF HITCH—NO WRAPPING THE KNOB—HERE'S THE SAVING:**

One tie wire measures 7 inches and 1,000 knobs take 7,000 inches or 583 feet or more, depending on size of wire used, costing more than $2.00. The time spent in cutting and tying the wire costs another $5.00 per thousand at the least.

The slanting screw or nail hole on the side (see cut) makes it mere play to attach knobs to joist or studding, in one-third of the time formerly required, saving an additional $3.00. Total saving at least $14.00 per thousand knobs.

One screw does the work, too, and prevents the knob from turning.

*Ask your jobber for it or write us.*

**SNYDER & HUNT CO.**

**BELLE PLAINE, IA.**

We ship from either Iowa or New Jersey.

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**Samson Spot Cord**

For ARC LAMP and TROLLEY CORD

Send for Samples and Prices

SAMSON CORDAGE WORKS, - Boston, Mass.

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**American Electric and Controller Co.**

*Automatic Protective Switches and Motor Starters*

**136 Liberty St., NEW YORK**

WATCH FOR OUR AD. NEXT WEEK IN THIS PAPER

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**GREAT BARRINGTON, MASS., U. S. A.**

UNIVERSAL EXPOSITION ST. LOUIS 1904

# GOLD MEDALS

PAN-AMERICAN EXPOSITION BUFFALO 1901

**THE HIGHEST AWARDS AT BOTH EXPOSITIONS FOR**

# WATTMETERS

# ECONOMY AND QUALITY

OKONITE TRADE MARK.

There is economy in using OKONITE Wires and Cables—They wear longer, are not affected by lime, mortar or cement, and do not deteriorate when exposed to extreme changes in temperature. The high quality of OKONITE has been maintained for years; no dead or reclaimed rubber enters into its manufacture. :: :: :: :: :: :: ::

**OKONITE WIRES AND CABLES** **OKONITE TAPE AND MANSON TAPE**

**Central Electric Company,** GENERAL WESTERN AGENTS 207-209-211 EAST JACKSON BOULEVARD CHICAGO, ILL.


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Inc. El. Lt. Manipulator Co.

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Western Electric Co.

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Wesco Supply Co.
Western Electric Co.

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Western Electric Co.

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Chicago Edison Co.
Electric Appliance Co.
National Carbon Co.
Reisinger, Hugo.
Wesco Supply Co.

**Castings.**
National Electric Co.
Parsell & Weed

**Chains.**
Jeffrey Mfg. Co.
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Cutler-Hammer Mfg. Co.
Cutter Elec. & Mfg. Co.
Ft. Wayne Elec. Wks. Inc.
Union Electric Mfg. Co.
Wesco Supply Co.
Western Electric Company.
Westinghouse El. & Mfg. Co.

**Clusters.**
Benjamin Elec. Mfg. Co.
Plume & Atwood Mfg. Co.

**Clutches, Magnetic.**
Cutler-Hammer Clutch Co.
Williams Electric Mach. Co.

**Coal and Ashes Handling Machinery.**
Jeffrey Mfg. Co.

**Coils and Magnets.**
Western Electric Co.

**Coloring, Lamp.**
Signaloid Chemical Works

**Commutator Compound**
Crollus & Son, E. R.
Fres-Ko Chemical Co.
McLennan & Co., K.

**Condensers, Electric.**
Stanley—G. I. Elec. Mfg. Co.

**Conduit and Conduits.**
American Circular Loom Co.
American Conduit Company
Central Electric Co.
Electric Appliance Co.
Osburn Flexible Conduit Co.
Wesco Supply Co.

**Conduits, Clay.**
McRoy Clay Works.

**Conduit Rods.**
Cope, T. J.

**Contractors and Electric Light Plants.**
Allis-Chalmers Company.
Bullock El. Mfg. Co.
Crocker-Wheeler Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
National Electric Co.
Northern Electrical Mfg. Co.
Wagner Electric Mfg. Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Controllers, Crane.**
Amer. Elec. & Controller Co.
Amer. Elec. Fuse Co.

**Cord.**
Runzel-Lenz Elec. Mfg. Co.
Samson Cordage Wks.

**Couplings, Magnetic.**
Cutler-Hammer Clutch Co.

**Cross-Arms, Pins and Brackets.**
Merthold & Jennings.
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Company.

**Cut-Outs and Switches.**
Bissell Co., The F.
Bossert Elec. Const. Co.
Central Electric Co.
Chicago Edison Co.
Cutter Elec. & Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Hamacek, A. F.
Hart Manufacturing Co.
Hill Elec. Co., W. S.
Manhattan Elec. Supply Co.
Trumbull Elec. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Dynamos and Motors.**
Allis-Chalmers Company.
Bissell Co., The F.
Bullock Elec. Mfg. Co.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Ft. Wayne Elec. Wks. Inc.
General Elec. Co.
Gregory Electric Co.
Mechanical Appliance Co.
National Electric Co.
Northern Electrical Mfg. Co.
Parsell & Weed
Robbins & Myers Co.
Stanley—G. I. Elec. Mfg. Co.
Stow Manufacturing Co.
Wagner Electric Mfg. Co.
Warren Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Economisers, Fuel.**
Green Fuel Economizer Co.

**Electric Heating Appl.**
Electric Appliance Co.
Simplex Elec. Heating Co.
Western Electric Co.

**Electric Railways.**
Crocker-Wheeler Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

**Electrical and Mechanical Engineers.**
Arnold Co., The
Badt, F. B.
Bailey, Fred. W. C.
Baker & Co., W. E.
Bryan, Wm. H.
Byllesby & Co., H. M.
Cornell, T. S.
Evans, Almirall & Co.
Hallberg, J. H.
Humphrey, Henry H.
Hunt & Co., Robt. W.
Jackson, D. C. & W. B.
Kemp, R. W.
Kohler Brothers.
Lethenie, Paul
Northern Electrical Mfg. Co.
Ruebel, Schwedtman, Wells.
Sargent & Lundy.
Schoit, W. H.
Stanley G. I. Elec. Mfg. Co.
Stanton, LeRoy W.
Underhill, Chas. R.
Willis, G. M.

**Electrical Instruments.** (Recording and Testing.)
Bissell Co., The F.
Central Electric Co.
Diamond Meter Co.
Duncan Elec. Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Machado & Roller.
Pignolet, L. M.
Reliance Instrument Co.
Robert Inst. Co., The
Sangamo Electric Co.
Stanley—G. I. Elec. Mfg. Co.
Stanley Instrument Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co
Weston Electrical Inst. Co.

**Electro-Plating Mach'y**
Crocker-Wheeler Company.
General Electric Co.

**Elevators-Conveyors.**
Jeffrey Mfg. Co.

**Engines, Gas and Gasoline.**
Allis-Chalmers Company.
Marinette Gas Engine Co.
Woolley Fdy. & Mach. Wks.

**Engines, Oil.**
American Diesel Engine Co.

**Engines, Steam.**
Allis-Chalmers Company.
Brownell Co., The
Buckeye Engine Co.

**Fans and Fan Motors.**
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Company.
Edison Mfg. Co.
General Electric Co.
Hunter Fan & Motor Co.
Robbins & Myers Co., The
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Fans, Exhaust and Ventilating.**
Green Fuel Economizer Co.

**Fibre.**
Karlavert Mfg. Co.
Vulcanized Fibre Co.

**Fittings.**
Plume & Atwood Mfg. Co.

**Fixtures, Gas and Elec.**
Beardsley Chandelier Mfg.Co.

**Flashers.**
Bissell Co., The F.
Doxsee Elec'l. Co., A. S.
Haller Machine Co.
Reynolds El. Flasher Mfg.Co
Schneider & Co., C. O.
Wesco Supply Co.

**Flexible Shafts.**
Stow Mfg. Co.

**Fuses and Fuse Wire.**
Amer. Elec. Fuse Co.
Bissell Co., The F.
Central Electric Co.
Central Tel. & El. Co
Chicago Fuse Wire & Mfg.Co.
D. & W. Fuse Company.
Electric Appliance Co.
Johns-Manville Co., H. W.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Company.

**Globes, Reflectors and Shades.**
Fostoria Glass Specialty Co.
Fostoria Incan. Lamp Co.
Haller Machine Co.
Holophane Glass Co.
Phoenix Glass Co.
Wesco Supply Co.
Western Electric Co.

**Governors, Water Wheel.**
Replogle Governor Works.

**Graphite Specialties.**
Dixon Crucible Co., Jos.
Holmes Fibre-Graphite Co.

**Guards, Lamp.**
Couch Co., Inc., S. H.

**Heating (Exhaust Steam).**
Amer. District Steam Co.

**Heating, Hot Water.**
Evans, Almirall & Co.

**Holders, Inc. Lamps.**
Electric Appliance Co.
Incandescent Electric Light Manipulator Co.

**Indicators**
Robertson & Sons, Jas. L.

**Inspection & Insurance**
Hartford Steam Boiler Inspection & Insurance Co.

**Insulating Machinery.**
New England Butt Co.

**Insulators and Insulating Materials.**
American Electrical Works.
Central Electric Co.
Chicago Edison Co.
Electric Appliance Co.
Indiana Rub. & Ins. Wire Co.
Johns-Manville Co., H. W.
Karlavert Mfg. Co.
Locke Insulator Co.
Manhattan Elec. Supply Co.
Mica Insulator Co.
Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The
Phillips Insulated Wire Co.
Simplex Electrical Co.
Snyder & Hunt Co.
Standard Underground C. Co.
Sterling Varnish Co.
Vulcanized Fibre Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Lamps, Arc.**
Bissell Co., The F.
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Gregory Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Lamps, Incandescent.**
Bay State Lamp Co.
Bissell Co., The F.
Bryan-Marsh Company.
Buckeye Electric Company.
Central Electric Co.
Chicago Edison Co.
Columbia Incan. Lamp Co.
Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
Fostoria Incand. Lamp Co.
Franklin Electric Mfg. Co.
General Electric Co.
McCandless & Co., H. W.
Nernst Lamp Co.
Sawyer-Man Elec. Co.
Shelby Electric Co.
Standard Elec'l Mfg. Co.
Sunbeam Incan. Lamp Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Lamps, Incandescent—Replacers & Cleaners.**
Inc. El. Lt. Manipulator Co.

**Lamps, Nernst.**
Nernst Lamp Co.

**Lamps, Vapor.**
Cooper, Hewitt Elec. Co.

**Leather Specialties.**
Bunge, Otto.

**Letters, Metal, Sign.**
Haller Machine Co.

**Lightning Arresters.**
Central Electric Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.

**Linemen's Climbers.**
Klein & Sons, Mathias.

**Magnet Wires.**
(See Wires and Cables.)

**Mechanical Draft.**
Green Fuel Economizer Co.

**Metaphones.**
Anderson & Nachman.

**Mica.**
Chicago Mica Co.
Mica Insulator Co.
Munsell & Co., Eugene.

**Mining Apparatus, Elec.**
Allis-Chalmers Company.
Crocker-Wheeler Company.
General Electric Co.
Jeffrey Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Motors.** (See Dynamos and Motors.)

**Nippers and Pliers.**
Klein & Sons, Mathias.

**Overalls.**
Carhartt & Co., Hamilton.

**Patent Attorneys.**
Bain, Foree.

**Phosphor Bronze.**
Phosphor Bronze Sm. Co.Ltd.

**Platinum, Wire and Sheet.**
Baker & Co., Inc.

**Poles and Ties.**
Berthold & Jennings.
Brooks, Hall L.
Duluth Log Co.
Fowler, John H.
Fowler-Jacobs Company.
Kellogg Switch. & Sup. Co.
Lindsley Bros. Co.
Loud's Sons Co., H. M.
Maltby Cedar Co.
Minneapolis Cedar & Lbr. Co.
Mueller Company, William.
Pacific Coast Pole Co.
Perrizo & Sons.
Phelan, D. W.
Pillsbury-Watkins Co.
Pittsburg & L. S. Iron Co.
Porter Cedar Company.
S. E. Missouri Cypress Co.
Sterling & Son, W. C.
Torrey Cedar Co.
Valentine-Clark Co., The.
Worcester Co., C. H.

**Pole Hole Diggers.**
Western Steel Gate Co.

**Polish (Metal).**
Hoffman, Geo. W.

**Portables.**
Plume & Atwood Mfg. Co.

**Power Transmission Machinery.**
Jeffrey Mfg. Co.

**Rail Joints.**
Continuous Rail Joint Company of America.

**Railway Supplies.**
Wesco Supply Co.

**Re-Winding—Repairs.**
Chicago Edison Co.
Gregory Electric Co.

**Rheostats.**
Amer. Electric Fuse Co.
Cutler-Hammer Mfg. Co.
General Electric Co.
Union Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Schools and Colleges.**
Highland Park College
Michigan College of Mines.

**Second-Hand Mach'y.**
Bissell Co., The F.
Chicago House Wrecking Co.
Gregory Electric Co.
Matthews & Bro., W. N.
Walsh's Sons & Co.

**Signs, Electric.**
Haller Machine Co.
Western Display Co.

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Sauquoit Silk Mfg. Co.

**Sockets & Receptacles.**
Pass & Seymour.
Yost Elec. Mfg. Co.

**Soldering Sticks, Salts and Paste.**
Chicago Solder Co.
Crollus & Son, E. R.
New Idea Soldering Paste Co.
Universal Co., The
Western Electric Co.

**Solenoids.**
Amer. Elec. & Controller Co.

**Speaking Tubes.**
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.

**Specialties, Electrical Mfrs. and Designers.**
Cutter Co., Geo.
Haller Machine Co.

**Speed Indicators.**
Weston Electrical Inst. Co.

**Storage Batteries.**
American Battery Co.
Electric Storage Battery Co.
General Storage Battery Co.
Gould Storage Battery Co.
Universal Elec. Stor. Bat. Co.

**Supplies, General Elec.**
Amer. Elect'l Supply Co.
Bissell Co., The F.
Central Electric Co.
Century Electric Co.
Chicago Edison Co.
Cutter Co., Geo.
Electric Appliance Co.
General Electric Co.
Manhattan Elect'l Supply Co
Wesco Supply Co.
Western Electric Co.

**Switchboards.**
Bissell Co., The F.
Gen. Incan. Arc Light Co.

**Telephones, Telephone Material and Switchboards.**
American El. Telephone Co
Anderson & Nachman.
Arnold Elec. Mfg. Co.
Automatic Electric Co.
Bissell Co., The F.
Central Electric Co.
Central Tel. & El. Co.
Electric Appliance Co.
International Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co.
Manhattan Elec. Supply Co.
Stromberg-Carlson Tel. M.Co
Wesco Supply Co.
Western Electric Co.

**Time Switches.**
Bissell Co., The F.

**Toggle Bolts.**
Wrigley Co., Thos

**Tools.**
Klein & Sons, Mathias.
Western Electric Co.

**Transformers.**
Central Electric Co.
Crocker-Wheeler Co.
Electric Appliance Co.
Ft. Wayne Elec. Works, Inc.
General Electric Co.
Gregory Electric Co.
Kuhlman Electric Co.
Manhattan Elec. Supply Co.
National Electric Co.
Stanley—G. I. Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Trucks, Electric Car.**
General Electric Co.
Westinghouse El. & Mfg. Co.

**Turbines, Steam.**
Allis-Chalmers Co.
General Electric Co.
Westinghouse El. & Mfg. Co

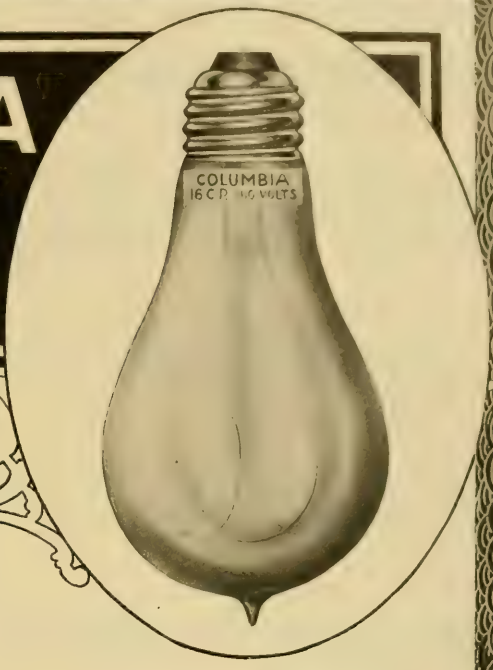
**Turbine Water Wheels**
Leffel & Co., Jas.

**Vulcanized Fibre.**
Vulcanized Fibre Co.

**Wires & Cables—Magnet Wires.**
American Electrical Works.
Belden Mfg. Co.
Bissell Co., The F.
Central Electric Co.
Crescent Ins. Wire & Cble. Co
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
Indiana Rub. & Ins. Wire Co
India Rubber & Gutta Percha Insulating Co.
Kellogg Switch. & Sup. Co.
Manhattan Elec. Supply Co.
National India Rubber Co
New York Insulated Wire Co.
Northern Wire & Cable Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co
Roebling's Sons Co., J. A.
Runzel-Lenz Elec. Mfg. Co.
Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Spargo Wire Co., Jas. A.
Standard Underground C. Co
Wesco Supply Co.
Western Electric Company.

**For Alphabetical Index of Advertisements See Page 3.**

# COLUMBIA LAMPS GIVE MOST LIGHT




is what you want to know.

Not what we say—but what it does.

**Buyers of INCANDESCENT LAMPS desire THE MOST LIGHT FOR LEAST CURRENT.**

For nearly sixteen years

# COLUMBIA LAMPS

have met every requirement of most exacting station managers, and throughout the world are acknowledged to be

## UNEQUALED IN QUALITY

Ask for Booklet. Copy of our "Wallet Full of Wisdom" mailed on request.
Order from any of our offices. LAMPS IN STOCK.

## Columbia Incandescent Lamp Co.

**SAINT LOUIS, MISSOURI, U. S. A.**

Branch Offices—Lamps in Stock

ST. LOUIS, MO., U. S. A.

NEW YORK: 1311 Havemeyer Bldg. PHILADELPHIA: 1227 Real Estate Trust Bldg.
CHICAGO: Central Electric Co. MINNEAPOLIS: 638 Boston Block.
SAN FRANCISCO: Paul Seller Elec. Works. MEMPHIS: 302 Scimitar Bldg.
MEXICO: Monterey, Van Voorhis Hnos.

LOOK FOR THE LICENSE LABEL IN THE STEM

Columbia Lamps are manufactured under a License to use the Chemical Exhaust Process of exhausting lamps. This process is vitally necessary in the production of the highest quality of lamp. Every package of Columbia Lamps carries a label reading: Licensed Under

Patent No. 537,693, April 16, 1895.
Patent No. 723,293, April 28, 1903
Patent No. 444,530, Jan. 13, 1891.
Patent No. 532,760, Jan. 22, 1895.

LOOK FOR THE LICENSE LABEL IN THE STEM

# Something New And of Vital Interest In Converters

**Mercury Vapor has been applied to another entirely novel service in the**

# COOPER HEWITT Mercury Vapor Converter

for transforming alternating current to direct current. It takes the place of the ordinary Motor-Generator set in charging Storage Batteries from alternating-current supply. Simple and compact, with

**NO MOVING PARTS**

Simply a glass bulb mounted in a holder together with a small switch-board.
A D.-C. Ammeter, a voltmeter, two double-pole switches and a regulator to give current adjustment, complete the apparatus.

**WRITE FOR DESCRIPTION**

## COOPER HEWITT ELECTRIC CO.

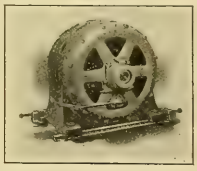
**220 W. 29TH ST., NEW YORK CITY**
**1121 WALNUT ST., PHILADELPHIA, PA.**



THE SKC SYSTEM

## Single-Phase and Poly-phase Induction Motors

Simple and substantial construction; excellent speed regulation; perfect ventilation; low temperature maintained in operation. :: ::



**Send for Bulletins**

**Stanley-G. I. Electric Mfg. Company**

**Pittsfield, Mass.** **Chicago, Monadnock Block**

When a concern orders a piece of apparatus, gives it a thorough test under the most extreme working conditions, orders another like it, and follows that up with still another order, what does it prove?

As we told you last week, the Riter-Conley Co., of Pittsburg, bought the first Accelerator we allowed to go out. After the company had it installed for two months, starting and stopping it from 200 to 250 times a day, another was ordered. Now its order is in for a third.

A progressive firm, such as this is, does not buy on sentiment. Its first Accelerator gave results or else it would not add two more to its equipment.

If this device had not fully lived up to our claims, that it would start a load gradually and smoothly; that it would instantly release when deenergized; that the faces would not drag when one member was idle; that no adjustments had to be made for wear of faces, and that the only attention required was to keep it supplied with oil and new carbons to replace those worn out, it would not have proven a paying investment.

But it has—the duplicate orders prove it.

There is some part of your plant in which the service could be improved by the use of Accelerators. Investigate and find out where it is.

Anyway send for our catalog, which tells how the Accelerator is constructed and how it operates. It may suggest to you a solution of some control problem.

## Cutler-Hammer Clutch Co.

MILWAUKEE, WISCONSIN

| NEW YORK | BOSTON | CHICAGO | PITTSBURG |
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| 136 Liberty St. | 176 Federal St. | Monadnock Bldg. | Farmers Bank Bldg. |

THE ARNOLD COMPANY
ENGINEERS CONSTRUCTORS
ELECTRICAL — CIVIL MECHANICAL
MARQUETTE BUILDING
CHICAGO

BYLLESBY, H. M. & CO.
(Incorporated)
ENGINEERS
Design, Construct and Operate Railway, Light, Power, Hydraulic and Gas Plants
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CONSULTING MECHANICAL AND ELECTRICAL ENGINEERS
Suite 801 Chemical Building
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BADT, F. B.
WILLIS, G. M.
Experts. Consulting Engineers.
1504 Monadnock, Chicago

CORNELL, T. S.
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136 S. BURDICK ST., ROOM 2,
KALAMAZOO, MICH.

KEMP, R. W.
Consulting and Contracting Telephone Engineer
Plans and Specification for complete plants. Old plants overhauled and placed on paying basis. Territory, Kansas, Oklahoma and Indian Territory.
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Long Distance Phone Central 1881
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Specialties—Central Station Heating Plants, Water Works, Steam Plants, Electric Light Plants and Street Railway Plants.
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CONSULTING ENGINEER
Designs, Specifications and Erection of Complete Electric Generating and Steam and Water Heating Plants and Distributing Systems.
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CINCINNATI, OHIO

EVANS, ALMIRALL & CO.,
Central Station Heating,
High Pressure Piping.
1057 Monadnock Blk., Chicago.

A LITTLE CARD
in this Directory may bring a big customer.

IF ONLY ONE
person or firm or corporation should look in this Directory for your address and fail to find it, you might fail to make a lump of money.

W. E. BAKER. H. R. BISHOP.
BAKER, W. E. & CO.
ENGINEERS,
ELECTRIC RAILWAYS.
27 William St., NEW YORK

YOU DON'T KNOW
how many customers you fail to get by not having your name in this Directory.

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Contracting Electrical Engineers,
Lighting Power Railways,
1804-1806-1808-1810-1812 Fisher Building,
CHICAGO.

STANTON, LE ROY W.
Consulting Telephone Engineer
Plans, Specifications and Supervision of Installation of Complete Telephone Plants
Special Reports on Telephone Properties and Apparatus
411 Electrical Bldg. Cleveland, Ohio

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M. Am. Soc. M. E.,
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Lincoln Trust Building, ST. LOUIS.

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Consulting Engineer
Electric Light, Power and Railway Plants
Suggestions to secure Economy, Specifications, Examinations and Reports
45 Broadway, NEW YORK
Long Distance Telephone 4578 Broad

LETHEULE, P., CONSULTING ENGINEER
Chief of French Electrical Department Louisiana Purchase Exposition
offers best opportunity for European agencies for sale of patents and licenses on patents and for representations at foreign expositions, namely Liege, 1905 and Milan, 1906. Catalogues and general outline of projects requested.
52 Rue de Clichy, Paris

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ELECTROMAGNET DESIGNS FOR POWER PURPOSES
Specialty — Designing Electromagnets and Solenoids for a given duty.
55 LIBERTY ST., NEW YORK

EMPIRE MINIATURE LAMPS
Send for Circular
H. W. McCANDLESS & CO.
67 & 69 Park Place
NEW YORK

DUGALD C. JACKSON, C. E.
WILLIAM B. JACKSON, M. E.
MEMBERS
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AMERICAN SOCIETY OF MECHANICAL ENGINEERS
AMERICAN SOCIETY OF CIVIL ENGINEERS
ENGINEERS. EXPERTS.
MADISON, WIS.

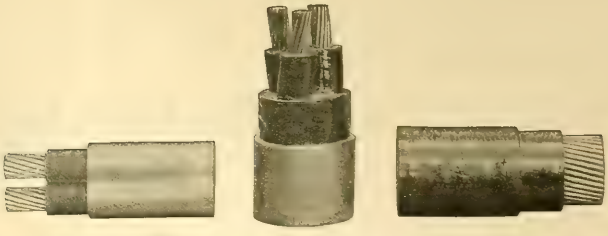
When a man's electrical ideas flow freely; when he discusses electrical subjects intelligently and glibly, you will be pretty safe in assuming that he keeps in touch with electrical progress by perusing the Western Electrician 52 times a year.

OTTO BUNGE
MANUFACTURER OF
LEATHER NAIL HEADS, BELTS, SAFETY AND CLIMBER STRAPS
1130 ST. PETER STREET,
INDIANAPOLIS, - - INDIANA.

# General Electric Company

Manufactures all Forms of **Insulated Wires and Cables**

Rubber,
Varnished
Cambric,



Paper,
Asbestos,
Weatherproof

Write for information concerning Wires and Cables insulated with our special form of Varnished Cambric. This insulation is equal and in many respects superior, to high grade rubber insulation and considerably cheaper.

General Office: SCHENECTADY, N. Y.

Chicago Office: Monadnock Block

Sales Offices in all large Cities

435

# The Western Electric Light Convention

THE National Electric Light Convention to be held at Denver, June 6th, 7th and 8th and at Colorado Springs, June 9th, 10th and 11th, will be the largest and the most important in the history of the association.

The issues of the Western Electrician of June 3d, 10th and 17th will be of corresponding importance.

The issue of June 3d will be distributed at the convention and will be devoted largely to the electrical interests of Denver and Colorado Springs. It will contain portraits of leading central-station men, completely illustrated articles descriptive of commercial lighting plants, the full programme of the convention, and much other material of especial value to those interested in central-station work.

As the coming convention will be noteworthy as being the first national electrical gathering to be held so far west as Colorado, the issue of June 3d will describe the electrical interests of the Centennial State in a manner worthy of the western electrical journal.

The issues of June 10th and 17th will contain the full and complete report of the convention proceedings.

The consequent value of these three issues to the advertiser who wishes to reach the eyes of the buyers of electrical machinery and supplies is evident.

Send your order today for space of liberal size.

As this will be a *Western* convention you should place your convention announcement in the Western Electrician.

**WESTERN ELECTRICIAN**

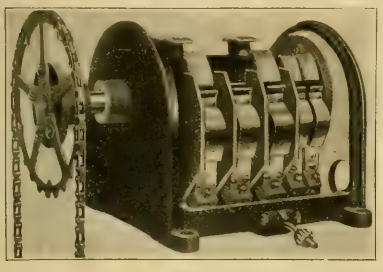
510 Marquette Building CHICAGO

# The Western Electrical Journal

A New Elevator

# Reversing Switch

For Use Only With Cutler-Hammer Self-Starters



Here's a switch that will withstand the wear and tear of elevator work, due to the constant making and breaking of the circuit.

Nothing to wear on it except the contacts, and as they are made of hard drawn copper, liberally proportioned, they will give long service. When they do wear they can be easily renewed (attached with screws) without disturbing any of the connections.

The iron drum is carefully insulated from the current carrying parts, is not affected by moisture, and consequently will not warp.

This switch can be installed in any convenient place—horizontally, vertically or on its side—no matter what the position may be, will work equally well.

It is designed to be used only in connection with C-H. self-starters and with them make ideal elevator control outfits.

Large sizes are equipped with powerful magnetic blow-outs for disrupting the arc which occurs upon opening the circuit.

We also build these switches especially for three-phase alternating-current motors, where the motor is thrown directly across the line in starting.

For dimensions and prices send for Bulletin 72B.

## The Cutler-Hammer Mfg. Co.

MILWAUKEE, WISCONSIN

NEW YORK 136 Liberty St. | BOSTON 176 Federal St | CHICAGO Monadnock Bldg. | PITTSBURG Farmers Bank Bldg.

## Security Cable Distributing Panels

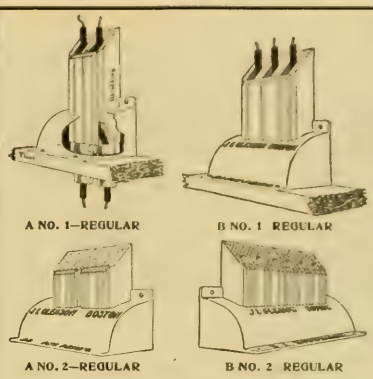
Ten cents per wire less five per cent for seven hundred and fifty wires or more

The F. Bissell Company.
Toledo O.

ALWAYS READY AND DOES THE WORK. WILL MAKE THE SOLDER FLOW WHERE YOU WANT IT, AND STAY WHERE YOU PUT IT. IN COLLAPSIBLE TUBES AND TIN BOXES.

"NEW IDEA" SOLDERING PASTE SAMPLE FREE.

NEW IDEA SOLDERING PASTE CO., 214 Hibbard Ave., Detroit, Mich.




## Gleason's Moulding Boxes.

Send postal for descriptive pamphlet and price list to

JOHN L. GLEASON
290 South St.
Jamaica Plain, Mass.

## JUNDELL UNIVERSAL MOTORS

STANDARD VARIABLE SPEED MOTORS HAVE A RANGE OF 3 TO 1 BY FIELD CONTROL

## National Electric Company
Milwaukee, U. S. A.

District Offices
New York, 135 Broadway.
Chicago, Old Colony Bldg.
Philadelphia, 1509 Land Title Bldg.
Pittsburg, Farmers' Bank Bldg.
Atlanta, Ga., Empire Bldg.
New Orleans, La., Hibernia Bank Bldg.

Sales Offices
Cleveland, Barton, Stevenson & Co.
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St. Louis, 829 Chemical Bldg.
Denver, Hendrie & Bolthoff Mfg. and Supply Co.
Seattle and San Francisco, Kilbourne & Clark Co.

# JUST SUPPLIES

In our new building, 134 to 140 West Jackson Boulevard, Chicago, we have the largest and best equipped Electrical Supply Warehouse in the world.
We have no side issues; our whole time and thought is given to see how quickly and satisfactorily we can fill orders for Electrical Supplies.
Try us and our methods.

ELECTRIC APPLIANCE COMPANY
134-136-138-140 West Jackson Boulevard. :: :: CHICAGO

*"AS GOOD AS*
*THE EDISON"*

is the claim made for all other lamps. When you can get the "Edison" why take
*"Just as Good?"*
LARGE STOCKS—PROMPT SHIPMENTS.

LOOK FOR THE LICENSE LABEL IN THE STEM

All types and varieties. Regular multiple lamps.
Street series lamps. Miniature lamps.

*GENERAL ELECTRIC COMPANY*
*Main Lamp Sales Office, - - Harrison, N. J.*
(488)

# BOSSERT'S BOXES

Drawn steel. One blow of a hammer gives clean round hole. No filing.
SAVE TIME, BOXES AND MONEY
Be up to date. Use them. Write for bulletin giving full particulars.
Bossert Electric Construction Co., UTICA N.Y.

**MICABOND** will save you money in your repair work as well as in your new machines. It is good insulation—made out of the best materials and is sold at reasonable prices.
CHICAGO MICA CO. VALPARAISO, IND.

# YOU NEED IT!

**Cale's Commutator Compound.**
The Only Article That Will Prevent Sparking.
Will keep the Commutator in good condition and prevent cutting. Absolutely will not gum the brushes.
50c. per stick. $5.00 per dozen. Send 50c. for trial stick.
FOR SALE BY ALL SUPPLY HOUSES OR
K. McLENNAN & CO., Sole Manufacturers, 909, 100 Washington Street, - CHICAGO.

**BIJUR "HIGH-DUTY"**
INSTALLATIONS RENEWALS **STORAGE BATTERIES**
GENERAL STORAGE BATTERY CO. 42 BROADWAY NEW YORK

SAUQUOIT SILK MFG. COMPANY
INSULATING and BRAIDING SILKS
MILLS:
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CHICAGO OFFICE:
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BOSTON OFFICE:
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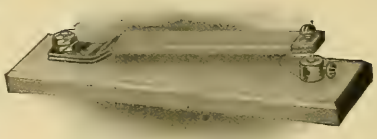
BEARDSLEE CHANDELIER MFG. CO. 256 and 257 So CANAL ST. CHICAGO
GAS & ELECTRIC FIXTURES FOR THE TRADE.
CATALOG SENT PREPAID TO DEALERS MENTION THIS PAPER

DON'T BUY ELECTRICAL SUPPLIES
Until you have seen our new Catalogue and new Price List.
Free to the trade.
Manhattan Electrical Supply Co.
NEW YORK: 32 Cortlandt St. CHICAGO: 188 Fifth Ave.

**MICA** Of all Qualities, In any Form at Lowest Prices
EUGENE MUNSELL AND CO.
NEW YORK and CHICAGO
**INSULATION** That Is.
Micanite, Linotape, M. I. C. Compound, Empire Cloth and Paper. For Years the Standard.
MICA INSULATOR CO., Originators
NEW YORK and CHICAGO

**VOLT - AMMETERS**
POCKET SIZE
For testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.
RELIABLE. - ACCURATE.
Send for Circular.
L. M. PIGNOLET
78-80 Cortlandt St., NEW YORK, N. Y.

A Motorless Flasher



Automatically operates three 16, six 8, twelve 4 c.-p. lamps or less, on either direct or alternating current.
Easily connected. Flash can be regulated. It saves electricity. It requires absolutely no attention and has nothing to get out of order. The contacts are heavy platinum and will wear indefinitely.
Price, each, $2.00. Discount to the trade.
C. O. SCHNEIDER & CO., Manufacturers, 84 E. Adams St., CHICAGO, ILL.

"STAR" INCANDESCENT LAMPS

LONG LIFE
GUARANTEED CANDLEPOWER,
HIGHEST EFFICIENCY.
MADE BY THE MOST SKILLED WORKMEN.
STANDARD ELECTRICAL MFG. COMPANY, : Niles, Ohio.

# TRAY PLATE BATTERY COMPANY

MANUFACTURERS OF THE CELEBRATED
**PATENT TRAY PLATE STORAGE BATTERY**
FOR CENTRAL LIGHTING, POWER AND ISOLATED PLANTS.
ALSO AN IMPROVED CELL TYPE BATTERY IN ALL GENERAL STYLES FOR ELECTRIC VEHICLES, SPARKING BATTERIES, ETC.
New York Office, 39 Cortlandt Street. 5-11 FREDERICK STREET, BINGHAMTON, N. Y., U. S. A.

FRANK N. PHILLIPS, Pres. E. ROWLAND PHILLIPS, V. P. C. H. WAGENSEIL, Treas. C. R. REMINGTON, Jr., Sec.

# AMERICAN ELECTRICAL WORKS,

PROVIDENCE, R. I.

BARE AND INSULATED ELECTRIC WIRE,

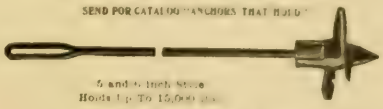
ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,
**Railway Feeder and Trolley Wire,**
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
CABLES FOR AERIAL AND UNDERGROUND USE.

NEW YORK STORE, W. J. Watson, 26 Cortlandt St.
CHICAGO STORE, F. E. Donohue, 82 Lake St.
MONTREAL BRANCH, Eugene F. Phillips' Electrical Works.
MAIN OFFICES AND FACTORIES, PHILLIPSDALE, R. I.

# A Stombaugh Guy Anchor

A STOMBAUGH GUY ANCHOR WILL HOLD 12,000 TO 30,000 LBS.

SEND FOR CATALOG "ANCHORS THAT HOLD"



¾ and 1 inch Stock
Holds Up To 15,000 Lbs.

W. N. MATTHEWS & BRO.
Manufacturers
603 Carleton Building ST. LOUIS

# EXPERT IN SOLICITOR OF U. S. & FOREIGN PATENTS

ELECTRICITY MECHANICS PATENT CAUSES

FOREE BAIN, 1662-3 Monadnock Blk., CHICAGO

M. KLEIN & SON

Send 2c stamp for new catalogue No. 6 of

**KLEIN'S TOOLS**

*For Electrical Workers and Line Builders.*

MATHIAS KLEIN & SONS.
81 W. Van Buren St., Chicago, Ill.

# It Can't Be Beat—The Guthrie Flasher

A SIGN FLASHER WITHOUT A MOTOR

Agents Wanted

**A FEW ADVANTAGES OF THIS FLASHER OVER ALL OTHERS:**

*First.*—The Price is lower.
*Second.*—It has fewer parts and is therefore the simplest flasher on the market.
*Third.*—It has no motor to cause trouble and consume current.
*Fourth.*—It costs nothing to operate this flasher.
*Fifth.*—It only occupies a space of 6 x 8 inches.
*Sixth.*—It can be regulated to flash any signs or show window lights in any manner desired.
Any combination of lights, without motor or cylinder.
Simplest and best on the market.
Works on any current.
The disadvantage of a flasher was the motor question.
We have overcome this and are putting out an article that meets a long felt want.

DOXSEE-BARRERE ELECTRIC CO.
1108-1110 Pine St., ST. LOUIS
General Agents for United States and Canada

# MOTOR DRIVEN FORGE BLOWERS

Compact, self contained, economical to operate and increase working capacity of smiths.

**THEY EMBODY NORTHERN MOTORS**

Means continuous, satisfactory, convenient operation.

See Leaflet No. 25,145.

**NORTHERN ELECTRICAL MANUFACTURING CO.**
ENGINEERS MANUFACTURERS
MADISON, WIS., U. S. A.
425 Monadnock Block, Chicago, Ill.

# Engineering

MECHANICAL, ELECTRICAL, STEAM, CIVIL.

Complete and short courses. Thoroughly equipped engineering shops. **Shop work from the beginning.** Short courses in Steam and Electrical Engineering. Expenses low. Accommodations the best. School all year. Students may enter any time. Correspondence steam and electrical courses. Send for catalogue. Mention course in which interested.
HIGHLAND PARK COLLEGE, DES MOINES, IOWA.

**CONTINUOUS RAIL JOINT CO. OF AM.**
NEWARK, N. J.
**OVER 20,000 MILES IN USE**
The St. Louis Exposition, 1904, awarded us the only gold medal for rail joint products.

# PRICE $10 LIST

From 0 to 150 Volts.
Also made up to 750 Volts.
FOR A. C. and D. C. WORK.
DISCOUNT TO THE TRADE.
WRITE FOR CIRCULARS

**RELIANCE INSTRUMENT CO.**
60-68 W. Van Buren St., Chicago.

# The JAMES A. SPARGO WIRE CO.

JAMES A. SPARGO, Pres. and Gen'l Mgr.
Manufacturers of
BARE AND TINNED COPPER WIRE
FINE SIZES A SPECIALTY Chicago Office, 1501 Monadnock Bldg. ROME, N. Y.

# NATIONAL CODE STANDARD

WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Ideal Wire.

**Prices and Samples on Application.**

# Phillips Insulated Wire Co.

Office and Factory: PAWTUCKET, R. I.

# YOST SPECIALTIES.

***Sockets, Wall Sockets, Weatherproof Sockets, Rosettes, Receptacles, Cord Adjusters.***

*Catalogue for the asking.*

**THE YOST ELECTRIC MFG. CO.**
TOLEDO, OHIO.

MAGNET WINDING MACHINES

BELDEN MANUFACTURING COMPANY
194 MICHIGAN ST. CHICAGO.

## Don't Procrastinate

But write today

authorizing us to insert your convention announcement in the great Electric Light Convention issues of the Western Electrician of June 3d, 10th and 17th.

Do not wait for our representative to call upon you. Do not wait for us to write you.

These convention issues will be of extraordinary advertising importance. They will reach practically every buyer of electrical machinery or supplies in the United States. They will be of permanent interest. They will be richly illustrated. They will correspond in importance with the importance of the convention itself. The issue of June 3d will be distributed at the convention. The issues of June 10th and 17th will contain the report of the convention proceedings.

Reserve space now.

Send us copy for your announcement, or authorize us to prepare copy and submit it for your approval.

Don't Procrastinate

**WANTED, FOR SALE** *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 3c each.* **POSITION WANTED** *advertisements (50 words or less), $1.00 an insertion; additional words 2c each.*

## POSITION WANTED.

Practical electrician of twelve years experience on D. C. and A. C. wishes position as chief electrician, in some central station as foreman of any branch of eletrical work. Good reference, also good reasons for change; cannot consider under $75 per month. Address BOX 469, care of Western Electrician, Chicago.

## POSITION WANTED.

As superintendent or electrician of lighting company or combined light and water plant; have had 17 years' experience in managing and operating lighting plants, 20 years with boilers, engines and water-works; results guaranteed; now employed as superintendent of light and water company. Address BOX 472, care Western Electrician, 510 Marquette Building, Chicago, Ill.

## POSITION WANTED.

Draughtsman (electrical), unmarried, 25 years of age, good technical education, 5 years' shop experience as machinist, 2½ years' office experience on electrical apparatus and switchboards. Have some experience in testing field. Address BOX 471, care Western Electrician, 510 Marquette Bldg., Chicago, Ill.

## WANTED.

Experienced draughtsmen in Electrical Apparatus, Switchboards, Motors and Generators; only first-class men need apply; state experience and salary expected. Address BOX 470, care of Western Electrician, 510 Marquette Building, Chicago.

## WANTED.

Good wiremen for single and polyphase work. Three to four years' experience. Permanent positions for reliable and sober men. Apply ELECTRIC SERVICE COMPANY, 208 N. Main St., South Bend, Ind.

## "WANTED"

Electrical contractors and supply dealers in every city to sell

**Reco and Improved Reynolds Sign Flashers**

They are very easy to sell at this season and we pay big commissions. Write for particulars to day.

**Reynolds Electric Flasher Mfg. Co.**
**221 Fifth Ave., Chicago**

## FOR SALE

| | | | | |
|---|---|---|---|---|
| 1-360 K. W. | General Electric | Alternator, | Three Phase | |
| 1-240 | " Westinghouse | " | Single | " |
| 2-150 | " Warren | " | " | " |
| 1-150 | " Westinghouse | " | " | " |
| 1-150 | " Wood | " | " | " |
| 1-150 | " Stanley | " | " | " |
| 1-150 | " General Electric | " | Three | " |
| 1-120 | " General Electric | " | Single | " |
| 1-120 | " Westinghouse | " | " | " |
| 1- 90 | " General Electric | " | " | " |
| 1- 75 | " Westinghouse | " | Two | " |
| 1- 75 | " Westinghouse | " | Single | " |
| 1- 75 | " Westinghouse | " | Two | " |

Direct connected to Gates' Engine.

Send for our **Monthly Bargain Sheet** with complete list and net prices.

**GREGORY ELECTRIC CO.**
**54-62 S. Clinton St., Chicago, Ill.**

## Galvanometers

**$5.00 EACH**

**WALSH'S SONS & CO.**
**260 WASHINGTON ST. NEWARK, N. J.**

## PLACE YOUR

**"Want" and "For Sale" advertisements in the**

**WESTERN ELECTRICIAN.**

**Immediate Returns.**

# ELECTRICAL MATERIAL FROM THE WORLD'S FAIR, ST. LOUIS, 1904

**An opportunity to secure rare bargains** in everything used in this line. This material that we are offering has seen but limited service and is practically as good as new for further use.

### LEAD COVERED CABLES.

| Feet. | Size. | Conductor. | Voltage |
|---|---|---|---|
| 20,000 | 200 M-C. M. | 3 | 6,600 |
| 9,600 | 4—0 | 3 | 6,600 |
| 4,700 | 3—0 | 3 | 6,600 |
| 7,000 | 2—0 | 3 | 6,600 |
| 14,500 | 1—0 | 3 | 6,600 |
| 18,500 | No. 1 | 3 | 6,600 |
| 11,000 | No. 2 | 3 | 6,600 |
| 4,700 | No. 3 | 3 | 6,600 |
| 7,100 | No. 4 | 3 | 6,600 |
| 11,500 | No. 6 | 3 | 6,600 |
| 25,000 | 4—0 | 1 | 2,200 |
| 1,000 | 2—0 | 1 | 2,200 |
| 11,000 | 1—0 | 1 | 2,200 |
| 9,000 | No. 1 | 1 | 2,200 |
| 11,000 | No. 2 | 1 | 2,200 |
| 18,000 | No. 4 | 1 | 2,200 |
| 48,000 | No. 6 | 1 | 2,200 |
| 1,900 | No. 8 | 1 | 2,200 |
| 25,000 | 500 M-C. M. | 1 | 500 |
| 80,000 | 4—0 | 1 | 500 |
| 11,000 | 3—0 | 1 | 500 |
| 14,000 | 2—0 | 1 | 500 |
| 3,700 | No. 1 | 1 | 500 |
| 2,000 | No. 6 | 1 | 500 |
| 180,000 | No. 6 | 1 | 8,000 |
| 14,500 | No. 14 | 6 | Fire Alarm |
| 39,000 | No. 14 | 4 | " " |
| 39,000 | No. 14 | 3 | " " |
| 9,600 | No. 14 | 2 | " " |

### Weatherproof and Rubber Covered Wire.

All sizes from No. 14 to 600,000 C. M.

### INCANDESCENT LAMPS

200,000 Lamps, used a short time, and in good condition for further service. Have been tested. They are 104 voltage, Edison base, 8 candlepower. In lots of 1,000, each 5 cents.

150,000 brand new Incandescent Lamps in original cases of 200, 250 and 400 Lamps, ranging from 100 to 110 voltage, 8 and 16 candlepower, General Electric make. Price each in case lots, 12½ cents.

20,000 Colored Incandescent Lamps, brand new, never used, General Electric make, 104 voltage, Edison base; colors, Amber, Green, Opal and Ruby; put up 200 in a case. Price each, 22 cents; are worth 35 cents each.

20,000 Incandescent Lamps, voltages 100 to 120, Edison. T. H. and Westinghouse base; 8, 10, 16, 20 and 25 candlepower; put up 250 in a case, second selection. Price each in case lots, 10½ cents.

### WOOD CONDUIT.

**100,000 Feet, Size 4½ x 4½.**

### MISCELLANEOUS

300,000 No. 9171 Porcelain, Edison Base Receptacles.
50,000 Weatherproof "Bryant" Sockets.
1,000,000 split glazed B. & D. Wiring Knobs.
300,000 Glazed Porcelain B. & D. Wiring Knobs, sizes 3½, 4½ and 5½.
20,000 No. 8 Standard Porcelain Knobs.
200,000 Single Wire glazed Porcelain Cleats.
15,000 Porcelain Cut-outs.
26,000 Plugs.
2,000,000 Unglazed Porcelain Tubes.
40,000 Glass Insulators.
20,000 Porcelain Cleats.
All kinds of switches and instruments.

**Ask for our Special Catalogue No. 567.**

**CHICAGO HOUSE WRECKING COMPANY, 35th and Iron Sts., CHICAGO.**

WORKS QUICK AND EASY. KEEPS ITS LUSTER. HOLDS OLD TRADE AND MAKES NEW. DOES NOT DETERIORATE. ESTABLISHED 16 YEARS. SOLD BY AGENTS AND DEALERS ALL OVER THE WORLD

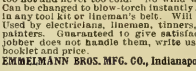
**U.S. METAL POLISH** 3 OUNCE BOX 10 CENTS. SAMPLES SENT FREE

GEO. W. HOFFMAN

POLISHES ALL METALS. BRANCHES: NEW YORK, CHICAGO, SAN FRANCISCO. 295 E. WASHINGTON ST. INDIANAPOLIS, IND.
HIGHEST AWARD. CHICAGO WORLD'S FAIR, 1893. LOUISIANA PURCHASE EXPOSITION 1904.

**ARE YOU LOOKING FOR TROUBLE?**
IF SO, GET A COPY OF
**TELEPHONE TROUBLES**
AND HOW TO FIND THEM
—IN—
BOTH MAGNETO AND COMMON BATTERY SYSTEMS.
**9th Edition Just Out. Price, 25c.**
**Electrician Publishing Co.,**
**510 Marquette Building,**
**CHICAGO.**

### GASOLINE SOLDERING IRON AND BLOW-TORCH



Furnished with two coppers, drop forged from bars, one for regular work and one for heavy work. Nothing complicated. No pump to get out of order. No platinum coil to burn out. Never too hot and never too cold. No wind will blow it out. Can be changed to blow-torch instantly. Can be carried in any tool kit or lineman's belt. Will last for years. Used by electricians, linemen, tinners, plumbers and painters. Guaranteed to give satisfaction. If your jobber does not handle them, write us for illustrated booklet and price.

**EMMELMANN BROS. MFG. CO., Indianapolis, Ind., U. S. A.**

## *Locations for Industries*

### *Erie Railroad*

### *Chicago to New York*

The Erie Railroad Company's Industrial Department has all the territory traversed by the railroad districted in relation to resources, adaptability, markets and advantages for manufacturing, and can advise with manufacturers in relation to the most suitable locations. For full information address

**LUIS JACKSON**
**Industrial Commissioner, Erie Railroad Company**
**21 Cortlandt Street, New York**

As your ad in the Western Electrician will be read, you will never be blue.

## ELECTRICAL AND OTHER INDUSTRIES ARE OFFERED LOCATIONS WITH

**Satisfactory Inducements, Favorable Freight Rates, Good Labor Conditions, Healthful Communities,**

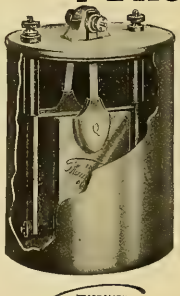
**ON THE LINES OF**
**THE ILLINOIS CENTRAL R. R.**
**AND THE**
**YAZOO & MISSISSIPPI VALLEY R. R.**

For full information and descriptive pamphlet address

**J. C. CLAIR,**
Industrial Commissioner
1 Park Row, Chicago, Ill

Electrical book buyers buy electrical books from the Electrician Publishing Co., 510 Marquette Bldg., Chicago.

# The Unanimous Endorsement



by leading railroads, gas engine manufacturers and primary battery users in general is due to the sure and constant current delivery that characterizes

# Edison Primary Batteries

This is the result of the following distinctive features: Freedom from local action and polarization; constant decrease of internal resistance during life of cell. For further particulars, write for catalogue 7.

TRADE MARK
Thomas A. Edison

## Edison Mfg. Company,

FACTORY, ORANGE, N. J.

NEW YORK, 31 UNION SQUARE. CHICAGO, 304 WABASH AVENUE.

## CHICAGO EDISON COMPANY REPAIR SHOPS

**76 MARKET STREET, CHICAGO. TELEPHONE MAIN 1280.**

Machine and Carpenter Work of All Kinds
Correspondence Solicited.

**OPEN DAY AND NIGHT.**

FIRST-CLASS EQUIPMENT THROUGHOUT.

Dynamos Armatures, Motors, Arc Lamps, Fans, Instruments.

# OFFICIAL TRAIN

**TO THE**

National Electric Light Association Meeting at

# DENVER AND COLORADO SPRINGS

**JUNE 6, 7, 8 AND 9, 10, 11, 1905.**

For the exclusive use of delegates, supply men, their friends and ladies, via

# BURLINGTON ROUTE

**(C., B. & Q. RY.)**

Operating in conjunction with the Pennsylvania R. R.

It is planned to run a special train out of New York as a second section of the Pennsylvania Limited, leaving New York sometime Saturday morning, June 3d. It is proposed to make this train in every respect a duplicate of the Pennsylvania Limited, viz., the same beautifully equipped parlor smoker, dining car, sleepers and possibly an observation car. This Pennsylvania Railroad section will run through solid to Denver. At Chicago, however, the Burlington section or strictly western train, will be coupled on to the Pennsylvania or eastern section of the train, and both trains thus united will be hauled as a solid train from Chicago direct to Denver over the Burlington route. An exact schedule has not as yet been made, but it now looks as though this train would certainly arrive in Chicago sometime Sunday morning, June 4th. It is the purpose to allow several hours in Chicago for a "breathing spell." This combination train will then leave Chicago sometime the same afternoon, and it is the plan to land the entire party from the combination train in Denver, Monday afternoon, June 5th, in ample time for supper and the evening's amusement.

In view of the enthusiasm displayed relative to this western convention and the fact that all berths on the train are not "lowers," (!) those desiring to join the convention party and go West from Chicago to Denver over the Burlington should, without delay, early make reservations DIRECT, addressing F. E. BELL, City Passenger Agent, BURLINGTON ROUTE, 211 S. CLARK ST., CHICAGO, who is handling all inquiries appertaining to reservations for Asst. Master of Transportation Frank L. Perry of the National Electric Light Association.

Reservations for the return trip over the Burlington may be made at Denver or at Colorado Springs.

A rate of $30.00 for the round trip has been authorized for this meeting.

For any additional information address as above

**F. E. BELL, City Passenger Agent, Burlington Route** **211 S. Clark St., CHICAGO**

1198

## Kellogg Express Switchboard Cabinet

The graceful Appearance comes from Simple Lines.

This Attractive Design has been so popular that it has been much copied by other manufacturers

**Fifty-Line Capacity** Quarter Sawed Oak for the entire Exterior of the Cabinet

Thoroughly seasoned wood

Finished in Light or Golden Oak

**Gold Medal** Highest Award Buffalo Exposition 1902

**Grand Prize** Highest Award St. Louis Exposition 1904

The Strongest, Longest Lived, Most Efficient Switchboards made. All telephone experts will tell you that.

**Kellogg Switchboard & Supply Co.**
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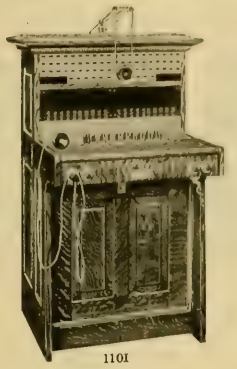

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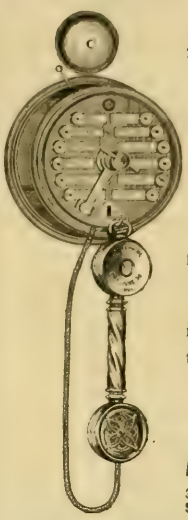

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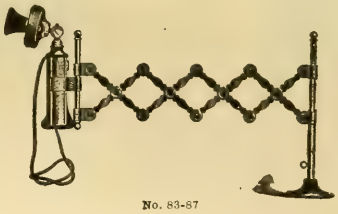

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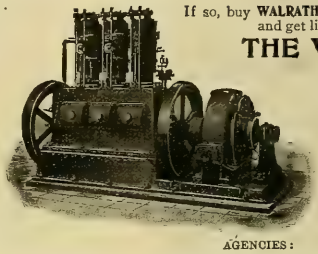

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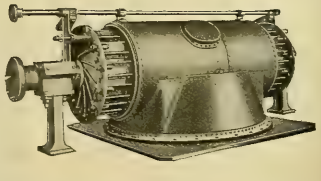

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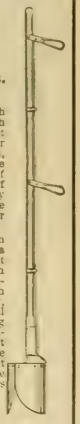

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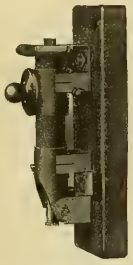

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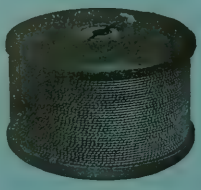

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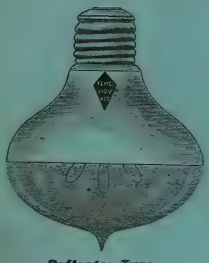

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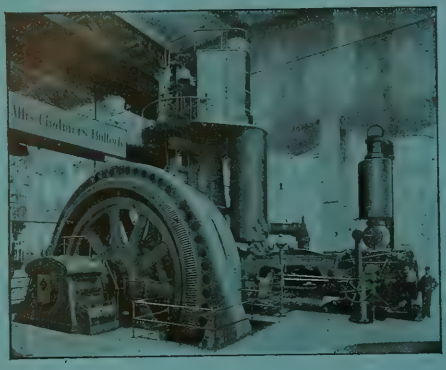

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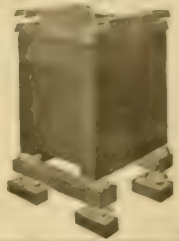

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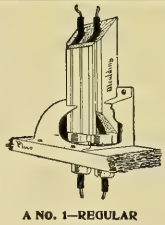

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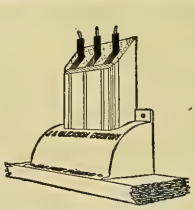

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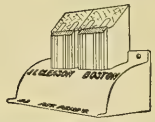

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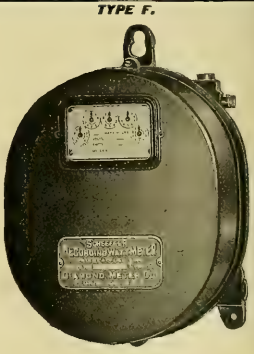

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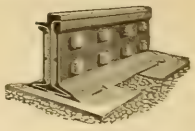

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Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Hamacek, A. F.
Hart Manufacturing Co.
Hill Elec. Co., W. S.
Manhattan Elec. Supply Co.
Trumbull Elec. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Dynamos and Motors.**
Allis-Chalmers Company.
Bissell Co., The F.
Bullock Elec. Mfg. Co.
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Co.
Ft. Wayne Elec. Wks. Inc.
General Elec. Co.
Gregory Electric Co.
Mechanical Appliance Co.
National Electric Co.
Northern Electrical Mfg. Co.
Parsell & Weed
Robbins & Myers Co.
Stanley—G. I. Elec. Mfg. Co.
Stow Manufacturing Co.
Wagner Electric Mfg. Co.
Warren Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Economizers, Fuel.**
Green Fuel Economizer Co.

**Electric Heating Appl.**
Electric Appliance Co.
Simplex Elec. Heating Co.
Western Electric Co.

**Electric Railways.**
Crocker-Wheeler Co.
General Electric Co.
Westinghouse El. & Mfg. Co.

**Electrical and Mechanical Engineers.**
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Badt, F. B.
Bailey, Fred. W. C.
Baker & Co., W. E.
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Byllesby & Co., H. M.
Cornell, T. S.
Evans, Almirall & Co.
Hallberg, J. H.
Humphrey, Henry H.
Hunt & Co., Robt. W.
Jackson, D. C. & W. B.
Kemp, K. W.
Kohler Brothers.
Letheule, Paul
Northern Electrical Mfg. Co.
Ruebel, Schwedtman, Wells.
Sargent & Lundy.
Schott, W. H.
Stanley G. I. Elec. Mfg. Co.
Stanton, LeRoy W.
Underhill, Chas. R.
Willis, G. M.

**Electrical Instruments.** (Recording and Testing.)
Bissell Co., The F.
Central Electric Co.
Diamond Meter Co.
Duncan Elec. Mfg. Co.
Electric Appliance Co.
Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Machado & Roller.
Pignolet, L. M.
Reliance Instrument Co.
Robert Inst. Co., The
Sangamo Electric Co.
Stanley—G. I. Elec. Mfg. Co.
Stanley Instrument Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co
Weston Electrical Inst. Co.

**Electro-Plating Mach'y**
Crocker-Wheeler Company.
General Electric Co.

**Elevators-Conveyors.**
Jeffrey Mfg. Co.

**Engines, Gas and Gasoline.**
Allis-Chalmers Company.
Marinette Gas Engine Co.
Woolley Fdy. & Mach. Wks.

**Engines, Oil.**
American Diesel Engine Co.

**Engines, Steam.**
Allis-Chalmers Company.
Brownell Co., The
Buckeye Engine Co.

**Fans and Fan Motors.**
Central Electric Co.
Century Electric Co.
Crocker-Wheeler Company.
Edison Mfg. Co.
General Electric Co.
Hunter Fan & Motor Co.
Robbins & Myers Co., The
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Fans, Exhaust and Ventilating.**
Green Fuel Economizer Co.

**Fibre.**
Karlavert Mfg. Co.
Vulcanized Fibre Co.

**Fittings.**
Plume & Atwood Mfg. Co.

**Fixtures, Gas and Elec.**
Beardslee Chandelier Mfg.Co.

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Doxsee Elec'l. Co., A. S.
Haller Machine Co.
Reynolds El. Flasher Mfg.Co
Schneider & Co., C. O.
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Central Tel. & El. Co.
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D. & W. Fuse Company.
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Manhattan Elec. Supply Co.
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Western Electric Company.

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Haller Machine Co.
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Phœnix Glass Co.
Wesco Supply Co.
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Replogle Governor Works.

**Graphite Specialties.**
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Holmes Fibre-Graphite Co.

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Couch Co., Inc., S. H.

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Amer. District Steam Co.

**Heating, Hot Water.**
Evans, Almirall & Co.

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Electric Appliance Co.
Incandescent Electric Light Manipulator Co.

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Robertson & Sons, Jas. L.

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Hartford Steam Boiler Inspection & Insurance Co.

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New England Butt Co.

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Chicago Edison Co.
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Johns-Manville Co., H. W.
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Manhattan Elec. Supply Co.
Mica Insulator Co.
Munsell & Co., Eugene.
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New York Insulated Wire Co.
Okonite Co., The
Phillips Insulated Wire Co.
Simplex Electrical Co.
Snyder & Hunt Co.
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Sterling Varnish Co.
Vulcanized Fibre Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Lamps, Arc.**
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Central Electric Co.
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General Electric Co.
Gregory Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Lamps, Incandescent.**
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Bissell Co., The F.
Bryan-Marsh Company.
Buckeye Electric Company.
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Columbia Incan. Lamp Co.
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Electric Appliance Co.
Fostoria Incand. Lamp Co.
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General Electric Co.
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Nernst Lamp Co.
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Shelby Electric Co.
Standard Elec'l Mfg. Co.
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Wesco Supply Co.
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Nernst Lamp Co.

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Cooper, Hewitt Elec. Co.

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Bunge, Otto.

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General Electric Co.
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.

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Klein & Sons, Mathias.

**Magnet Wires.**
(See Wires and Cables.)

**Mechanical Draft.**
Green Fuel Economizer Co.

**Metaphones.**
Anderson & Nachman.

**Mica.**
Chicago Mica Co.
Mica Insulator Co.
Munsell & Co., Eugene.

**Mining Apparatus, Elec.**
Allis-Chalmers Company.
Crocker-Wheeler Company.
General Electric Co.
Jeffrey Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Motors.** (See Dynamos and Motors.)

**Nippers and Pliers.**
Klein & Sons, Mathias.

**Overalls.**
Carhartt & Co., Hamilton.

**Patent Attorneys.**
Bain, Foree.

**Phosphor Bronze.**
Phosphor Bronze Sm. Co. Ltd.

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Baker & Co., Inc.

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Brooks, Hall L.
Duluth Log Co.
Fowler, John H.
Fowler-Jacobs Company.
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Loud's Sons Co., H. M.
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Minnesapolis Cedar & Lbr. Co.
Mueller Company, William.
Pacific Coast Pole Co.
Perrizo & Sons.
Phelan, D. W.
Pillsbury-Watkins Co.
Pittsburg & L. S. Iron Co.
Porter Cedar Company.
S. E. Missouri Cypress Co.
Sterling & Son, W. C.
Torrey Cedar Co.
Valentine-Clark Co., The.
Worcester Co., C. H.

**Pole Butt Diggers.**
Western Steel Gas Co.

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Hoffman, Geo. W.

**Portables.**
Plume & Atwood Mfg. Co.

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Jeffrey Mfg. Co.

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Gregory Electric Co.

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Amer. Electric Fuse Co.
Cutler-Hammer Mfg. Co.
General Electric Co.
Union Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Schools and Colleges.**
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Michigan College of Mines.

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Chicago House Wrecking Co.
Gregory Electric Co.
Matthews & Bro., W. N.
Walsh's Sons & Co.

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Haller Machine Co.
Western Display Co.

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Sauquoit Silk Mfg. Co.

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Pass & Seymour.
Yost Elec. Mfg. Co.

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Chicago Solder Co.
Crollus & Son, E. R.
New Idea Soldering Paste Co.
Universal Co., The
Western Electric Co.

**Solenoids.**
Amer. Elec. & Controller Co.

**Speaking Tubes.**
Central Electric Co.
Electric Appliance Co.
Manhattan Elec. Supply Co.
Wesco Supply Co.
Western Electric Co.

**Specialties, Electrical Mfrs. and Designers.**
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Haller Machine Co.

**Speed Indicators.**
Weston Electrical Inst. Co.

**Storage Batteries.**
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Electric Storage Battery Co.
General Storage Battery Co.
Gould Storage Battery Co.
Universal Elec. Stor. Bat. Co.

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Central Electric Co.
Century Electric Co.
Chicago Edison Co.
Cutter Co., Geo.
Electric Appliance Co.
General Electric Co.
Manhattan Elect'l Supply Co
Wesco Supply Co.
Western Electric Co.

**Switchboards.**
Bissell Co., The F.
Gen. Incan. Arc Light Co.

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Anderson & Nachman.
Arnold Elec. Mfg. Co.
Automatic Electric Co.
Bissell Co., The F.
Central Electric Co.
Central Tel. & El. Co.
Electric Appliance Co.
International Tel. Mfg. Co.
Kellogg Switchb. & Sup. Co
Manhattan Elec. Supply Co.
Stromberg-Carlson Tel. M.Co
Wesco Supply Co.
Western Electric Co.

**Time Switches.**
Bissell Co., The F.

**Toggle Bolts.**
Wrigley Co., Thos

**Tools.**
Klein & Sons, Mathias.
Western Electric Co.

**Transformers.**
Central Electric Co.
Crocker-Wheeler Co.
Electric Appliance Co.
Ft. Wayne Elec. Works, Inc.
General Electric Co.
Gregory Electric Co.
Kuhlman Electric Co.
Manhattan Elec. Supply Co.
National Electric Co.
Stanley—G. I. Elec. Mfg. Co.
Wagner Electric Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

**Trucks, Electric Car.**
General Electric Co.
Westinghouse El. & Mfg. Co.

**Turbines, Steam.**
Allis-Chalmers Co.
General Electric Co.
Westinghouse El. & Mfg. Co

**Turbine Water Wheels**
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**Vulcanized Fibre.**
Vulcanized Fibre Co.

**Wires & Cables—Magnet Wires.**
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Belden Mfg. Co.
Bissell Co., The F.
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Crescent Ins. Wire & Cble. Co
Electric Appliance Co.
General Electric Co.
Hazard Manufacturing Co.
Indiana Rub. & Ins. Wire Co
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Kellogg Switch. & Sup. Co.
Manhattan Elec. Supply Co.
National India Rubber Co
New York Insulated Wire Co.
Northern Wire & Cable Co.
Okonite Co., The
Phillips, Eugene F.
Phillips Insulated Wire Co
Roebling's Sons Co., J. A.
Runzel-Lenz Elec. Mfg. Co.
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For Alphabetical Index of Advertisements See Page 3.

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***MODERNIZING ENGINEERS***

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## Automatic Controllers and Starters

***For all types and sizes of Induction Motors***
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***For all classes and conditions of service***
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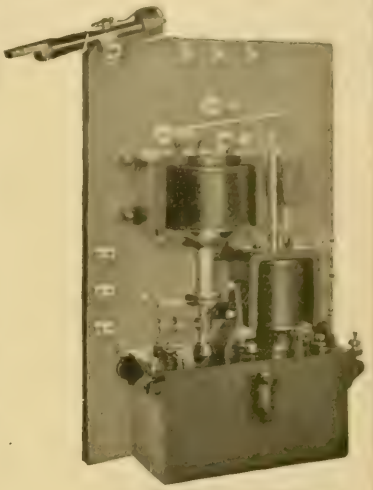

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**Just What the World Has Been Waiting For.**

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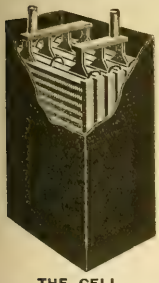

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This plate is so strong electrically and mechanically that no amount of electrical abuse or of vibration in traction service can dislodge even the slightest particle of its active material.
Lowest internal resistance of any storage battery in the world.
The weight efficiency is conservatively 14 watts per pound total weight, and electrical efficiency unsurpassed . . . .

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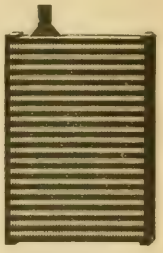
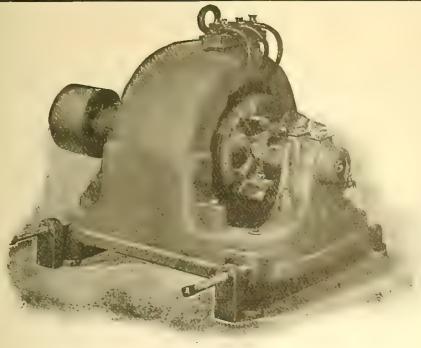


THE PLATE



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# Don't Be Afraid

of the Gas Plant

**WORK UP A MOTOR LOAD**

We can furnish you

## SINGLE PHASE MOTORS

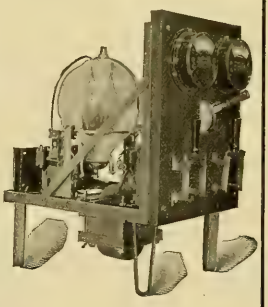
that will start under full load in sizes ranging from 1/8 to 35 H. P.

*Wagner Electric Mfg. Co.*

*ST. LOUIS, MO., U. S. A.*

## For Charging Storage Batteries

from alternating current sources and for work of this nature the



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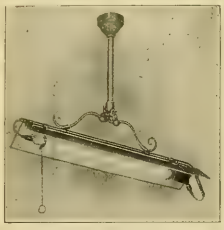
This is intended to take the place of the ordinary A. C.–D. C. Motor Generator Set in converting alternating to direct current.



No moving parts.
Simple and compact.

*Send for description of this and also of the*

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"The Light to Work By"

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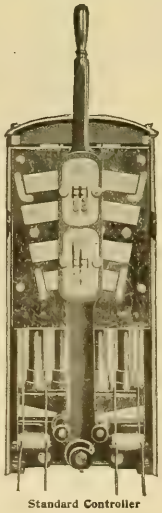

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Enclosed Controller

MADE IN ALL SIZES

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Chicago New York



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Drawn steel. One blow of a hammer gives clean round hole. No filing.

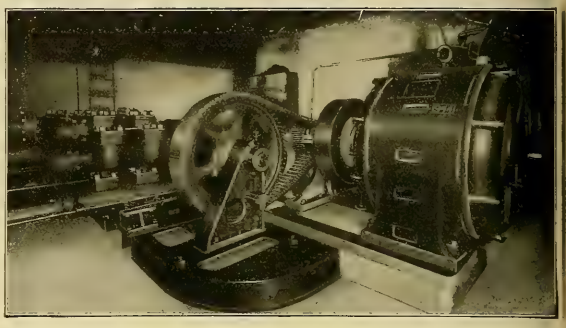
**SAVE TIME, BOXES AND MONEY**

Be up to date. Use them. Write for bulletin giving full particulars.

Bossert Electric Construction Co., UTICA N.Y.



## One Accelerator Is Saving $960 a Year In This Plant



In the plant shown above the Cutler-Hammer Accelerator has saved $960.00 a year in current and four-fifths of wear and tear to the apparatus to which it is connected.

Previous to the installation of the Accelerator, the apparatus was run at full speed all day, but only one-fifth of that time was it doing actually necessary work During this idle load of eight hours a day, the motor used 25 K. W. or 200 K. W. hours per day.

Since the installation of the Accelerator it has automatically started and stopped the apparatus as required, the latter remaining idle eight hours a day. While running idle the motor uses but 5 K. W. or 40 K. W. hours per day.

The saving is 20 K. W., or 160 K. W. hours per day. Figuring at the minimum rate of 2c a K. W. the saving effected is $3.20 a day, or $960 for a year of 300 days. The Accelerator cost but $350, and has saved nearly three times its cost.

This is only one instance of the saving that can be effected by the use of this device. If you have any problem of automatic control, which under the present conditions show a waste of power, submit to us what you wish to accomplish and we will figure out a way for doing it.

The Accelerator is applicable for any work where it is desired to start a load smoothly and gradually, either automatically or by push buttons.

It has no parts to get out of order and requires no attention beyond being kept supplied with oil and the replacing of old carbons.

Our catalog fully describes it. Send for it.

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New and up-to-date method of handling orders.
New and interesting prices.

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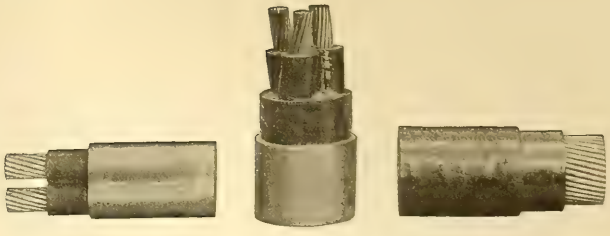
Varnished
Cambric,



Paper,
Asbestos,
Weatherproof

Write for information concerning Wires and Cables insulated with our special form of Varnished Cambric. This insulation is equal and, in many respects superior, to high grade rubber insulation and considerably cheaper.

**General Office: SCHENECTADY, N. Y.**

Chicago Office: Monadnock Block

Sales Offices in all large Cities

435

# JUST SUPPLIES

In our new building, 134 to 140 West Jackson Boulevard, Chicago, we have the largest and best equipped Electrical Supply Warehouse in the world.
We have no side issues; our whole time and thought is given to see how quickly and satisfactorily we can fill orders for Electrical Supplies.
Try us and our methods.

ELECTRIC APPLIANCE COMPANY
134-136-138-140 West Jackson Boulevard. :: :: CHICAGO

# LAMPS

Get acquainted with the
PEERLESS—MONEY SAVERS
MADE RIGHT PRICED RIGHT ARE RIGHT
THE WESCO SUPPLY CO.,
ST. LOUIS, MO.
Branch Warehouse, Ft. Worth, Texas. "EVERYTHING ELECTRICAL"

# MICA

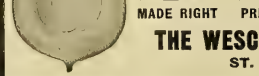
Of all Qualities, in any Form at Lowest Prices
EUGENE MUNSELL AND CO.
NEW YORK and CHICAGO

# INSULATION That Is.

Micanite, Linotape, M. I. C. Compound, Empire Cloth and Paper. For Years the Standard.
MICA INSULATOR CO., Originators
NEW YORK and CHICAGO

# WANTED

You Who are Troubled with Sparking and Cutting of Commutators to Use




The only article that will PREVENT SPARKING. Will keep the commutator in good condition and PREVENT CUTTING.
Absolutely Will Not Gum The Brushes . . .
It will put that high gloss on the commutator you have so long sought after.
50 Cts. per Stick. $5.00 per Dozen
For Sale by all Supply Houses, or
FREE, Sample Stick.
K. McLENNAN & CO., Sole Manufacturers,
909 Title and Trust Bldg., CHICAGO, ILL.

The insulation is the most important part of your machine—be sure you buy only the best. Cheap insulation cannot be good insulation.
IF IT'S MICABOND YOU CAN BE SURE YOU HAVE THE BEST—OUR GUARANTEE IS BEHIND IT
CHICAGO MICA CO. : : : Valparaiso, Ind.

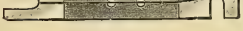
VOLT - AMMETERS
POCKET SIZE
For testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.
RELIABLE. - ACCURATE.
Send for Circular.
L. M. PIGNOLET
78-80 Cortlandt St., NEW YORK, N. Y.

BIJUR "HIGH-DUTY"
INSTALLATIONS RENEWALS
STORAGE BATTERIES
GENERAL STORAGE BATTERY CO. 42 BROADWAY NEW YORK

YOST SPECIALTIES.

Sockets, Wall Sockets, Weatherproof Sockets, Rosettes, Receptacles, Cord Adjusters.
Catalogue for the asking.
THE YOST ELECTRIC MFG. CO.
TOLEDO, OHIO.

THE SECURITY FUSE



It has been urged that "Carbon Arresters" are a necessity, are better than our mica fuses and ground strips, that they are better understood and "the trade is educated to them," etc., etc. None of these are true unless it be the last, and if true it is perhaps our fault in not sooner calling attention to the plain fact that the line and the ground are separated, in both cases, by a mica sheet—nothing more nor less. In our design the lightning jumps from the fuse through the mica to the brass ground, and in the carbon design it jumps from one carbon through the mica to a carbon ground. Our fuse opens the circuit and must be renewed. The carbon device grounds the line permanently and must be cleaned out. We claim greater safety and convenience. A fuse is always used with the carbon, making it, the carbon, an unnecessary addition, and therefore objectionable.

Free with Security Distributing Panels. If purchased alone, $1.00 per hundred, less ten per cent for orders of five hundred.

*Write for free sample and complete catalogue No. 125 E. on Pole Line devices.*

THE F. BISSELL COMPANY
TOLEDO, O.

# EDISON LAMPS

Can be Obtained Promptly

Extensive Factory Facilities and Large Stocks insure quick and accurate delivery.

All Types and Varieties
Regular Multiple Lamps
Street Series Lamps
Miniature Lamps

GENERAL ELECTRIC COMPANY
Main Lamp Sales Office:
HARRISON, N. J.
(477)

# NOT EXCELLED
FOR
Electrical Work

CHICAGO SOLDER CO.
Formerly KESTER ELECTRIC MFG. CO.
46 North Union Street CHICAGO
R. C. MILLER, Burlington Building, St. Louis, Mo., Gen'l Western Agent

AN INSTRUMENT FOR ISOLATED PLANT WORK.

Diameter of Base Flange, 7½" Inches.
LIST PRICE $16.50.

This popular type of WHITNEY instrument has a polished all-brass case and a permanent magnet movement giving equally divided scales and dead beat indications. The ammeters of large capacity are supplied with separate shunts.

Send for complete price list and our attractive discounts to
ELECTRIC APPLIANCE CO., Chicago, Ill.
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ELECTRICAL ENGINEERING CO., Minneapolis.
STANDARD ELECTRIC CO., Cincinnati, O.
OR
MACHADO & ROLLER, New York, N.Y.

FRANK N. PHILLIPS, Pres. E. ROWLAND PHILLIPS, V. P. C. H. WAGENSEIL, Treas. C. H. REMINGTON, Jr., Sec.

**AMERICAN ELECTRICAL WORKS,**

PROVIDENCE, R. I.

BARE AND INSULATED ELECTRIC WIRE,

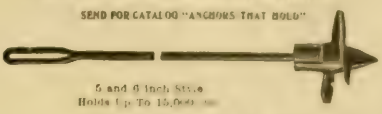
ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,
**Railway Feeder and Trolley Wire,**
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
CABLES FOR AERIAL AND UNDERGROUND USE.

NEW YORK STORE, W. J. Watson, 26 Cortlandt St.
CHICAGO STORE, F. E. Donohoe, 82 Lake St.
MONTREAL BRANCH, Eugene F. Phillips' Electrical Works.
MAIN OFFICES AND FACTORIES, PHILLIPSDALE, R. I.

**A Stombaugh Guy Anchor**

A STOMBAUGH GUY ANCHOR WILL HOLD 12,000 TO 30,000 LBS.

SEND FOR CATALOG "ANCHORS THAT HOLD"



5 and 6 inch Size
Holds Up To 15,000 lbs.

W. N. MATTHEWS & BRO.
Manufacturers
603 Carleton Building ST. LOUIS

**EXPERT IN** ELECTRICITY MECHANICS PATENT CAUSES
SOLICITOR OF U. S. & FOREIGN **PATENTS**
FORÉE BAIN, 1652-3 Monadnock Blk., CHICAGO

**"AMERICAN" STORAGE CELLS**
ARE THE BEST. Send for descriptive Circular.
**AMERICAN BATTERY CO.,**
EST'D 1888. 171 S. Clinton St., Chicago.

Crimshaw

Raven White Core

Raven Black Core

**ALL OUR WIRES** pass inspection and carry the above **TRADE-MARKS** on our tags. We also manufacture **Crimshaw** and **Competition Tapes** and **Splicing Compounds.**

**NEW YORK INSULATED WIRE COMPANY,**

MAIN OFFICE: 114, 116 & 118 Liberty St., New York.
BRANCHES: CHICAGO: 192 Desplaines St. BOSTON: 7 Otis St. SAN FRANCISCO: 638 Mission St.

COLOR YOUR OWN LAMPS WITH **"Signaloid"** Liquid Coloring
**SIGNALOID CHEMICAL WORKS**
KLIEGL BROS., Props. 129 W. 38th St., NEW YORK

**IN YOUR CITY**

There is a fine opening for you to sell Reco and Reynolds Flashers. Every merchant who operates an electric sign can be interested. They make an electric sign 10 times as attractive and save 40% of the current.
We'll pay you a liberal commission and tell you just how to sell them. Write us to-day for particulars. **REYNOLDS ELECTRIC FLASHER MFG. CO.,**
221 Fifth Avenue, CHICAGO.

**Warren Alternator**

It's not the OLD-FASHIONED kind that revolves a bundle of copper wire and a mysterious set of copper rings one or two thousand revolutions a minute—takes brushes and intricate apparatus to collect the current and get it out on the circuit wires.

**We Guarantee What We Sell and Sell What We Guarantee.**

WARREN ELECTRIC MFG. CO.
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**"Diamond H" Switches**

Trade H Mark

This Trade-Mark guarantees quality.
The Hart Mfg. Co., Hartford, Conn.
New York Boston Chicago Toronto, Ont.

**NATIONAL CODE STANDARD**

"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Ideal Wire.
Prices and Samples on Application.

**Phillips Insulated Wire Co.**
Office and Factory: PAWTUCKET, R. I.

Advertising opportunities come and go.

The wise advertiser is the one who recognizes them and seizes them.

An exceptional opportunity to place yourself and your product prominently before the world of electrical buyers will be afforded in the three great Electric Light Convention issues of the WESTERN ELECTRICIAN of June 3d, 10th and 17th.

Will you neglect this opportunity or utilize it?

The issue of June 3d will be distributed among the delegates at Denver. Copies will also be distributed on the convention special train which will leave Chicago June 4th. The issues of June 10th and 17th will contain the complete report of the convention proceedings.

All three issues will have a wide circulation among buyers of electrical machinery and supplies in every state in the union.

If you wish to seize and utilize this opportunity to obtain unlimited publicity reserve space to-day, and send copy for your announcement to-day or to-morrow.

The opportunity is going, going—and will soon be gone.

**WANTED, FOR SALE** *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 3c each.* **POSITION WANTED** *advertisements (50 words or less), $1.00 an insertion; additional words 2c each.*

## POSITION WANTED.

As superintendent or electrician of lighting company or combined light and water plant; have had 17 years' experience in managing and operating lighting plants, 20 years with boilers, engines and water-works; results guaranteed; now employed as superintendent of light and water company. Address BOX 472, care Western Electrician, 510 Marquette Building, Chicago, Ill.

## POSITION WANTED.

A young experienced chemist who has developed a new process of producing the very refractory metals in a carbon, nitrogen and oxygen free form, desires to connect himself with an electrical firm or individual capitalist interested in conducting research work on metallic incandescent lamp filaments. Address BOX 475, in care Western Electrician, 510 Marquette Bldg., Chicago, Ill.

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Light and power solicitor in a city of 40,000 in the Middle West A man of good address, possessing tact, judgment and ambition. An excellent opportunity is afforded with a liberal broad-gauged concern. Write fully concerning experience. Address BOX 473, care Western Electrician, 510 Marquette Bldg., Chicago.

## WANTED.

Experienced draughtsmen in Electrical Apparatus, Switchboards, Motors and Generators; only first-class men need apply; state experience and salary expected. Address BOX 470, care of Western Electrician, 510 Marquette Building, Chicago.

## WANTED.
## SALESMAN;
## STANLEY-C. I. CO.,

1543 Monadnock Block, Chicago.

## FOR SALE

One 30 horse power, 2 phase, type C, Westinghouse Motor, 220 volts, 840 R. P. M., brand new, run less than four months on a light load, 60 cycle, 7,200 alternations. Address BOX 474, care Western Electrician, 510 Marquette Bldg.

## FOR SALE.

ALTERNATING-CURRENT MOTORS.

H. P. SINGLE-PHASE. 125-133 CYCLES.

8 ½ Stanley, 100-110 volts, new.
1 1 Emerson, 110v., self-starting.
1 1 Wagner, 208 volts, aut.
1 1½ Wagner, 104 volts.
3 1½ Wagner, 208 volts, aut.
1 3¼ Century, 104 volts, aut.

H. P. SINGLE-PHASE. 60 CYCLE.

1 1 Emerson, 220 volts, self-start.
2 1 Wagner, 220 volts.
1 2 Wagner, 220 volts, aut.
1 5 Wagner, 220 volts.
1 5 Century, 208 volts, aut.
1 80 Wagner, 104 volts, aut.

H. P. TWO PHASE. 60 CYCLE.

1 10 Westinghouse, type C, 220 volts.

THREE-PHASE. 60 CYCLE.

2 1 Gen. Elec., 110 volts.
1 2 Gen. Elec., 110 volts.
1 2 Gen. Elec., 220 volts.
1 7½ Westinghouse, 220 volts, type C.
1 15 Gen. Elec., 110 volts, form L.
1 30 Gen. Elec., 110 volts, form A.
2 40 Gen. Elec., 220 volts, form L.
1 50 Gen. Elec., 220 volts, form L.

Send for our Monthly Bargain Sheet with complete list and net prices.

**GREGORY ELECTRIC CO.** 54-62 S. Clinton St. CHICAGO, ILL.

**WHY NOT**

Get our easy terms on

ROBERTSON-THOMPSON INDICATOR
WILLIS PLANIMETER
VICTOR REDUCING WHEEL

Jos. L. Robertson & Sons, 198 Fulton St., New York

## Copper, Brass, Iron Machinery

Purchased by

WALSH'S SONS & CO., Newark, N. J.

**Don't Stop! Keep On! Read! Improve!**

ELECTRICIAN PUBLISHING CO.
510 MARQUETTE BLDG.
Publishers and dealers of electrical books

# ELECTRICAL MATERIAL FROM THE WORLD'S FAIR, ST. LOUIS, 1904

**An opportunity to secure rare bargains** in everything used in this line. This material that we are offering has seen but limited service and is practically as good as new for further use.

### LEAD COVERED CABLES.

| Feet. | Size. | Conductor. | Voltage. |
|---|---|---|---|
| 25,500 | 300 M.C. M. | 3 | 6,600 |
| 9,500 | 4—0 | 3 | 6,600 |
| 4,700 | 3—0 | 3 | 6,600 |
| 7,500 | 2—0 | 3 | 6,600 |
| 14,500 | 1—0 | 3 | 6,600 |
| 18,500 | No. 1 | 3 | 6,600 |
| 11,500 | No. 2 | 3 | 6,600 |
| 4,700 | No. 3 | 3 | 6,600 |
| 7,100 | No. 4 | 3 | 6,600 |
| 11,500 | No. 6 | 3 | 6,600 |
| 29,000 | 4—0 | 1 | 2,200 |
| 1,900 | 2—0 | 1 | 2,200 |
| 11,000 | 1—0 | 1 | 2,200 |
| 9,000 | No. 1 | 1 | 2,200 |
| 11,000 | No. 2 | 1 | 2,200 |
| 18,000 | No. 4 | 1 | 2,200 |
| 48,000 | No. 6 | 1 | 2,200 |
| 1,900 | No. 8 | 1 | 2,200 |
| 23,000 | 500 M.C. M. | 1 | 500 |
| 50,000 | 4—0 | 1 | 500 |
| 11,000 | 3—0 | 1 | 500 |
| 11,000 | 2—0 | 1 | 500 |
| 3,700 | No. 1 | 1 | 500 |
| 2,300 | No. 6 | 1 | 500 |
| 180,000 | No. 6 | 1 | 8,000 |
| 14,500 | No. 14 | 6 | Fire Alarm |
| 39,000 | No. 14 | 4 | " " |
| 39,000 | No. 14 | 3 | " " |
| 9,500 | No. 14 | 2 | " " |

### Weatherproof and Rubber Covered Wire.

All sizes from No. 14 to 600,000 C. M.

### INCANDESCENT LAMPS

200,000 Lamps, used a short time, and in good condition for further service. Have been tested. They are 104 voltage, Edison base, 8 candlepower. In lots of 1,000, each 5 cents.

150,000 brand new Incandescent Lamps in original cases of 200, 250 and 400 Lamps, ranging from 100 to 110 voltage, 8 and 16 candlepower, General Electric make. Price each in case lots, 12½ cents.

20,000 Colored Incandescent Lamps, brand new, never used, General Electric make, 104 voltage, Edison base; colors, Amber, Green, Opal and Ruby; put up 200 in a case. Price each, 22 cents; are worth 35 cents each.

20,000 Incandescent Lamps, voltages 100 to 120, Edison. T. H. and Westinghouse base; 8, 10, 16, 20 and 25 candlepower; put up 250 in a case, second selection. Price each in case lots, 10½ cents.

### WOOD CONDUIT.

100,000 Feet, Size 4½ x 4½.

### MISCELLANEOUS

300,000 No. 9171 Porcelain, Edison Base Receptacles.
50,000 Weatherproof "Bryant" Sockets.
1,000,000 split glazed B. & D. Wiring Knobs.
300,000 Glazed Porcelain B. & D. Wiring Knobs, sizes 3½, 4½ and 5½.
20,000 No. 8 Standard Porcelain Knobs.
200,000 Single Wire glazed Porcelain Cleats.
15,000 Porcelain Cut-outs.
26,000 Plugs.
2,000,000 Unglazed Porcelain Tubes.
40,000 Glass Insulators.
20,000 Porcelain Cleats.
All kinds of switches and instruments.

**Ask for our Special Catalogue No. 567.**

**CHICAGO HOUSE WRECKING COMPANY, 35th and Iron Sts., CHICAGO.**

COMPETITIVE TEST OF TABULATING MACHINERY.—Beginning June 10, 1905, the Director of the Census will proceed to have a practical test made of electrical and mechanical devices for tabulating purposes, with a view to contracting for the use of such tabulating apparatus for the work of the Bureau of the Census for the fiscal year beginning July 1, 1905. All parties owning or controlling any such devices are invited to participate in this competition, the rules and regulations governing which may be obtained upon application to S. N. D. North, Director of the Census, Department of Commerce and Labor, Washington, D. C.

### NOTICE OF PROPOSAL.

Proposals for an electric-light franchise to furnish the lights for the streets, commercial houses and residences will be received by the Electric Light Committee of the City Council of the City of Aledo, Ill., a city of 2,500 inhabitants. Said proposals must be sealed and filed with the City Clerk on or before the 1st day of June, 1905, at 10 o'clock A. M.

Specifications will be furnished on application.

The city reserves the right to reject any or all proposals.

W. D. EMERSON,
City Clerk.

WORKS QUICK AND EASY. KEEPS ITS LUSTER. HOLDS OLD TRADE AND MAKES NEW. DOES NOT DETERIORATE. ESTABLISHED 16 YEARS. SOLD BY AGENTS AND DEALERS ALL OVER THE WORLD

**U.S. METAL POLISH** GEO. W. HOFFMAN

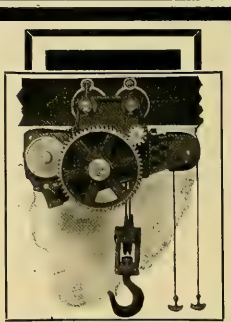
3 OUNCE BOX 15 CENTS
SAMPLES SENT FREE

POLISHES ALL METALS. BRANCHES: NEW YORK, CHICAGO, SAN FRANCISCO. 235 E. WASHINGTON ST. INDIANAPOLIS, IND.
HIGHEST AWARD. CHICAGO WORLD'S FAIR, 1893. LOUISIANA PURCHASE EXPOSITION 1904.

516

## TRUE HOISTING MOTORS

NOT adaptions of ill-fitted frames, but specially designed Box Type Motors for Crane and Hoist Service.



*RUGGED* *DUST-PROOF*
*SIMPLE* *LONG LIVED*

*See Bulletin No. 2532*

WE SHOW A NORTHERN BOX TYPE MOTOR OPERATING A NORTHERN ENGINEERING WORKS TROLLEY HOIST.

**NORTHERN ELECTRICAL MFG. CO.**

ENGINEERS—MANUFACTURERS

MADISON, WIS., U. S. A.

425 MONADNOCK BLOCK, CHICAGO, ILL.

**SAUQUOIT SILK MFG. COMPANY**

**INSULATING and BRAIDING SILKS**

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## "Practical and to the Point"

IS ALL THAT NEED BE SAID OF

## THE TELEPHONE HAND-BOOK

By HERBERT LAWS WEBB.

160 Pages, 133 Illustrations, Cloth, Price $1.00.

The book for those interested in telephony.

**ELECTRICIAN PUBLISHING CO., 510 Marquette Bldg., CHICAGO.**

## EVERY COMFORT

Attends the Traveler between

**Chicago Indianapolis Cincinnati & Louisville**

Who Travels via the

**MONON ROUTE**

Consult Your Local Ticket Agent

## ELECTRICAL AND OTHER INDUSTRIES ARE OFFERED LOCATIONS

WITH

Satisfactory Inducements, Favorable Freight Rates, Good Labor Conditions, Healthful Communities,

ON THE LINES OF

THE ILLINOIS CENTRAL R. R.

AND THE

YAZOO & MISSISSIPPI VALLEY R. R.

For full information and descriptive pamphlet address

J. C. CLAIR,
Industrial Commissioner
1 Park Row, Chicago, Ill.

The more money you spend in advertising the more money you have.
The less money you spend in advertising the less money you have.

## CHICAGO EDISON COMPANY REPAIR SHOPS

76 MARKET STREET, CHICAGO. TELEPHONE MAIN 1280.

Machine and Carpenter Work of All Kinds Correspondence Solicited.

**OPEN DAY AND NIGHT.**

FIRST-CLASS EQUIPMENT THROUGHOUT.

Dynamos Armatures, Motors, Arc Lamps, Fans, Instruments.

"FRES-KO"
SOLDERING PASTE

IT "CREEPS" INTO EVERY CREVICE

TELEPHONE SWITCHBOARD MEN!
FRES-KO Soldering Paste is NOT a "KANKERWORM" that eats out the "vitals" of a hundred or so connections. Absolutely non-corrosive!

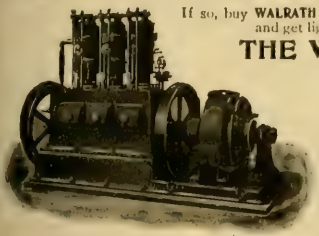
FRES-KO CHEMICAL CO. • Fort Wayne, Ind.

ARE YOU LOOKING FOR MONEY?

If so, buy WALRATH GAS OR GASOLINE ENGINES and get light on the subject.

THE WALRATH

Received the Highest Award at the Pan-American Exposition.



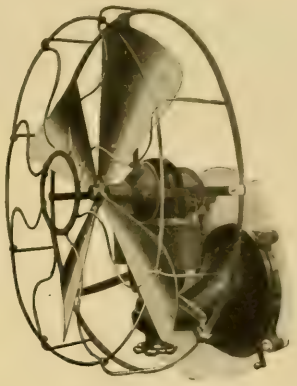
It will produce as good a commercial light as that of an automatic steam engine, either belted or direct-connected generator. Simple, Economical and Reliable

Send for Catalogue W

MARINETTE GAS ENGINE CO.,
CHICAGO HEIGHTS, ILL.

AGENCIES:
Keystone Engineering Co., Farmer's Bank Bldg., Pittsburg, Pa.
Strong, Carlisle & Hammond Co., 61-67 Frankfort St., Cleveland, Ohio
Mackay Engineering Co., 149 Broadway, N. Y.
C. H. Seidenglanz., 52 When Bldg., Indianapolis, Ind.

ALL DAY LONG
DAY AFTER DAY



Our Endurance Record

WESTERN ELECTRIC CO.

NEW YORK Other Large Cities CHICAGO

Bituminized Fibre Conduit

For Underground Construction

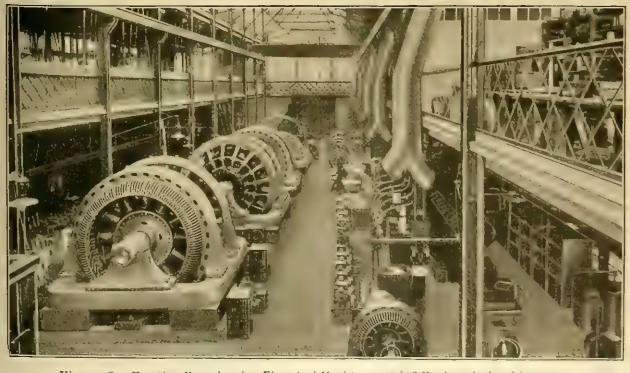
**COMBINES** the **GOOD FEATURES** of other conduits.
**ELIMINATES** the **BAD FEATURES** existing in many kinds.
**HAS VALUABLE FEATURES** not found in any other duct.

The American Conduit Company has a corps of experts in underground construction and is prepared to furnish supervision of work if desired. We would prefer to co-operate with contractors in underground construction, but if desired will submit estimates and bids and take contracts for completed underground systems in any part of the United States or Canada.

AMERICAN CONDUIT COMPANY

Main Offices
1005-6 MANHATTAN BUILDING
CHICAGO.

Other Offices
170 Broadway, New York
336 Macy Street, Los Angeles



View in Our Erecting Bay, showing Electrical Machinery 40,000 Kw.) ready for shipment.

Direct and Alternating Current

Electrical Machinery

Built in all Capacities and Types

NATIONAL ELECTRIC COMPANY
MILWAUKEE

McRoy Conduits.
"ROOKERY"—Chicago—

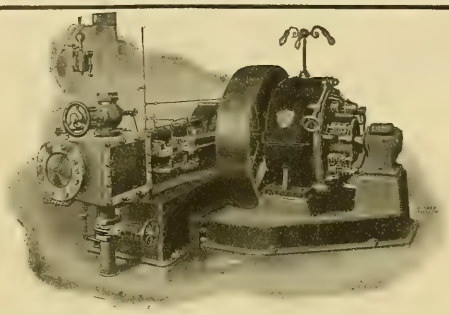
# CLEAN BOILERS

**Dearborn Water Treatment**

made to suit the case takes off the scale, keeps it off, stops corrosion and foaming. Send gallon of water for analysis. :: :: ::

**DEARBORN DRUG & CHEMICAL WORKS,**

227-234 Postal Telegraph Building, CHICAGO, ILL. WM. H. EDGAR, President. Telephone: Harrison 3930 and 3931.



The Brownell Direct-Connected Outfit.

**THE BROWNELL CO., Dayton, O.**

Manufacturers of Boilers, Engines, Heaters and Sheet Iron Work.

# DIESEL ENGINES

Operating on CRUDE or FUEL Oil

**Guaranteed Fuel Consumption**

on variable load, ranging from ¼ to full load

**12½ Gals. per 100 Kw. Hours**

SUITABLE FOR ALL STATIONARY POWER

For further information address

**AMERICAN DIESEL ENGINE COMPANY**

11 Broadway NEW YORK

# GREEN'S ECONOMIZER

Steam Fuel

Saves 10 to 20% in Fuel

We Build and Install Mechanical Draft Plants
FANS BLOWERS EXHAUSTERS PRESSURE BLOWERS, ETC
SEND FOR CATALOGUE

Increases Boiler Capacity 20 to 40%

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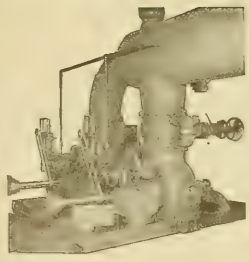

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# OFFICIAL TRAIN

**TO THE**

National Electric Light Association Meeting at

# DENVER AND COLORADO SPRINGS

**JUNE 6, 7, 8 AND 9, 10, 11, 1905.**

For the exclusive use of delegates, supply men, their friends and ladies, via

# BURLINGTON ROUTE

**(C., B. & Q. RY.)**

Operating in conjunction with the Pennsylvania R. R.

A special train will leave New York as a second section of the Pennsylvania Limited, Saturday morning, June 3d. This train will be in every respect a duplicate of the Pennsylvania Limited, viz., the same beautifully equipped parlor smoker, dining car, sleepers and an observation car. This Pennsylvania Railroad section will run through solid to Denver. At Chicago, however, the Burlington section or strictly western train, will be coupled on to the Pennsylvania or eastern section of the train, and both trains thus united will be hauled as a solid train from Chicago direct to Denver over the Burlington Route.

***The Proposed Schedule Follows:***

| | | | | | |
|---|---|---|---|---|---|
| Lv. | New York, N. Y. | 10:25 A. M., | (Eastern Time) | Saturday, June | 3 |
| " | Philadelphia, Pa. | 12:40 Noon, | " " | " " | 3 |
| " | Harrisburg, Pa. | 3:05 P. M., | " " | " " | 3 |
| " | Washington, D. C. | 10:50 A. M., | " " | " " | 3 |
| " | Baltimore, Md. | 12:00 Noon, | " " | " " | 3 |
| " | Pittsburg, Pa. | 8:15 P. M., | (Central Time) | " " | 3 |
| Ar. | Chicago, Ill. | 8:25 A. M., | - - | Sunday, " | 4 |
| Lv. | " " | 11:15 A. M., | - - | " " | 4 |
| Ar. | McCook, Neb. | 8:10 A. M., | - - | Monday, " | 5 |
| Lv. | " " | 7:10 A. M., | (Mountain Time) | " " | 5 |
| Ar. | Denver, Colo. | 2:30 P. M., | " " | " " | 5 |

It will be noted that the special train arrives in Denver Monday afternoon, June 5th, in ample time for dinner and evening's amusement in addition to giving opportunity to arrange for hotel accomodations.

Those desiring to join the convention party and go West from Chicago to Denver over the Burlington should, without delay, early make reservations DIRECT, addressing F. E. BELL, City Passenger Agent, BURLINGTON ROUTE, 211 S. CLARK ST., CHICAGO, who is handling all inquiries appertaining to reservations for Asst. Master of Transportation Frank L. Perry of the National Electric Light Association.

Reservations for the return trip over the Burlington may be made at Denver or at Colorado Springs.

A rate of $30.00 for the round trip has been authorized for this meeting and the tickets will be good not only to Denver but to Colorado Springs and Pueblo.

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1215

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The graceful Appearance comes from Simple Lines.

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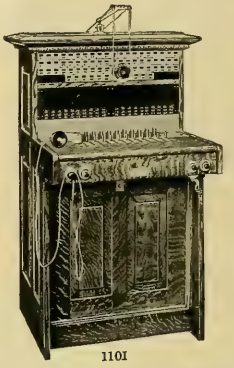

1101

Key shelf is so low, operator can use an ordinary chair

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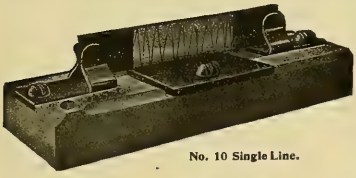
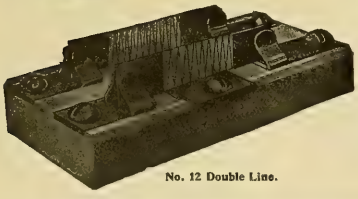


No. 10 Single Line.



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Tickets on sale to points in Montana, Idaho, Washington, Oregon and British Columbia, first and third Tuesdays in May and June,

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| Auburn, N. Y. | Princeton, N. J. |
| Lewiston, Me. | Albuquerque, N. M. |
| Auburn, Me. | Van Wert, O. |
| Fall River, Mass. | Battle Creek, Mich. |
| New Bedford, Mass. | Clayton, Mo. |
| Los Angeles, Cal. | Pentwater, Mich. |
| San Diego, Cal. | Toronto Junction, Can. |
| Hopkinsville, Ky. | Wilmington, Del. |
| Sioux City, Ia. | Riverside, Cal. |
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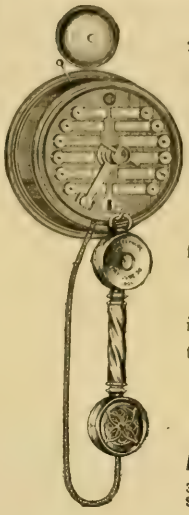

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Full directions with each telephone.

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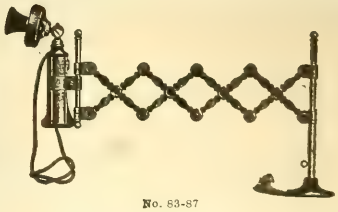

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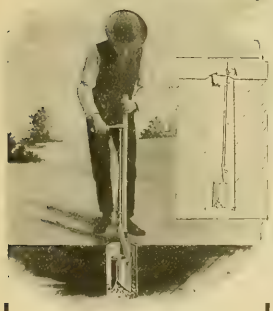

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# Notice to the Public.

**THE ATTENTION OF THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY HAS BEEN CALLED TO THE FACT THAT CERTAIN OF ITS COMPETITORS ARE OFFERING TO SUPPLY POLYPHASE INDUCTION AND SYNCHRONOUS MOTORS, AND APPARATUS FOR USE THEREWITH, AFTER MAY 1, 1905, BECAUSE *CERTAIN OF THE TESLA MOTOR PATENTS* EXPIRE ON THAT DATE.**

**Intending purchasers of Polyphase Apparatus are hereby notified that the Westinghouse Electric and Manufacturing Company owns numerous other patents relative to these subjects, and the public is warned against infringement thereof. The Westinghouse Company will take energetic steps against makers and users of infringing devices, after May 1, 1905, as it has in the past. Its rights under its own patents, or those which it controls or under which it is licensed, must be respected.**

Attention is called to the following patents, among others, relating to alternating-current motors and systems:—

No. 416,194, to Tesla, granted December 3, 1889, induction motors.

No. 459,772, to Tesla, granted September 22, 1891, for use of induction motor as starting device for synchronous motor.

No. 487,796, to Tesla, granted December 13, 1892, for relation between number of poles on generator and on motor.

No. 445,207, to Tesla, granted January 27, 1891, for split-phase motor, sustained against Scott and Janney Electric and Manufacturing Company—opinion filed, Circuit Court, September 27, 1899.

No. 508,188, to Stanley, granted November 7, 1893, for compensated field for alternating-current motor.

No. 511,559, to Tesla, granted December 26, 1893, for split-phase method of operating motors. This patent has been sustained against the Dayton Fan and Motor Company—opinion filed, Circuit Court, February 6, 1901, and opinion filed, Circuit Court of Appeals, November 5, 1902; against Hiram C. Roberts and the Sangamo Electric Company—opinion filed, Circuit Court, September 10, 1903; against the Mutual Life Insurance Company, et al—opinion filed, Circuit Court, February 9, 1904, against the Electric Appliance Company—opinion filed, Circuit Court, March 26, 1904; against the Jefferson Electric Light Heat, and Power Company—opinion filed, Circuit Court, March 28, 1904; and against the Stanley Instrument Company—opinion filed, Circuit Court of Appeals, September 9, 1904.

No. 511,560, to Tesla, granted December 26, 1893, for split-phase means for operating motors. Sustained conjointly with 511,559 in each case.

No. 511,915, to Tesla, granted January 2, 1894, for split-phase method of operating motors. Sustained against Scott and Janney Electric and Manufacturing Company—opinion filed, Circuit Court, September 27, 1899.

No. 529,272, to Hutin & Leblanc, granted November 13, 1894, for damping device for alternating-current motors. This patent is now in suit against the Bullock Electric Manufacturing Company.

No. 553,469, to Hutin & Leblanc, granted January 21, 1896, for variable speed induction motor.

No. 469,809, to Stanley, granted March 1, 1892, for self-regulating transformer. Sustained against the Saranac Lake Electric Light Company—opinion filed, Circuit Court, April 26, 1901, opinion filed, Circuit Court of Appeals, January 14, 1902; and against the Montgomery Electric Light and Power Company—opinion filed, Circuit Court, June 18, 1904.

No. 582,132, to Lamme, granted May 4, 1897, induction motor.

No. 599,940, to Lamme, granted March 1, 1898, induction motors.

No. 609,990, to Lamme, granted August 30, 1898, starting arrangement for induction motors.

No. 609,991, to Lamme, granted August 30, 1898, starting arrangement for induction motors.

No. 610,067, to Lamme, granted August 30, 1898, induction motors.

No. 633,856, to Lamme & Mallett, granted September 26, 1899, induction motors.

No. 644,865, to Lamme, granted March 6, 1900, starting arrangement for induction motors.

No. 582,481, to Nolan, granted May 11, 1897, armature core construction. This patent is now in suit against the Bullock Electric Manufacturing Company.

No. 519,862, to Lamme, granted May 15, 1894, for starting arrangement for synchronous motors. This patent is now in suit against the Indianapolis, Shelbyville and Southeastern Traction Company.

No. 763,547, to Dusinberre, granted June 28, 1904, iuduction motors.

No. 763,379, to Dusinberre, granted June 28, 1904, induction motors.

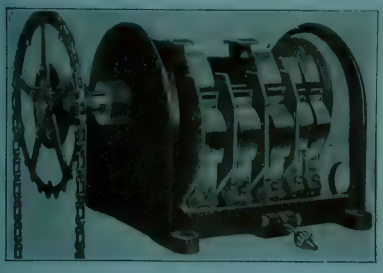
No. 759,183, to Lamme, granted May 3, 1904, alternating-current motor.

Re-issue 12,223, to Hutin and Leblanc, granted May 24, 1904, for alternating-current transformation.

A New Elevator

# Reversing Switch

For Use Only With Cutler-Hammer Self-Starters



Here's a switch that will withstand the wear and tear of elevator work, due to the constant making and breaking of the circuit.

Nothing to wear on it except the contacts, and as they are made of hard drawn copper, liberally proportioned, they will give long service. When they do wear they can be easily renewed (attached with screws) without disturbing any of the connections.

The iron drum is carefully insulated from the current carrying parts, is not affected by moisture, and consequently will not warp.

This switch can be installed in any convenient place—horizontally, vertically or on its side—no matter what the position may be, will work equally well.

It is designed to be used only in connection with C-H. self-starters and with them make ideal elevator control outfits.

Large sizes are equipped with powerful magnetic blow-outs for disrupting the arc which occurs upon opening the circuit.

We also build these switches especially for three-phase alternating-current motors, where the motor is thrown directly across the line in starting.

For dimensions and prices send for Bulletin 72B.

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All Type K Wattmeters
are Popular
because

1st—They look right
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The Multiphase Type K registers all the energy in any multiphase circuit all the time. It is easier to install and easier to read than two single-phase meters used for the same purpose.

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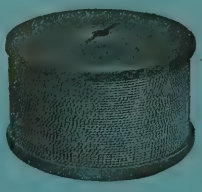

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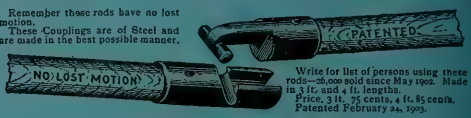
Remember these rods have no lost motion. These Couplings are of Steel and are made in the best possible manner.




Write for list of persons using these rods—26,000 sold since May 1902. Made in 3 ft. and 4 ft. lengths. Price, 3 ft., 75 cents, 4 ft. 85 cents. Patented February 24, 1903.

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ONE VALUABLE FEATURE No tools are needed for changing from desk to bracket, or for changing the direction of the air current.

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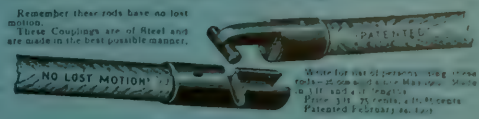


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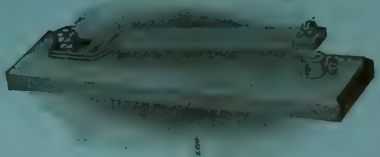

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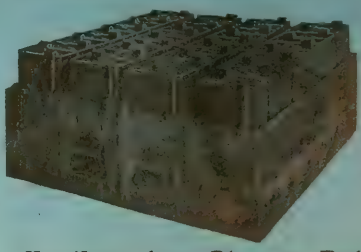

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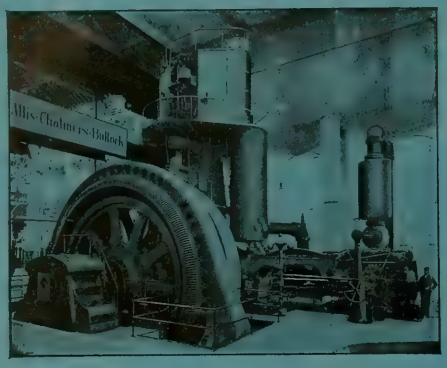


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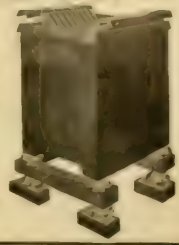

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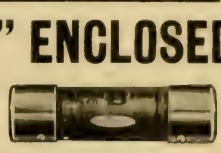

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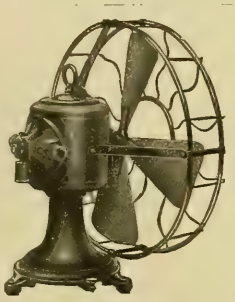

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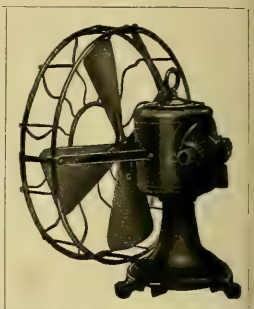

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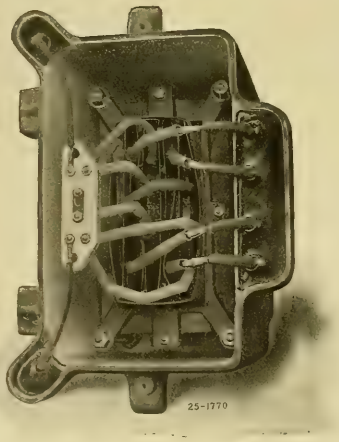


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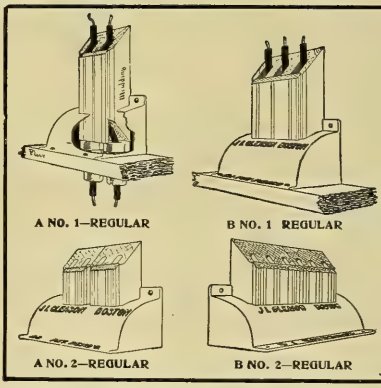

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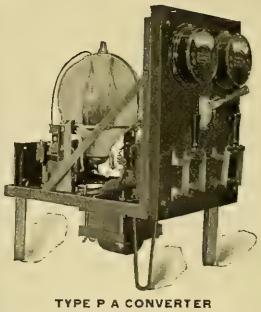

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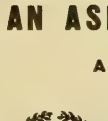


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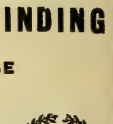



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Standard Underground C. Co
Wesco Supply Co.
Western Electric Company.

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# The Mica Insulator Company's Basic Patent for Manufacturing Micanite Sustained

THE Mica Insulator Company, through Messrs. Kenyon & Kenyon, its solicitors, brought suit in equity in the United States Circuit Court for the District of New Jersey against the Union Mica Company, a New Jersey corporation, and John M. Lay. After submission of full proofs and arguments on both sides, the Honorable George Gray, of Delaware, U. S. Circuit Judge, has just filed an opinion holding that

The Union Mica Company and John M. Lay have infringed upon the rights of the Mica Insulator Company under the Dyer United States Patent No. 483,646, and that this patent introduced a new and valuable raw material to the art.

Copies of the complete opinion of Judge Gray will be mailed to anyone interested upon application to the Mica Insulator Company.

The following are quoted from Judge Gray's opinion:

"The expert testimony on both sides show that a substantially new material has, by the process of the patent in suit been supplied to the electrical art." * * * "The trade name 'Micanite,' given to this material by the patentee, has established for itself a recognized place in the electrical art."

---

Speaking of the Dyer process, Judge Gray refers to it as:

"The process that has so completely solved the difficulties in the way of economically and efficiently utilizing Mica."

---

"The process is thus characterized by a product unique and admittedly of the greatest utility."

---

"I have no difficulty in finding that the process of the Dyer patent in suit is unanticipated, and that it involves patentable invention."

---

"I am satisfied * * * that * * * the defendant company has been guilty of the infringement of claims 1 and 2 of the Dyer patent, as charged in the bill."

---

The Mica Insulator Company advises dealers and users of Mica insulating material to avoid purchasing mica products made in substantially the way Micanite is made. The patent has been sustained after long and expensive litigation and the Mica Insulator Co. proposes to enforce its rights under the Dyer patent against all infringers, and against all who aid and abet unauthorized manufacturers to infringe by purchasing the product of the infringement. The Dyer patent covers broadly the only process by which a material having the valuable characteristics of Micanite or a Mica product capable of being molded can be made.

# MICA INSULATOR COMPANY

**CHICAGO, 358 Dearborn St.** **218 Water St., NEW YORK**

*Our engineering department devotes its whole time to solving problems of electric motor control. Tell us what you wish to accomplish and we'll plan the way.*

# Self Starters for Large Motors

No other form of starter for the automatic control of large motors will operate so effectively as the Cutler-Hammer Multiple Solenoid.

Every contact is made with a snap and without arcing.

Steps of resistance are cut out by solenoid switches, each switch being energized in turn by a master solenoid, the latter's action being governed by a dash pot. This arrangement gives a smooth and easy start to the motor.

The opening of the main circuit is accomplished by a solenoid circuit maker and breaker, equipped with powerful blowouts for disrupting the arc.

The largest size motors can be automatically started and stopped by this system with a switch carrying not over one ampere of current, and controlled by a float switch, or small pressure regulator, or by any kind of small switch operated by hand or automatic devices.

It can be used with either reversing or non-reversing motors for operating pumps, electric elevators, cranes, hoists etc.

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Manufacturers of Electrical Apparatus

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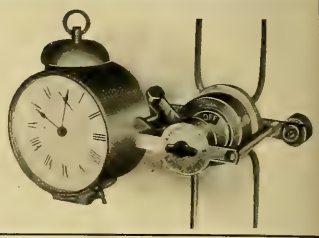

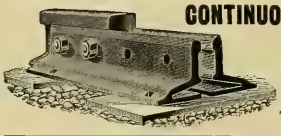

**CONTINUOUS RAIL JOINT CO. OF AM.**

NEWARK, N. J.

**OVER 20,000 MILES IN USE**

The St. Louis Exposition, 1904, awarded us the only gold medal for rail joint products.

## The Starting Torque of the Accelerator

The Accelerator does automatically what is attempted manually in starting a load with a friction clutch.

There is bound to be jerking with the friction clutch as the operator does not know what tension to apply until his machine gives him warning. There is also bound to be considerable wear of faces, which in consequence will require repeated adjusting.

The Accelerator gets its starting torque from a magnetic drag, due to eddy currents set up in the armature member.

This drag exerts its strongest power when there is the greatest difference in speed between the two faces (at the start when one member is idle). As the driven member attains speed, this turning effort falls off, and when the two faces are revolving nearly at the same speed it disappears entirely and mechanical friction brings the driven member up to the speed of the driving member.

The start is smooth and the acceleration gradual. The wear of faces is guarded against by a film of oil on the surfaces of the plates, which also helps to dissipate any heat.

If you are obtaining indifferent results from the use of friction clutches, let us know under what conditions they are being used and and we'll demonstrate how much better the Accelerator will serve your purpose.

Anyway send for our catalog, which describes how the Accelerator is built and how it operates.

## Cuttler-Hammer Clutch Co.

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Experts. Consulting Engineers.
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Consulting and Contracting Telephone Engineer.
Plans and Specifications for complete plants. Old plants overhauled and placed on paying basis. Territory, Kansas, Oklahoma and Indian Territory.
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SCHOTT, W. H.,
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CONSULTING ENGINEER
Designs, Specifications and Erection of Complete Electric Generating and Steam and Water Heating Plants and Distributing Systems.
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Central Station Heating,
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1057 Monadnock Blk., Chicago.

A LITTLE CARD
in this Directory may bring a big customer.

IF ONLY ONE
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BAKER, W. E. & CO.
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ELECTRIC RAILWAYS.
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how many customers you fail to get by not having your name in this Directory.

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Contracting Electrical Engineers,
Lighting Power Railways,
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Consulting Telephone Engineer
Plans, Specifications and Supervision of Installation of Complete Telephone Plants
Special Reports on Telephone Properties and Apparatus
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Chief of French Electrical Department Louisiana Purchase Exposition
offers best opportunity for European agencies for sale of patents and licenses on patents and for representations at foreign expositions, namely: Liege, 1905 and Milan, 1906. Catalogues and general outline of projects requested.
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ELECTROMAGNET DESIGNS FOR POWER PURPOSES
Specialty — Designing Electromagnets and Solenoids for a given duty.
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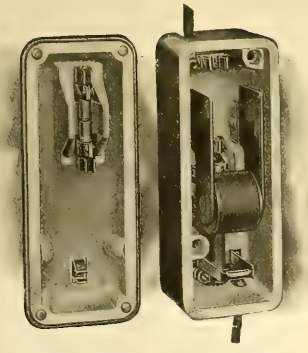
American Electric and Controller Co.
Automatic Protective Switches and Motor Starters
136 Liberty St., NEW YORK
WATCH FOR OUR AD. NEXT WEEK IN THIS PAPER

SOCKETS :: BRASS SHELL
NO SCREWS IN SHELL
SMALL QUANTITY 15½c. Order now.
G. F. SAUTER CO., ELECTRICAL CONTRACTORS
Segel Bldg., Cor. State and Lafayette Sts.,
SCHENECTADY, N. Y.

General Electric Company

Lightning Arresters For Direct Current Circuits



Type M Form D2 Lightning Arrester for Indoor Use

No moving parts—always ready. Direct path-minimum gap. Magnetic blow-out—no danger of line current following discharge.

Porcelain box-strong, inconspicuous, safe.

Type M Form D2 Lightning Arrester for Outdoor Use

PRINCIPAL OFFICES: SCHENECTADY, N. Y.

SALES OFFICES IN LARGEST CITIES IN UNITED STATES

570

# JUST SUPPLIES

In our new building, 134 to 140 West Jackson Boulevard, Chicago, we have the largest and best equipped Electrical Supply Warehouse in the world.
We have no side issues; our whole time and thought is given to see how quickly and satisfactorily we can fill orders for Electrical Supplies.
Try us and our methods.

ELECTRIC APPLIANCE COMPANY
134-136-138-140 West Jackson Boulevard. :: :: CHICAGO

## Edison Miniature Lamps

Over 500,000 Annually Shipped to Users

*All types, every variety.*
*Prompt shipment in any quantity.*

Candelabra Lamps
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Telephone Lamps
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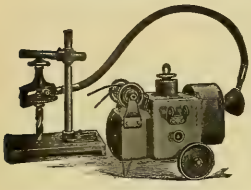
EDISON DECORATIVE AND MINIATURE LAMP DEPARTMENT

General Electric Company, Harrison, N.J.

(510)



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COMBINATION OF
## Stow Flexible Shaft
AND
## MULTI-SPEED MOTOR

Practically dust and water proof. For Portable Drilling, Tapping, Reaming, Emery Grinding, etc. Write for Catalogue and Prices.

STOW MFG. CO., Binghamton, N. Y.

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*Reduces the working capacity of a motor or dynamo, wears out the commutator, wastes power and may cause a fire. All this may be avoided if you use . . . . . .*

50 Cents per Stick. $5.00 per Dozen.
*SEND FOR FREE SAMPLE STICK*
For sale by all supply houses, or

The only article that will PREVENT SPARKING. Will keep the Commutator in good condition and PREVENT CUTTING.

Absolutely Will Not Gum The Brushes.

It will put that high gloss on the Commutator you have so long sought after.

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# The "REFLECTRIC"

consumes less current and can be read at a greater distance than any other electric sign to-day on the market. Write for booklet.

WESTERN DISPLAY COMPANY, SOLE MANUFACTURERS
ST. PAUL, - - MINN.

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POCKET SIZE

For testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.
RELIABLE. - ACCURATE.
Send for Circular.

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## BEARDSLEE CHANDELIER MFG. CO.
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GAS & ELECTRIC FIXTURES FOR THE TRADE.
CATALOG SENT PREPAID TO DEALERS MENTION THIS PAPER

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## BIJUR "HIGH DUTY" STORAGE BATTERIES
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## Water-Wheel Governors

Our new mechanical governors co-operate with the inertia effect on the water and the momentum of the plant.
They have cut the cost of good government in two. Guaranteed in every particular.

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## INSULATING and BRAIDING SILKS

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MANUFACTURERS OF
SINGLE-PHASE SELF-STARTING
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Of all Qualities, in any Form at Lowest Prices
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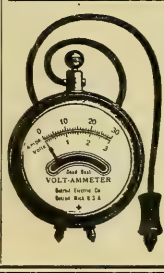


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Dead Beat
Accurate, Durable
Guaranteed

List Price, $6.00 including leather case.

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3 Volts.
30 Amperes.

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CABLES FOR AERIAL AND UNDERGROUND USE.

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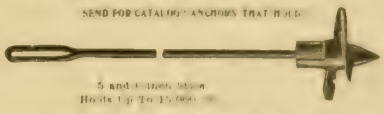
A STOMBAUGH GUY ANCHOR WILL HOLD 12,000 TO 30,000 LBS

SEND FOR CATALOG "ANCHORS THAT HOLD"



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WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Ideal Wire.
Prices and Samples on Application.

# Phillips Insulated Wire Co.

Office and Factory: PAWTUCKET, R. I.

# SIMPLE DYNAMOS

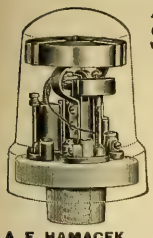
For industrial and isolated plant service. Compact, readily and easily cared for, and

**Economical In Operation**

SEE GENERATOR BULLETIN No. 2546

We show a Northern Dynamo direct connected to a Charter Kerosene Engine.

NORTHERN ELECTRICAL MANUFACTURING CO.
ENGINEERS -- MANUFACTURERS
MADISON, WIS., U. S. A.
425 Monadnock Block, CHICAGO, ILL.



AUTOMATIC SERIES ARC CUT-OUT
For Power, St. Ry., A. C. and D. C. Series Circuits.
A. F. HAMACEK, CHICAGO, ILL.
2014 KENMORE AVE.

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KUHLMAN ELECTRIC CO., - - ELKHART, IND.

# WE BUY OLD BELTS

OR SCRAPS, ANY SIZE OR CONDITION.
WE CLEAN, REPAIR AND RENEW OLD BELTS.
LEATHER PRESERVER MFG. CORP.
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M. KLEIN & SON
Send 2c stamp for new catalogue No. 6 of
KLEIN'S TOOLS
For Electrical Workers and Line Builders.
MATHIAS KLEIN & SONS,
81 W. Van Buren St., Chicago, Ill.

# DON'T BUY ELECTRICAL SUPPLIES

Until you have seen our new Catalogue and new Price List.
Free to the trade.

Manhattan Electrical Supply Co.
NEW YORK: 32 Cortlandt St.
CHICAGO: 188 Fifth Ave.

# PRICE $10 LIST

From 0 to 60 Amperes.
Also made up to 400 Amperes.
FOR A. C. and D. C. WORK.
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BELDEN MANUFACTURING COMPANY
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***Sheet Brass,*** *All Tempers*
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***Brass Butts,*** *Desk Narrow, Broad Middle, Ball Tipped and Water Closet*

***Brass and Iron Jack Chain, Brass Safety Chain, Etc.***
*Catalogues on Application*

***THE PLUME & ATWOOD MFG. CO.***
*New York* *Chicago*

HAVE YOU or HAVE YOU NOT sent us copy for your announcement in our National Electric Light Convention issues of June 3d, 10th and 17th?

If not, why not?

You are a business man; and you are seeking business.

We mean business when we say that you should send us copy and authorize us to insert your announcement in these three important special issues if you wish to attract the attention of electrical buyers in every state in the country.

If you send copy today we can insert your ad in a good location.

In a few days it will be too late.

DO IT NOW.

**WANTED, FOR SALE** *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 3c each.* **POSITION WANTED** *advertisements (50 words or less), $1.00 an insertion; additional words 2c each.*

## POSITION WANTED.

Practical electrician of twelve years experience in D. C. and A. C. wishes position as electrician, in some central station or factory. Any branch of electrical work and electrical cranes. Cannot consider under $75 per month. Address BOX 476, care of Western Electrician, 510 Marquette Bldg., Chicago.

## POSITION WANTED.

As telephone lineman. Have had charge of a 100 drop switchboard with seventy-five private phones and twenty party lines. Installed for two years. Address BOX 477, care of Western Electrician, 510 Marquette Bldg., Chicago.

## POSITION WANTED.

Single young man with good habits and six years' practical experience with meters, arc lamps, motors and wiring desires a position in central station; would consider position as meter inspector; can furnish good reference. Address BOX 481, care of Western Electrician, 510 Marquette Bldg., Chicago.

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DRAFTSMAN AND ENGINEER. Electrical graduate preferred. For power plant work. Must have some experience in design of piping, machinery, layouts, etc., and be capable of working independently. Permanent position and future for the right man. Address BOX 478, care of Western Electrician, 510 Marquette Bldg., Chicago.

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Good, reliable young man to take charge of a small water power electric light plant. Must be good all around man. State age and experience. Address BOX 479, care of Western Electrician, 510 Marquette Bldg., Chicago.

## WANTED.

Light and power solicitor in a city of 40,000 in the Middle West. A man of good address, possessing tact, judgment and ambition. An excellent opportunity is afforded with a liberal broad-gauged concern. Write fully concerning experience. Address BOX 473, care Western Electrician, 510 Marquette Bldg., Chicago.

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Three traveling men, one thoroughly posted in the electric supply line, one thoroughly posted in electric railway supply line, one thoroughly posted on arc lamps. All must have actual road experience. Those posted in territory west of Pittsburg preferred. Address BOX 480, care of Western Electrician, 510 Marquette Bldg., Chicago.

## FOR SALE.

100 second-hand 110 V., D. C. 12-inch and 16-inch fans in good condition. Columbus Public Service Co., Columbus, O.

## FOR SALE.

**ALTERNATING-CURRENT MOTORS.**

H. P. SINGLE-PHASE. 125-133 CYCLES.

8 ½ Stanley, 100-110 volts, new.
1 1 Emerson, 110v., self-starting.
1 1 Wagner, 208 volts, aut.
1 1½ Wagner, 104 volts.
3 1½ Wagner, 208 volts, aut.
1 3½ Century, 104 volts, aut.

H. P. SINGLE-PHASE. 60 CYCLE.

1 ¼ Emerson, 220 volts, self-start.
2 1 Wagner, 220 volts.
1 2 Wagner, 220 volts, aut.
1 5 Wagner, 220 volts.
1 5 Century, 208 volts, aut.
1 30 Wagner, 104 volts, aut.

H. P. TWO PHASE. 60 CYCLE.

1 10 Westinghouse, type C, 220 volts.

THREE-PHASE. 60 CYCLE.

2 1 Gen. Elec., 110 volts.
1 2 Gen. Elec., 110 volts.
1 2 Gen. Elec., 220 volts.
1 7½ Westinghouse, 220 volts, type C.
1 15 Gen. Elec., 110 volts, form L.
1 30 Gen. Elec., 110 volts, form A.
2 40 Gen. Elec., 220 volts, form L.
1 50 Gen. Elec., 220 volts, form L.

Send for our Monthly Bargain Sheet with complete list and net prices.

**GREGORY ELECTRIC CO.** 54-62 S. Clinton St. CHICAGO, ILL.

## Copper, Brass, Iron Machinery

Purchased by

**WALSH'S SONS & CO.,** Newark, N. J.

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**ELECTRICIAN PUBLISHING CO.**
510 MARQUETTE BLDG.
Publishers and dealers of electrical books

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**An opportunity to secure rare bargains** in everything used in this line. This material that we are offering has seen but limited service and is practically as good as new for further use.

### LEAD COVERED CABLES.

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| 26,000 | 300 M.C. M. | 3 | 6,600 |
| 9,500 | 4—0 | 3 | 6,600 |
| 4,700 | 3—0 | 3 | 6,600 |
| 7,500 | 2—0 | 3 | 6,600 |
| 14,500 | 1—0 | 3 | 6,600 |
| 18,500 | No. 1 | 3 | 6,600 |
| 11,500 | No. 2 | 3 | 6,600 |
| 4,700 | No. 3 | 3 | 6,600 |
| 7,100 | No. 4 | 3 | 6,600 |
| 11,500 | No. 6 | 3 | 6,600 |
| 25,000 | 4—0 | 1 | 2,200 |
| 1,900 | 2—0 | 1 | 2,200 |
| 11,000 | 1—0 | 1 | 2,200 |
| 9,000 | No. 1 | 1 | 2,200 |
| 11,000 | No. 2 | 1 | 2,200 |
| 18,400 | No. 4 | 1 | 2,200 |
| 48,000 | No. 6 | 1 | 2,200 |
| 1,900 | No. 8 | 1 | 2,200 |
| 29,000 | 500 M.C. M. | 1 | 500 |
| 50,000 | 4—0 | 1 | 500 |
| 11,000 | 3—0 | 1 | 500 |
| 1,000 | 2—0 | 1 | 500 |
| 3,700 | No. 1 | 1 | 500 |
| 2,900 | No. 6 | 1 | 500 |
| 180,000 | No. 6 | 1 | 3,000 |
| 14,500 | No. 14 | 6 | Fire Alarm |
| 39,000 | No. 14 | 4 | " " |
| 39,000 | No. 14 | 3 | " " |
| 9,500 | No. 14 | 2 | " " |

### Weatherproof and Rubber Covered Wire.

All sizes from No. 14 to 600,000 C. M.

### INCANDESCENT LAMPS

200,000 Lamps, used a short time, and in good condition for further service. Have been tested. They are 104 voltage, Edison base, 8 candlepower. In lots of 1,000, each 5 cents.

150,000 grand new Incandescent Lamps in original cases of 200, 250 and 400 Lamps, ranging from 100 to 110 voltage, 8 and 16 candlepower, General Electric make. Price each in case lots, 12½ cents.

20,000 Colored Incandescent Lamps, brand new, never used, General Electric make, 104 voltage, Edison base; colors, Amber, Green, Opal and Ruby; put up 200 in a case. Price each, 22 cents; are worth 35 cents each.

20,000 Incandescent Lamps, voltages 100 to 120, Edison. T. H. and Westinghouse base; 8, 10, 16, 20 and 25 candlepower; put up 250 in a case, second selection. Price each in case lots, 10½ cents.

### WOOD CONDUIT.

100,000 Feet, Size 4½ x 4½.

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300,000 No. 9171 Porcelain, Edison Base Receptacles.
50,000 Weatherproof "Bryant" Sockets.
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300,000 Glazed Porcelain B. & D. Wiring Knobs, sizes 3½, 4½ and 5½.
20,000 No. 8 Standard Porcelain Knobs.
200,000 Single Wire glazed Porcelain Cleats.
15,000 Porcelain Cut-outs.
26,000 Plugs.
2,000,000 Unglazed Porcelain Tubes.
40,000 Glass Insulators.
20,000 Porcelain Cleats.
All kinds of switches and instruments.

**Ask for our Special Catalogue No. 567.**

**CHICAGO HOUSE WRECKING COMPANY, 35th and Iron Sts., CHICAGO.**

# STORAGE BATTERIES!

**(THE "X-CELL")**

**Complete Battery Plants for Any Purpose**
**Telephone Power Plants a Specialty**

**TOLEDO STORAGE BATTERY & ELECTRIC CO., 111 Ottawa St., Toledo, O.**

### NOTICE OF PROPOSAL.

Proposals for an electric-light franchise to furnish the lights for the streets, commercial houses and residences will be received by the Electric Light Committee of the City Council of the City of Aledo, Ill., a city of 2,500 inhabitants. Said proposals must be sealed and filed with the City Clerk on or before the 1st day of June, 1905, at 10 o'clock A. M.

Specifications will be furnished on application.

The city reserves the right to reject any or all proposals.

W. D. EMERSON,
City Clerk.

COMPETITIVE TEST OF TABULATING MACHINERY.—Beginning June 10, 1905, the Director of the Census will proceed to have a practical test made of electrical and mechanical devices for tabulating purposes, with a view to contracting for the use of such tabulating apparatus for the work of the Bureau of the Census for the fiscal year beginning July 1, 1905. All parties owning or controlling any such devices are invited to participate in this competition, the rules and regulations governing which may be obtained upon application to S. N. D. North, Director of the Census, Department of Commerce and Labor, Washington, D. C.

WORKS QUICK AND EASY. KEEPS ITS LUSTER. HOLDS OLD TRADE AND MAKES NEW. DOES NOT DETERIORATE. ESTABLISHED 16 YEARS. SOLD BY AGENTS AND DEALERS ALL OVER THE WORLD

**U.S. METAL POLISH** 2 OUNCE BOX 10 CENTS SAMPLES SENT FREE GEO. W. HOFFMAN

POLISHES ALL METALS. BRANCHES: NEW YORK, CHICAGO, SAN FRANCISCO. 295 E. WASHINGTON ST. INDIANAPOLIS, IND.
HIGHEST AWARD. CHICAGO WORLD'S FAIR, 1893. LOUISIANA PURCHASE EXPOSITION 1904.

# 4 BEAUTY SPOTS

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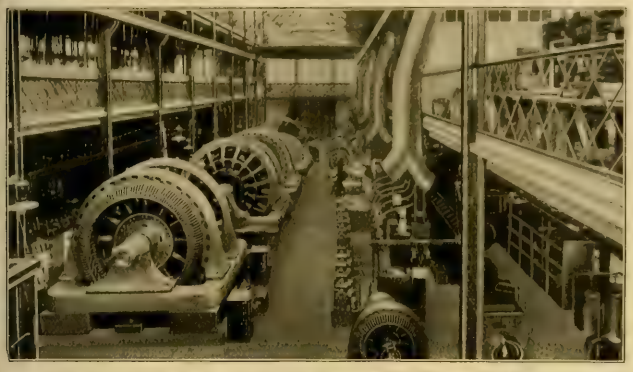

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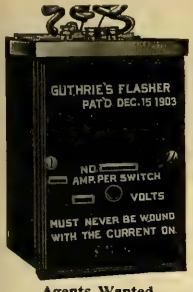


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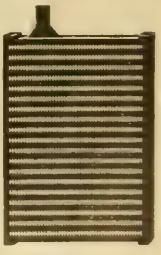

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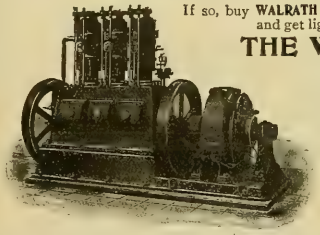

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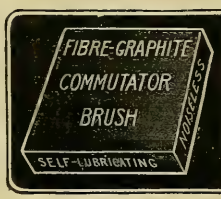


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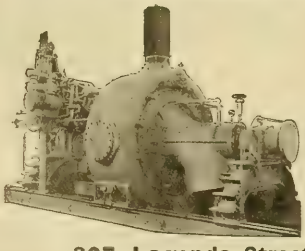

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The illustration shows the large NIAGARA design, HORIZONTAL SHAFT TURBINES recently installed by us, for the NIAGARA FALLS HYDRAULIC POWER & MANUFACTURING CO., Niagara Falls, N. Y. Tests conducted by competent engineers, developed as follows:

| Head | Gateage | Speed | H. P. | Generator Efficiency | Turbine Efficiency |
|---|---|---|---|---|---|
| 213 ft. | ½ | 257 r. p. m. | 1750 | 95 per cent | 73.00 per cent |
| 213 ft. | ¾ | 257 r. p. m. | 3000 | 95 per cent | 85.60 per cent |
| 213 ft. | Full | 257 r. p. m. | 3500 | 95 per cent | 81.50 per cent |

These results have never been equaled by any turbine of the Horizontal Shaft Design, operating under equally HIGH HEADS. The test was made AFTER TURBINES WERE INSTALLED, direct coupled to generators. Francis' weirs and formulæ for discharge were used. The original test reports on file at our offices. These turbines are all fitted with our SAMSON BALANCED GATES. Note especially the UNIFORM SPEED at ALL GATEAGES.

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# OFFICIAL TRAIN

**TO THE**

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# DENVER AND COLORADO SPRINGS

**JUNE 6, 7, 8 AND 9, 10, 11, 1905.**

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Operating in conjunction with the Pennsylvania R. R.

A special train will leave New York as a second section of the Pennsylvania Limited, Saturday morning, June 3d. This train will be in every respect a duplicate of the Pennsylvania Limited, viz., the same beautifully equipped parlor smoker, dining car, sleepers and an observation car. This Pennsylvania Railroad section will run through solid to Denver. At Chicago, however, the Burlington section or strictly western train, will be coupled on to the Pennsylvania or eastern section of the train, and both trains thus united will be hauled as a solid train from Chicago direct to Denver over the Burlington Route.

***The Proposed Schedule Follows:***

| | | | | | |
|---|---|---|---|---|---|
| Lv. New York, N. Y. | 10:25 A. M., | (Eastern Time) | Saturday, | June | 3 |
| " Philadelphia, Pa. | 12:40 Noon, | " " | " | " | 3 |
| " Harrisburg, Pa. | 3:05 P. M., | " " | " | " | 3 |
| " Washington, D. C. | 10:50 A. M., | " " | " | " | 3 |
| " Baltimore, Md. | 12:00 Noon, | " " | " | " | 3 |
| " Pittsburg, Pa. | 8:15 P. M., | (Central Time) | " | " | 3 |
| Ar. Chicago, Ill. | 8:25 A. M., | - - | Sunday, | " | 4 |
| Lv. " " | 11:15 A. M., | - - | " | " | 4 |
| Ar. McCook, Neb. | 8:10 A. M., | - - | Monday, | " | 5 |
| Lv. " " | 7:10 A. M., | (Mountain Time) | " | " | 5 |
| Ar. Denver, Colo. | 2:30 P. M., | " " | " | " | 5 |

It will be noted that the special train arrives in Denver Monday afternoon, June 5th, in ample time for dinner and evening's amusement in addition to giving opportunity to arrange for hotel accommodations.

Those desiring to join the convention party and go West from Chicago to Denver over the Burlington should, without delay, early make reservations DIRECT, addressing F. E. BELL, City Passenger Agent, BURLINGTON ROUTE, 211 S. CLARK ST., CHICAGO, who is handling all inquiries appertaining to reservations for Asst. Master of Transportation Frank L. Perry of the National Electric Light Association.

Reservations for the return trip over the Burlington may be made at Denver or at Colorado Springs.

A rate of $30.00 for the round trip has been authorized for this meeting and the tickets will be good not only to Denver but to Colorado Springs and Pueblo.

For any additional information address as above

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1215

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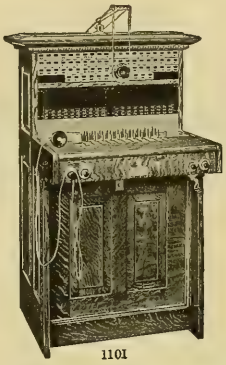

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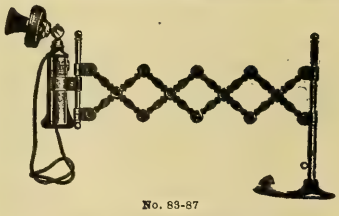

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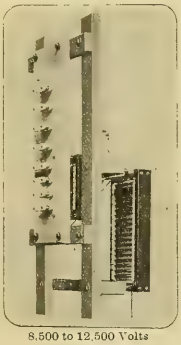
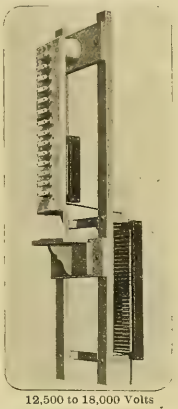
## Low Equivalent Lightning Arresters

For Alternating-Current Circuits
from 2,500 Volts and Upwards

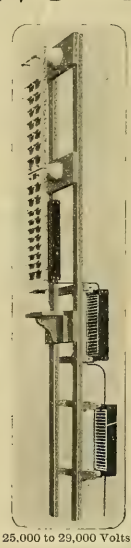


8,500 to 12,500 Volts

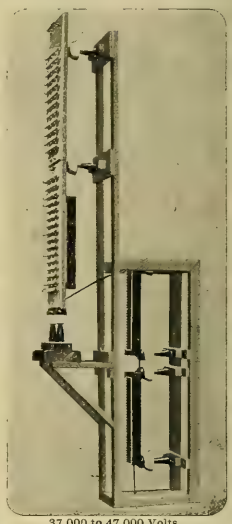


12,500 to 18,000 Volts

The illustrations show some high voltage Low Equivalent Lightning Arresters, and some typical methods of mounting. These differ with various plants and voltages, yet are all simple and easily constructed. The framework does not form part of the equipment, but will be provided if desired.



25,000 to 29,000 Volts



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WOOD LIGHTING & POWER SYSTEM
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BY ALL UNBIASED METER EXPERTS TO BE THE MOST RELIABLE DIRECT CURRENT WATTMETER IN THE WORLD

DUNCAN ELECTRIC MFG. CO.
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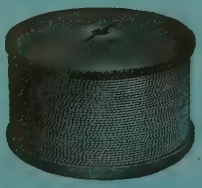

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NATIONAL ELECTRIC LIGHT CONVENTION NUMBER

# Western Electrician

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Technology Quarterly
Mass. Inst. of Tech.
Boston, Mass.

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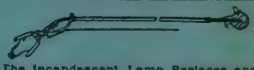
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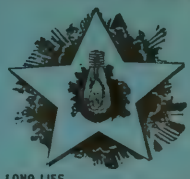
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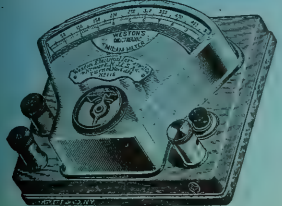
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Voltmeters, Millivoltmeters, Voltammeters, Ammeters, Milammeters, Ground Detectors and Circuit Testers, Ohmmeters, Portable Galvanometers.
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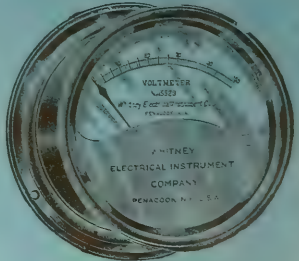
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Are winners. Scales are equally divided. Indications are dead beat; high range ammeters have separate shunts and the cases are of heavy polished brass.
Prices are right. The list figure for the meter illustrated for instance, being $16.50.
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ST. LOUIS, 1904


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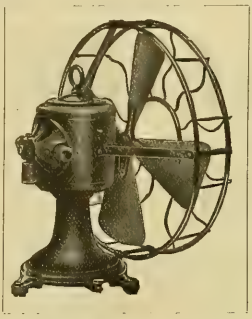

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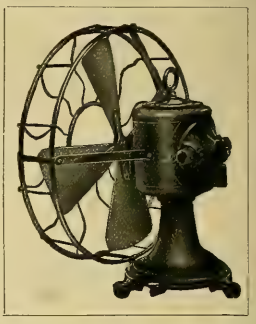
CHICAGO EDISON COMPANY,

139 ADAMS ST., CHICAGO.



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YOUR TROUBLES ARE OVER WITH BAD JOINTS *IF* YOU USE

## *"NOCOROSO"* SOLDERING STICK

"THE *STICK* THAT MAKES THE SOLDER *STICK*"

PASTE AND SALTS ALSO

"K & W" COMPOSITE DYNAMO BRUSHES, COMMUTATOR LUBRICATING COMPOUND

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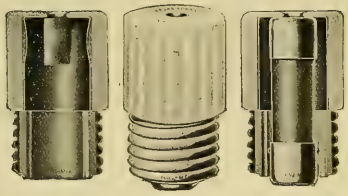
(AGENTS WANTED) (SUCCESSORS TO K. & W. CO.) PITTSFIELD, MASS.

## "NATIONAL STANDARD"

**FUSE PLUG**

250 VOLTS 3-60 AMPS.



The make up of the "National Standard" fuse plug consists of a cylindrical brass shell on one end of which the Edison Standard screw thread is formed. The other end of the shell is provided with inwardly projecting clip contacts, and on the outside of this upper end of the plug a corrugated porcelain cap is fitted and firmly secured. The screw thread end of the plug shell forms one contact. Inside of the screw thread portion is a porcelain button having annular hole. The plug is now made complete by simply inserting through the hole in the porcelain button a "National Standard" fuse of the desired capacity which is pushed directly into the clips on the inside of the upper portion of the shell. The other end of the fuse projects slightly from the porcelain button and forms the other terminal of the plug. When blown the fuse may be ejected from the plug shell by simply pushing through the small hole through the top of the porcelain cap.

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(INCORPORATED)

MANUFACTURERS OF

**INSULATED CORDS**

637 University Building SYRACUSE, N. Y.

FACTORY, 419 TRACY STREET

**ELECTRICIANS PLEASE READ**

**the following test:**

SYRACUSE UNIVERSITY

Syracuse, N. Y., March 6th, 1905.

The Reed Electrical Cordage Co.
Syracuse, N. Y.

Gentlemen:—I have tested the insulation of the samples of lamp cord which you furnished me and find that both of them exceed the Underwriters' requirements of 50 megohms per mile. Both samples gave an insulation resistance of over 70 megohms per mile, 70 megohms being the limit which the sensibility of my instruments would allow me to specify. The tests were made after the cord had soaked for twenty-four hours in a saturated solution of salt.

Yours very truly,
(Signed) W. P. GRAHAM.
Department of Electrical Engineering.

**To increase our working capital we are offering a few shares of treasury stock at $25.00 per share for a limited time only. Please address secretary for further particulars.**

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**For Alphabetical Index of Advertisements See Page 8.**

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**CHICAGO**

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**CENTRAL STATION**
**HEATING—GAS—WATER WORKS—ELECTRIC LIGHT PLANTS**

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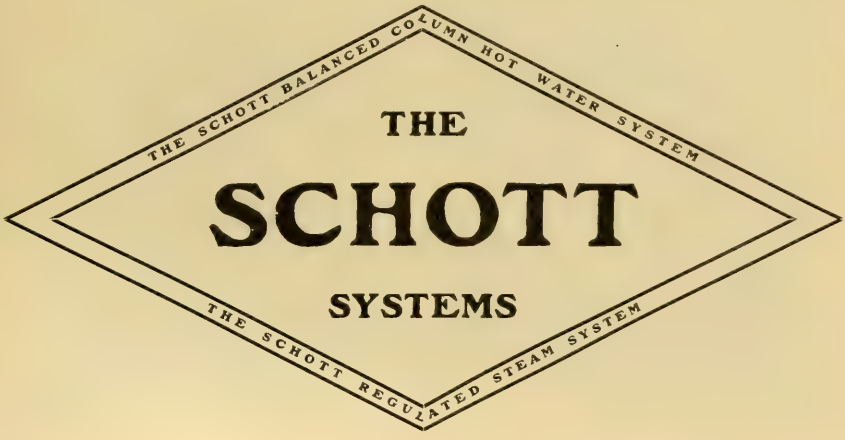


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## THE SCHOTT BALANCED COLUMN SYSTEM

NO BACK PRESSURE
NO NOISE
GREATEST CAPACITY
PERFECT REGULATION

## THE SCHOTT REGULATED STEAM SYSTEM

AUTOMATIC VACUUM CIRCULATION
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GREATEST PIPE LINE CAPACITY
PERFECT REGULATION

**CORRESPONDENCE SOLICITED**

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## NEW BUILDING

## 134-136-138-140 West Jackson Boulevard

## Chicago

America's Largest Electrical Supply Warehouse

# General Electric Company

## Arc Lamps with Diffuser Ceiling

**Give an agreeable white light equal to strong daylight in which colors show their true values.**

**The diffuser ceiling utilizes the lamp in the scheme of decoration.**

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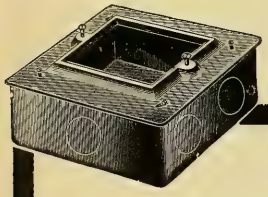
(547)

# They Won't Break



## Figure Up the Saving

That would result if you could eliminate the cost of time spent in reaming and filing and the value of the boxes broken in producing a round hole in cast iron junction boxes. You can save this money by using

## Bossert Drawn Steel Junction Boxes

They have holes with hermetically sealed plugs that can be removed with a single blow of a hammer. The result is a clean round hole without any filing or reaming. And the boxes won't break. Use them and you will be in a better position to meet competition. We also make a superior grade of

**DRAWN STEEL BUSHINGS**
**SWITCH BOARDS**
**KNIFE SWITCHES**
**PANEL BOARDS**
**PANEL BOARD BOXES**

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Manufacturer of

The "Chloride Accumulator"

123 Installations in Central Station Service

SALES OFFICES:

Philadelphia, New York Boston, Chicago, St. Louis, Cleveland, San Francisco, Toronto, Canada.

# Greetings

# from

## Chicago Edison Company

Edison Building

## Chicago

IT'S ON TOP AND IS GOING TO REMAIN THERE.

IT'S THE STANDARD OF AMERICA.

IT'S THE ONE THAT EVERYBODY SPEAKS WELL OF.

IT'S THE ONLY ONE HAVING FIRE-PROOF BINDING POSTS.

IT'S THE ONLY RELIABLE ONE MADE.

ITS GREAT SUPERIORITY HAS BEEN PROVEN.

IT'S THE DUNCAN.

2½ TO 10,000 AMPERES

MADE FOR ALL PRESSURES

IN USE BY 963 CENTRAL STATIONS.

HAS GREATER TORQUE THAN ANY OTHER METER IN USE.

THE ONLY ONE THAT REGISTERS ON A "HYLO" LAMP.

DON'T FORGET IT IN YOUR NEXT ORDER.

AGAIN WE SAY: IT'S THE DUNCAN.

—— o ——

# DUNCAN ELECTRIC MFG. CO.

LAFAYETTE, IND., U. S. A.

# "Unit National Accumulator"

# Battery Company

## Electric Storage Batteries

**POSITIVE PLATE** + **NEGATIVE PLATE**

***Rigidity***
Has an antimoniated lead frame.

***No Buckling***
As ample room for expansion is made between each unit and conducting frame.

***Large Contact Surface***
Resulting in high capacity at high discharge rates.

***Retention of Capacity***
Because ample reserve lead is provided.

***High Capacity and Low Back Pressure***
Being of Faure type.

***Retention of Capacity***
The shape of grid holds active material in place.

***Great Conductivity***
Through peculiar rib and pin construction; also resulting in high potential at high discharge rates.

**EQUALS:**

A UNIT COMBINING THE FEATURES OF

**HIGH POTENTIAL**
**WATT EFFICIENCY**
**LONG LIFE**

***Descriptive Catalogue and Prices furnished upon application***

General Offices, Laboratory and Works
BUFFALO, N. Y.

**Buffalo, N.Y.**

Sales Offices
NEW YORK
CHICAGO
BOSTON
PROVIDENCE

# JANDUS

## INTERCHANGEABLE
# ARC LAMP

GOLD MEDAL
Highest Award
WORLD'S FAIR
St. Louis

SAVES HALF CARBON BILLS

SAVES HALF TRIMMING EXPENSE

GOLD MEDAL
Highest Award
WORLD'S FAIR
St. Louis

**200 HOURS**
Guaranteed
ON CONSTANT POTENTIAL
D. C. CIRCUITS

**150 HOURS**
Guaranteed
ON CONSTANT POTENTIAL
A. C. CIRCUITS

150 HOURS GUARANTEED ON 6.6-AMP. A. C. AND D. C. SERIES CIRCUITS

## The Ideal Lamp for Central Stations and Isolated Plants

A perfect burning lamp in every respect. Every part accessible for quick replacement or repair. The case, glassware and general structure are alike for all circuits. The same lamp is available for use on direct or alternating-current circuits, series or multiple, by very simple substitutions of mechanism without disturbing any part of the main structure.

# THE JANDUS ELECTRIC COMPANY

MANUFACTURERS OF ENCLOSED ARC LAMPS, ELECTRIC FANS, ELECTRIC MOTORS, ETC.

## CLEVELAND

114 Liberty Street, New York; Monadnock Bldg., Chicago; Real Estate Trust Bldg., Philadelphia; Ewing-Merkle Electric Co., St. Louis; Robbins Electric Co., Pittsburg; Electrical Engineering Co., Minneapolis; Albert Smith, Milwaukee; Henry L. Walker Co., Detroit; The D. A. Tompkins Co., Charlotte; The F. Bissell Co., Toledo; Fobes Supply Co., Seattle; J. H. Cramphorn, Boston; McCarthy Bros. & Ford, Buffalo; B. & C. Electric Co., Utica; Bishop Wilbur Co., San Francisco. CANADIAN AGENTS—The Packard Electric Co., St. Catharines, Ont. ORIENTAL AGENTS—The China & Japan Trading Co., Yokohama and New York.

# DIAMOND H SWITCHES

AND

# RECEPTACLES

**GIVE COMPLETE SATISFACTION**

Made from the best material only and assembled with perfect accuracy.

Sheet mica insulation throughout.

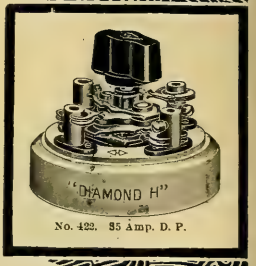
Spring Phosphor-Bronze contacts.

Hardened steel mechanism.

An examination will convince you that they are the best switches made.

We also make a complete line of wall appliances which are unequaled for

No. 322. 20 Amp. D. P.




No. 423. 35 Amp. D. P.

## STRENGTH and DURABILITY

**AND ARE NATIONAL ELECT. CODE STANDARD**

No. 220 5 Amp. S. P.

No 221. 10 Amp. S.P.

Write our nearest office for catalogue of Switches, Receptacles and Wall Appliances.

**MANUFACTURED BY**

# THE HART MFG. CO.

HARTFORD

CONN.

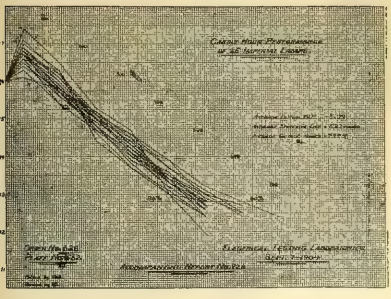
# STRAWBERRIES AND INCANDESCENT LAMPS!

Patent 537,693, April 16, '95
Patent 726,203, April 28, '03

LOOK FOR THE LICENSE LABEL IN THE STEM

Patent 444,580, Jan. 13, '91
Patent 532,760, Jan. 22, '95

**Rather peculiar isn't it to mention incandescent lamps and strawberries in the same breath? But it is all perfectly consistent because strawberries are bought by the box and incandescent lamps are bought by the box. You know how disappointed you are—or your wife or your sweetheart is—when she upsets the berries out of the box into the bowl and finds the only real good ripe ones were all on top of the box—common sense would tell you that this is the case with some lamp manufacturers, not that they put a good layer of lamps on top of the box—not at all—but they do mix 'em in and that you know very well. They take chances on your picking out of the box a good lamp for your photometric test.**



**We challenge you to test any box of Bryan-Marsh Imperial Lamps and you will find them marvelous in uniformity of life and lighting power.**

**TO ILLUSTRATE THIS SCIENTIFICALLY BY FACTS:** A very prominent lamp buyer instituted a competitive test of incandescent lamps at the Electrical Testing Laboratories in New York; five hundred Imperial Lamps were submitted.

Without going into details, the Imperial Lamps not only won the order, but the tests made at the laboratory disclosed **A MARVELOUS UNIFORMITY IN THEIR LIFE AND LIGHTING POWER.** The accompanying diagram is a reproduction of the test sheet as made out by the laboratory. Reference to the cut will show the remarkably uniform candle-hour performance.

It is needless to point out that this feature is an exceedingly valuable one for lamp buyers either large or small. **IT MEANS RELIABILITY.**

Have you ever used Imperial Lamps? **NOW IS THE TIME.**

# THE BRYAN-MARSH COMPANY

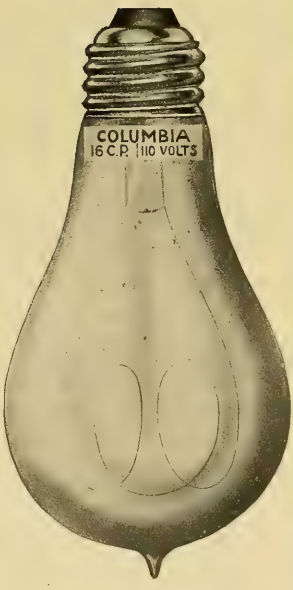
**227-29 Fulton St., New York**
**315 Dearborn St., Chicago**

**DENVER** McPhee Building
**CINCINNATI** Perin Building
**MINNEAPOLIS** Lumber Exchange
**SAN FRANCISCO** Crossley Building

## "MOST LIGHT FOR 1 CENT"

# COLUMBIA

# LAMPS




***Are you entirely satisfied with the lamp in use on your circuits at the present time?***

***The Columbia Lamps are sold under definite guarantees covering uniformity, candle power maintenance and other essential features.***

***Make comparative tests during the Summer months in order to determine the best lamp for your requirements during the Fall and Winter months.***

***Investigate spherical values of the Columbia as compared with other lamps.***

***We solicit a trial order.***

***We carry a complete stock of Crystal Lamps (Meridian type).***

***Send for prices, etc., on Holophane glassware, also Inner Globes and Turn Down Lamps.***

## The Columbia Incandescent Lamp Co.

***2115-17-19 Locust St., ST. LOUIS, MO.***

NEW YORK OFFICE: 1311 Havemeyer Bldg.
PHILADELPHIA: 1227 Real Estate Trust Bldg.
CHICAGO: Central Electric Co.
MINNEAPOLIS: 638 Boston Block
MEXICO: Monterey, Van Voorhis Hnos.
SAN FRANCISCO: Paul Seiler Electrical Works
MEMPHIS: 302 Scimitar Bldg.

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After years of experiment, and the expenditure of a large amount of money we offer to the engineering profession, for Underground, Electric Light and Power Cables, a

## HIGH INSULATION

combining all of the desirable qualities of RUBBER, as well as being absolutely

## Acid, Alkali and Waterproof

This dielectric has none of the defects of paper insulation and is not affected by electrolysis and dampness, yet can be sold in

## COMPETITION WITH PAPER

"SAFTRON" is made by the pioneer manufacturers of underground cable in America, and is

**FULLY GUARANTEED**

WRITE FOR QUOTATIONS

**THE SAFETY INSULATED WIRE & CABLE CO.**

**114-116 LIBERTY ST., NEW YORK.**

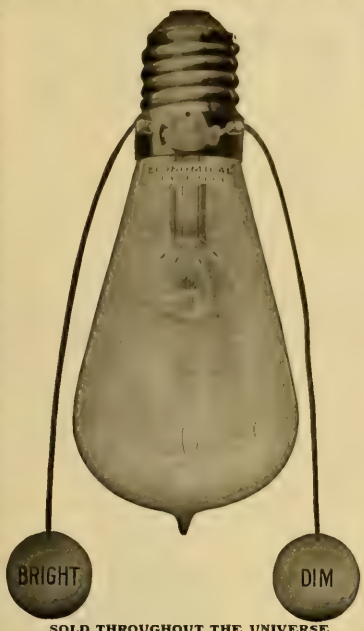
OKONITE TRADE MARK

# THE MASTER OF THE CURRENT

THE STANDARD FOR
RUBBER INSULATION

*The* OKONITE COMPANY *Ltd*
*Manufacturers of Insulated Wires and Cables*
253 BROADWAY NEW YORK CITY.

*Manufrs Adv. Bureau N.Y.*




SOLD THROUGHOUT THE UNIVERSE

# Turn Up the "TURN DOWN LAMP"

## IF YOU WANT A BRIGHT LIGHT

*TURN IT DOWN if you want a light that is soft and dim. For bright or dim pull the string. See the small filament.*

***Its Use Saves 80% of Current***

*Burn the "Dim" in parlor, hall, bedroom, bathroom and in the sickroom when a bright light is unnecessary.*

## The TURN DOWN LAMP IS ECONOMICAL

*It received the highest and only award at the St. Louis Exposition, 1904.*

*Our booklet illustrates a few places where the TURN DOWN LAMP can be applied.*

*We furnish it to Central Stations with their imprint, to be mailed with their monthly bills.*

*Write for booklet and price list.*

THE ECONOMICAL ELECTRIC LAMP CO., 227-229 Fulton Street, NEW YORK

# WM. ROCHE

**52 and 54 Park Place, NEW YORK**

## DRY BATTERIES FOR ALL OPEN CIRCUIT WORK

Our "New Standard" Dry Cells will bear competition with any others of like size on the market for Telephone and Bell Service. **DURABILITY, EFFICIENCY** and **RECUPERATING QUALITIES** are the points of recommendation.

Our "Auto Gas" Batteries and "Fireball" Spark Coils, with the Roche Improved "Mica Por" Plug, constitute the Perfect Ignition Outfit and the kind you want for your car or boat. Send for Catalogue and learn something to your advantage.

Flashlights, Cigar Lighters, Gas Lighters and other Electric Novelties.

**Electric Heating Apparatus**
SEND FOR 62-PAGE CATALOGUE.
**UNIT" ENAMELED RHEOSTATS**
**SIMPLEX ELECTRIC HEATING CO.,**
Cambridgeport, Mass.

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NORTHERN WIRE & CABLE CO.
OFFICES: Milwaukee, 740-742 Wells Bldg. Chicago, 1202 Marquette Bldg.
MAGNET WIRES
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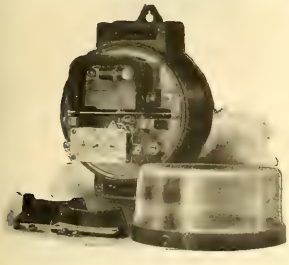
**Michigan College of Mines**
F. W. McNAIR, President
A State Institution located in and making use of an active mining district. Summer term begins June 12. For year book and record of graduates, apply to
PRESIDENT OR SECRETARY, Houghton, Mich.



# STANLEY WATTMETERS

**FOR ALTERNATING CURRENT, SINGLE PHASE AND POLYPHASE SERVICE**

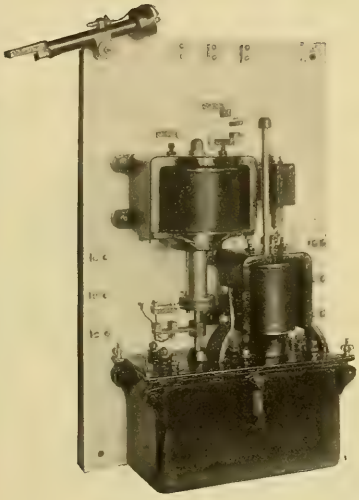
# ROTATED JEWEL BEARING

JEWEL SURFACE ALWAYS NEW—PERMANENT ACCURACY AT ALL LOADS. MADE ALSO IN ROUND, SWITCHBOARD TYPE 6⅞ IN. DIAMETER, BACK CONNECTED.

**STANLEY INSTRUMENT COMPANY,** GREAT BARRINGTON, MASS.

# CENTRAL STATION

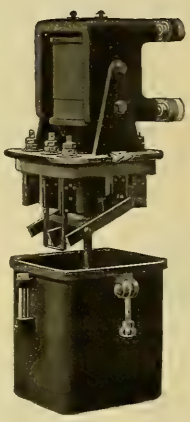
## CONTROLLING DEVICES



**BULLETIN No. 3**

Describes Solenoid Switches for the control of transformers and lighting circuits. Throwing reserve feeders in service in cases of break downs.

Also stopping and starting of small motors.



**BULLETIN No. 4**

Describes automatic starters for the control of rotary sets and large induction motors in connection with all classes of service including tool and machine drives, pumping and ventilating systems, etc.

**BULLETIN No. 7**

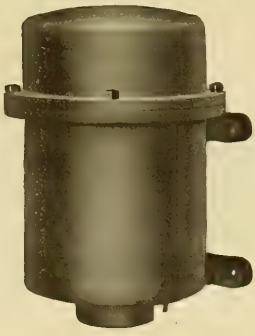
Describes Solenoids for the operation of electric brakes on hoists, cranes, etc. For the operation of valves, lifting magnets and magnetic gripping devices.

Any given pull, long or short stroke, iron clad and open type for any service.

**BULLETIN No. 9**

Describes Drum Type Controller for the operation of machine tools, mill machinery, printing presses, cranes, hoists, elevators and conveyors, transfer tables and draw bridges.

Plain starting and speed regulating.



All apparatus is of the simplest possible design, accessible for repairs, ample in capacity, capable of standing abuse. EQUIPPED WITH NO-VOLTAGE AND OVERLOAD SAFETY DEVICES.

**WE ARE MODERNIZING ENGINEERS**

Send us a full statement of any problem. We shall be glad to help you solve it.

# American Electric and Controller Co.

136 LIBERTY STREET, NEW YORK

# "THE STANDARD" FANS

TEN MODELS

THE BEST PAYING LOAD for any power station is its ELECTRIC FAN load—running all day and in many cases all night. Never varying, and in most cases running on the lighting meters. It really constitutes the ideal station business. Every well-posted manager knows this. What some of them have not yet learned, however, is that the most profitable and satisfied customers can be had by permanently adopting "The Standard" line for direct current circuits, with its ten models to select from, to suit every class and need of the trade.

## THE ROBBINS & MYERS CO.

**Main Office and Works: SPRINGFIELD, OHIO**

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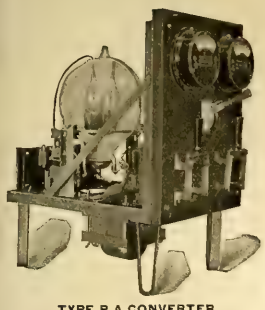
PITTSBURG: 126 Seventh Street. ST. PAUL: 133 and 135 E. 5th Street. DALLAS, TEXAS: Opera House Building.
ST. LOUIS: 12 N. Eight Street. LOS ANGELES: 278 S. Main Street. SAN FRANCISCO: 16-18 Second Street.



TYPE P A CONVERTER

COOPER-HEWITT MERCURY VAPOR LAMPS

## COOPER-HEWITT Vapor Converter

For charging storage batteries from alternating currents

Write for Bulletins and Prices

COOPER-HEWITT ELECTRIC CO.
220 West 29th St., NEW YORK

THE BEST **BRAZING TORCH**

FOR ELECTRICIANS

**HOTTEST ON EARTH**

The Turner 4B Gasoline Brazing Torch is used by all mechanics for light work in brazing, annealing, tempering and drawing temper of small tools, etc. This torch produces an intensely hot, pointed flame of over 3,000° Fahr. Burns 4 hours from one filling.

**PRICE $4.50 NET**

**THE TURNER BRASS WORKS**
**23 N. Franklin St., Chicago**

# CONVENTIONISTS

DON'T MISS THIS

***Electricity Bottled in Small Doses Under Our "Columbia Brands" will be Distributed by Our Sales-Manager, Mr. N. C. Cotabish***

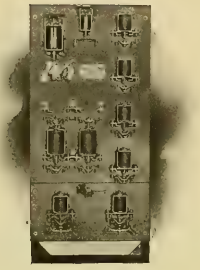
**BE SURE TO HUNT HIM UP**

DON'T MISS THIS

**NATIONAL CARBON COMPANY, - CLEVELAND, O.**

*Our engineering department devotes its whole time to solving problems of electric motor control. Tell us what you wish to accomplish and we'll plan the way.*

# Self Starters for Large Motors



No other form of starter for the automatic control of large motors will operate so effectively as the Cutler-Hammer Multiple Solenoid.

Every contact is made with a snap and without arcing.

Steps of resistance are cut out by solenoid switches, each switch being energized in turn by a master solenoid, the latter's action being governed by a dash pot. This arrangement gives a smooth and easy start to the motor.

The opening of the main circuit is accomplished by a solenoid circuit maker and breaker, equipped with powerful blowouts for disrupting the arc.

The largest size motors can be automatically started and stopped by this system with a switch carrying not over one ampere of current, and controlled by a float switch, or small pressure regulator, or by any kind of small switch operated by hand or automatic devices.

It can be used with either reversing or non-reversing motors for operating pumps, electric elevators, cranes, hoists etc.

Send for bulletin 70 D for full description.

## The Cutler-Hammer Mfg. Co.

MILWAUKEE, WISCONSIN

NEW YORK 136 Liberty St. BOSTON 176 Federal St. CHICAGO Monadnock Bldg. PITTSBURG Farmers Bank Bldg.

## STORAGE BATTERIES!

(THE "X-CELL")

Complete Battery Plants for Any Purpose
Telephone Power Plants a Specialty

TOLEDO STORAGE BATTERY & ELECTRIC CO., 111 Ottawa St., Toledo, O.

## Cope's Patent Quick Coupling Conduit Rod

Remember these rods have no lost motion.
These Couplings are of Steel and are made in the best possible manner.

Write for list of persons using these rods—26,000 sold since May 1902. Made in 3 ft. and 4 ft. lengths.
Price, 3 ft. 75 cents, 4 ft. 85 cents.
Patented February 24, 1903.

T. J. COPE

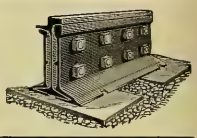
3244 North Fifteenth Street PHILADELPHIA, PA.

## CONTINUOUS RAIL JOINT CO. OF AM.

NEWARK, N. J.

OVER 20,000 MILES IN USE

Highest Award at Paris Exposition, 1900, Buffalo, 1901, and St. Louis, 1904.



# ITS FIRST COST

## A Secondary Consideration

The first cost of an Accelerator is a secondary consideration. Of course it costs more than a friction clutch, a number of times more, but it's worth 100 times more because it lasts a 100 times longer, and is 100 times less trouble.

In a certain factory in Wisconsin is a 100-H.P. friction clutch. Once a week the wooden blocks have to be renewed. In a month or two the cost of these renewals amount to as much as the first cost of an Accelerator,—and then the trouble and delay.

An Accelerator in place of that friction clutch would last years and years. It would not have to be adjusted; it would entail no expense except the cost of oil and new carbons, a cost so small that it is hardly worth considering; and it would start the machinery every time without any jerking, simply by pushing a button.

If you have a similar case, don't figure on the first cost. Take your pad and pencil and figure out the cost of repairs, the cost, bother and annoyance of delays, and estimate the saving to your machinery by proper and gradual starting.

We're anxious for an opportunity to prove to you that the Accelerator is the ideal clutch; that it is the only one on the market that has the proper principle of starting; that its construction is such that it gives no trouble, causes no delays, works equally well whether started by push buttons or automatic devices, and that when the current is turned off instantly releases.

Our catalogue will give you an idea of its construction and operation.

## Cutler-Hammer Clutch Co.

MILWAUKEE, WIS.

NEW YORK 136 Liberty St. BOSTON 176 Federal St. CHICAGO Monadnock Bldg. PITTSBURG Farmers Bank Bldg.

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BARE AND INSULATED ELECTRIC WIRE,

ELECTRIC LIGHT LINE WIRE,
INCANDESCENT AND FLEXIBLE CORDS,
**Railway Feeder and Trolley Wire,**
AMERICANITE, MAGNET, OFFICE AND ANNUNCIATOR WIRES.
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**EXPERT IN** ELECTRICITY MECHANICS PATENT CAUSES
SOLICITOR OF U. S. & FOREIGN **PATENTS**
FORÉE BAIN, 1652-3 Monadnock Blk., CHICAGO

**REPAIRING RECALIBRATING**
ELECTRIC METERS.
INTERNATIONAL ELECTRIC METER CO.
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THE DENVER CITY TRAMWAY CO.
AND THE
COLORADO SPRINGS ELECTRIC CO.
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**STOMBAUGH GUY ANCHORS**
EXTENSIVELY

5 AND 6 INCH STYLE.

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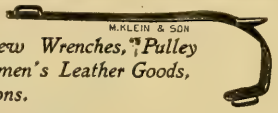
203 N. 2d STREET ST. LOUIS

Your Lights Will Burn Brighter
IF YOU USE
**KLEIN'S TOOLS**
IN YOUR CONSTRUCTION WORK
THEY WERE THE BEST WHEN FIRST INTRODUCED IN 1857.
THEY HAVE BEEN THE BEST EVER SINCE.
ASK YOUR LINEMAN.

*Climber's Splicing Clamps, Pliers, Lag Screw Wrenches, Pulley Blocks, Wire Grips, Linemen's Leather Goods, Wire Reels, Shovels, Spoons.*




MATHIAS KLEIN & SONS, Standard Tools, 81 W. Van Buren St. CHICAGO, ILL.

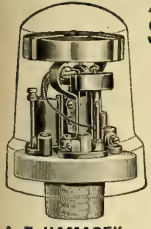
**NATIONAL CODE STANDARD**

WEATHER-PROOF TRADE MARK "O.K." LINE AND HOUSE WIRES

"O. K." Weatherproof Wire.
Slow-Burning Weatherproof and Ideal Wire.
Prices and Samples on Application.

**Phillips Insulated Wire Co.**
Office and Factory: PAWTUCKET, R. I.

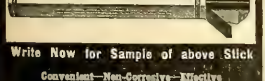
**"AMERICAN" STORAGE CELLS**
ARE THE BEST. Send for descriptive Circular.
AMERICAN BATTERY CO.,
ESTD 1888. 171 S. Clinton St., Chicago.



THIS AUTOMATIC SERIES ARC **CUT-OUT**
Has resistance equal to 15 feet of
No. 12 WIRE
A. F. HAMACEK, CHICAGO, ILL.
2014 KENMORE AVE.

**Engineering** MECHANICAL, ELECTRICAL, STEAM, CIVIL.
Complete and short courses. Thoroughly equipped engineering shops. Shop work from the beginning. Short courses in Steam and Electrical Engineering. Expenses low. Accommodations the best. School all year. Students may enter any time. Correspondence steam and electrical courses. Send for catalogue. Mention course in which interested.
HIGHLAND PARK COLLEGE, DES MOINES, IOWA.

**DOES THE WORK**




Write Now for Sample of above Stick
Convenient—Non-Corrosive—Effective.
We also make the famous Crolius Commutator Compound; eliminates sparking and all commutator troubles. Send for sample.
E. R. CROLIUS & SON
6419 Peoria Street - CHICAGO, ILL.

**New Methods**
**New Prices**

Owing to the introduction of new machinery we are enabled to **greatly reduce** the prices of **Paper Insulators.**

Paper sleeves used for the insulation of cables are packed 110 in a box and are furnished in any desired diameter.

The standard length is three inches, but any desired length can be furnished.

All tubes are made of strong, tough paper, spirally rolled.

Paper Insulators in box ready for shipment.

**American Electric Fuse Co.**
Chicago — New York — Atlanta

**DO YOU THINK**

your announcement should appear in the issues of the Western Electrician of June 10th and 17th?

**IF YOU DO**
MAIL COPY TO-DAY

These two issues will contain the report of the National Electric Light Convention at Denver. Big convention; big issues; big circulation. They should contain your announcement—

**WE THINK**

**WANTED, FOR SALE** *and similar* **WANT COLUMN** *advertisements (50 words or less), $1.50 an insertion; additional words 3c each.* **POSITION WANTED** *advertisements (50 words or less), $1.00 an insertion; additional words 2c each.*

## POSITION WANTED.

As superintendent or manager of an electric light plant, big contracting firm or mill. Have had years of experience, handling all types of machines and am a practical electrical mechanic familiar with all modern methods of construction, interior wiring and installing machinery maintenance and I can go at once. Address Box 482, care of Western Electrician. 510 Marquette Building, Chicago.

## POSITION WANTED.

By a high grade Bell man of twelve years practical experience who wishes to go into the independent field. Fully competent to take charge of any construction work. Past four years spent as exchange manager in their most important cities in a western state where they have strongest opposition. Address Box 483 care of Western Electrician, 510 Marquette Building, Chicago, Ill.

## WANTED.

Salesmen to sell Rock Island Dry Batteries. Commission basis only. Apply at once in writing to the Rock Island Battery Company, Rock Island, Ill.

## WANTED

Salesman in factory making gas and electrical glassware; requires the services of a first-class man accustomed to calling upon central stations, electrical supply and gas fixture trade. Good salary to satisfactory man. State previous experience, age and salary expected. Address BOX 484, care of Western Electrician, 510 Marquette Building, Chicago.

## FOR SALE.

100 second-hand 110 V., D. C. 12-inch and 16-inch fans in good condition. Columbus Public Service Co., Columbus, O.

## FOR SALE

Two hundred shares in a completely equipped electric light plant, heating and power plant, incorporated under the laws of Illinois and situated in a city of 2,500 inhabitants. The plant is thoroughly up to date, with complete duplicate equipment, is on a well-paying basis and is constantly increasing its list of customers. This stock is a controlling interest, being two-thirds of the entire stock issue of three hundred shares and the present owners of same wishing to retire from this line of business. Will sell for $3,500 on easy terms as follows: $2,500 cash, and balance secured by the stock as collateral. The actual cost of the plant is $20,000 with a bonded indebtedness of $12,000. Inspection of plant invited at any time. Address STEWARD BROS. BANK, Plano, Ill.

## NOTICE

Specifications for the construction of the overhead and underground work have been prepared and placed in the hands of contractors. Parties wishing to bid who have not received specifications will notify the WISCONSIN LIGHT & POWER CO., LaCrosse, Wis.


**FREE**

50 Pardridge Easy Cord Adjusters

Send 15c in stamps or coin to

THE Pardridge Shade & Reflector Co.

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**Copper, Brass, Iron Machinery**

Purchased by

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**KLEIN'S TOOLS**

*For Electrical Workers and Line Builders.*

MATHIAS KLEIN & SONS, 81 W. Van Buren St., Chicago, Ill.

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**An opportunity to secure rare bargains** in everything used in this line. has seen but limited service and is practically as good as new for further use. This material that we are offering

### LEAD COVERED CABLES.

| Feet. | Size. | Conductor. | Voltage. |
|---|---|---|---|
| 26,500 | 300 M-C. M. | 3 | 6,600 |
| 9,000 | 4—0 | 3 | 6,600 |
| 4,700 | 3—0 | 3 | 6,600 |
| 7,500 | 2—0 | 3 | 6,600 |
| 14,500 | 1—0 | 3 | 6,600 |
| 18,500 | No. 1 | 3 | 6,600 |
| 11,500 | No. 2 | 3 | 6,600 |
| 4,700 | No. 3 | 3 | 6,600 |
| 7,100 | No. 4 | 3 | 6,600 |
| 11,500 | No. 6 | 3 | 6,600 |
| 25,000 | 4—0 | 1 | 2,200 |
| 1,000 | 2—0 | 1 | 2,200 |
| 11,000 | 1—0 | 1 | 2,200 |
| 9,000 | No. 1 | 1 | 2,200 |
| 11,000 | No. 2 | 1 | 2,200 |
| 18,000 | No. 4 | 1 | 2,200 |
| 48,000 | No. 6 | 1 | 2,200 |
| 1,000 | No. 8 | 1 | 2,200 |
| 25,000 | 500 M-C. M. | 1 | 500 |
| 50,000 | 4—0 | 1 | 500 |
| 11,000 | 3—0 | 1 | 500 |
| 11,000 | 2—0 | 1 | 500 |
| 3,700 | No. 1 | 1 | 500 |
| 2,900 | No. 6 | 1 | 500 |
| 180,000 | No. 6 | 1 | 8,000 |
| 14,500 | No. 14 | 6 | Fire Alarm |
| 39,000 | No. 14 | 4 | " " |
| 39,000 | No. 14 | 3 | " " |
| 9,600 | No. 14 | 2 | " " |

### Weatherproof and Rubber Covered Wire.

All sizes from No. 14 to 600,000 C. M.

### INCANDESCENT LAMPS

200,000 Lamps, used a short time, and in good condition for further service. Have been tested. They are 10¼ voltage, Edison base, 8 candlepower. In lots of 1,000, each 5 cents.

150,000 grand new Incandescent Lamps in original cases of 200, 250 and 400 Lamps, ranging from 100 to 110 voltage, 8 and 16 candlepower. General Electric make. Price each in case lots, 12½ cents.

20,000 Colored Incandescent Lamps, brand new, never used, General Electric make, 104 voltage, Edison base; colors, Amber, Green, Opal and Ruby; put up 200 in a case. Price each, 22 cents; are worth 35 cents each.

20,000 Incandescent Lamps, voltages 100 to 120, Edison. T. H. and Westinghouse base; 8, 10, 16, 20 and 25 candlepower; put up 250 in a case, second selection. Price each in case lots, 10½ cents.

### WOOD CONDUIT.

100,000 Feet, Size 4½ x 4½.

### MISCELLANEOUS

300,000 No. 9171 Porcelain, Edison Base Receptacles.
60,000 Weatherproof "Bryant" Sockets.
1,000,000 split glazed B. & D. Wiring Knobs.
300,000 Glazed Porcelain B. & D. Wiring Knobs, sizes 3½, 4½ and 5½.
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25,000 Plugs.
2,000,000 Unglazed Porcelain Tubes.
40,000 Glass Insulators.
20,000 Porcelain Cleats.
All kinds of switches and instruments.

**Ask for our Special Catalogue No. 567.**

**CHICAGO HOUSE WRECKING COMPANY, 35th and Iron Sts., CHICAGO.**

530

# ELECTRICAL EQUIPMENT DESIGNED FOR INDUSTRIAL PLANT SERVICE

**APPLIED** in progressive plants to reduce operating costs and to increase output.

LEAFLET No. 25130

CHICAGO OFFICE: 425 MONADNOCK BLOCK

## FOR SALE

220 To 250 Volt Motors

| H. P. | |
|---|---|
| 1 | 7½ Towle, M. P., new. |
| 1 | 8 Holtzer-Cabot. |
| 1 | 8 Crocker-Wheeler, series. |
| 1 | 8 Western Electric M. P., direct connected to Eaton & Prince elevator, complete with controller and drum. |
| 1 | 9½ Crocker-Wheeler, M. P., new. |
| 1 | 10 C. & C., M. P. |
| 1 | 10 Keystone, M. P. |
| 1 | 10 Bernard, M. P. |
| 1 | 15 Eddy. |
| 1 | 15 Keystone, M. P. |
| 1 | 15 Western Elec., M. P. |
| 1 | 20 Sprague. |
| 1 | 20 Western Elec., M. P. |
| 1 | 25 Edison, self-oilers. |
| 1 | 30 Crescent, M. P. |
| 2 | 30 Westinghouse, M. P. |
| 1 | 40 Bernard, M. P. |
| 2 | 40 Western Electric, M. P. |
| 1 | 50 E. & C. Multipolar. |
| 2 | 50 Am. Engine Co., M. P. |
| 1 | 60 C. & C., self-oiler. |
| 1 | 60 Maine, M. P. |
| 1 | 70 Fuller, multipolar. |
| 1 | 150 Eddy, M. P. |
| 2 | 200 National, M. P. |

Send for our Monthly Bargain Sheet with complete list and net prices.

**GREGORY ELECTRIC CO.** 54-62 S. Clinton St. CHICAGO, ILL.

# Largest Tourist Cars

NORTHERN PACIFIC YELLOWSTONE PARK LINE

They are new, roomy, well ventilated, cool, leather-upholstered, void of dust-catching devices, strongly built, steel-platformed, broad-vestibuled and electric-lighted.

Completely equipped with mattresses, pillows, blankets, bed linen, curtains and cooking ranges. Toilet rooms contain wash stands, towels, soap, combs, brushes, etc.

Two persons comfortably accommodated in a double berth in these cars. Rates are only one-half those charged in the standard Pullman sleeping cars. Each car is in charge of a uniformed colored porter, whose sole duty it is to care for the comfort of its occupants.

ON THE

## Northern Pacific Railway

*C. A. Matthews, Gen. Agt. Pass. Dept., 208 S. Clark St., Chicago, Ill. Send six cents for Wonderland 1905, to A. M. Cleland, Gen. Pass. Agt., St. Paul, Minn.*

# ELECTRICAL AND OTHER INDUSTRIES ARE OFFERED LOCATIONS

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Satisfactory Inducements, Favorable Freight Rates, Good Labor Conditions, Healthful Communities,

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Machine and Carpenter Work of All Kinds. Correspondence Solicited.

**OPEN DAY AND NIGHT.**

FIRST-CLASS EQUIPMENT THROUGHOUT.

Dynamos Armatures, Motors, Arc Lamps, Fans, Instruments.

# HOLOPHANE GLASS CO.

# WINS SUIT

## Prismatic Reflector Patent Declared Valid.

**Decree in favor of O. A. Mygatt, President of Holophane Glass Company with PERMANENT INJUNCTION and ACCOUNTING against E. L. Zalinski, and the Illuminating Engineering Company.**

Following are extracts from the opinion handed down by Judge Ray of the Circuit Court of the United States, Southern District of New York, May 17, 1905:

*"The evidence fully sustains the claim of the patent.* * * * The defendant is making and selling substantially what the complainant is making and selling or is authorized by his patent to make and sell. True in some, if not all, the angle is changed; the edge is curved or beaded, and in some there are other slight changes, but these changes are evidently made to be used in justifying the infringement if possible. *The defendants' shades or reflectors are BALD APPROPRIATIONS of the complainant's patent.* Slight changes are made which add nothing to the ornamentation, but rather detract therefrom. These, however, enable the defendants to say 'our shade or reflector is different from yours, therefore we do not infringe.' * * * This cannot be so if any design patent is to be held valid.

**"The Court is of the opinion that the patent is valid and that the defendants infringe. There will be a decree for an injunction and an accounting."**

We are the owners of numerous mechanical and design patents, covering our different forms and shapes of transparent glass reflectors made on the prismatic principle, and it is our intention to prosecute all manufacturers and dealers who make or sell prismatic shades or reflectors infringing these patents.

## HOLOPHANE GLASS CO.

**227 Fulton Street - - - - New York**

127 FULTON STREET CHICAGO

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For Signs, Letters, Flashers, Dimmers, Timeswitches, Lamps, Rubberrings and anything pertaining to Signs,

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But if you want QUALITY investigate the

Century Single Phase Motor

and you will find it. They are self starting under full load.

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ST. LOUIS, MISSOURI

Electrical Machinery

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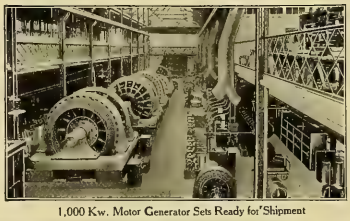
We Build Direct & Alternating Current Apparatus in all capacities & types for Lighting, Power & Railway Service



1,000 Kw. Motor Generator Sets Ready for Shipment

National Electric Company

Milwaukee

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We Manufacture

Cords for Telephones and Switchboards. Cables and Wires for Switchboards. Cables for Interior Purposes.

Write us concerning our No. 100 Switchboard Cord

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THE NEW ALUMINUM ENCASED FOCUSING FLASHLIGHT

A pocket flashlight with greater power, more light, more life—indestructible and no higher in price.

Beware of infringements made under patent 520,429, May 29, 1894. Sustained by United States Court of Appeals.

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I. A. Bennett, Manager, Western Office

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CHICAGO

# "CIRCULAR LOOM"
# "ELECTRODUCT"

Patented July 21, 1891.

## The PIONEER and IDEAL Conduits For Interior Wiring

Approved by All Boards of Fire Underwriters in the United States. Endorsed and Used by Architects, Electrical Engineers and Contractors.

## American Circular Loom Company

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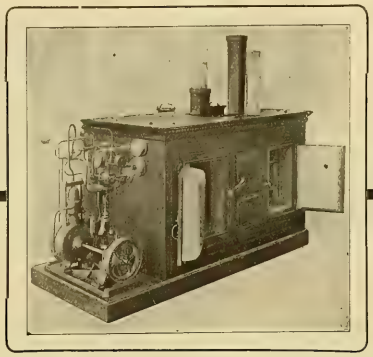

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BY attaching our combined ice-making and refrigerating machine to your refrigerator box you can secure a low and even temperature, dry air, sanitary refrigeration, and sterilized, hygienic ice—while you will avoid all slop and drip. It is cheaper than the old way. :: :: :: :: :: ::

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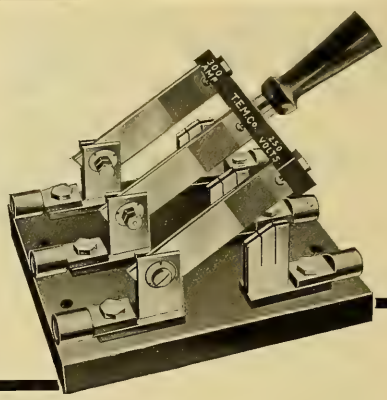
NEW BRUNSWICK NEW JERSEY



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Trumbull Type A switches are absolutely the highest grade it is possible to produce. Their satisfying quality lies not in the superiority of any single feature, but is due to the general excellence of the entire switch. You need them. Send for catalogue "B," containing complete description and prices.

THE

TRUMBULL ELECTRIC MFG. CO.

PLAINVILLE, CONN. New York, 136 Liberty St.

Continuous and judicious advertising is the magic wand which converts a little business into a big business.

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OLD AND NEW CODE STYLES

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Catalog No. 16 with illustrations is ready and is as plain as a primer. You see what you want at a glance

Our Trade Mark stands for good goods in all Electrical Fuses and Fuse Wire

**CHICAGO FUSE WIRE & MFG. CO.**

Chicago, Buffalo
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# McRoy Conduits.

"ROOKERY"—Chicago

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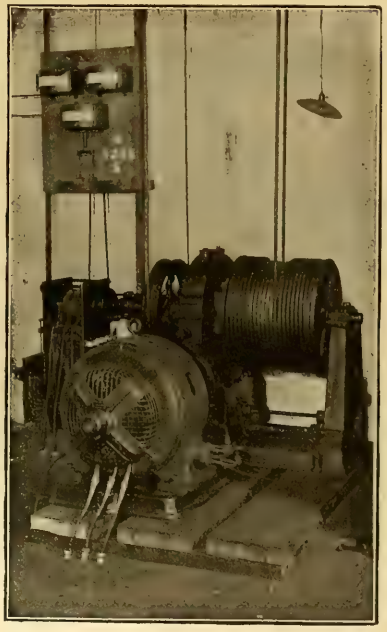
## A SINGLE-PHASE ELEVATOR MOTOR

After many years of continuous experimental work and diligent observations of all important motor improvements in this country and abroad, we are finally able to announce the development of a PERFECT SINGLE-PHASE POWER MOTOR for Elevator and Hoist Work. This new motor promises all the advantageous torque, current and other performance characteristics of the best direct-current motors for the same class of service, and we invite immediate correspondence looking to the installation of such equipments as you may require.

We are prepared to supply on short notice motors of 10 H. P. or less capacity, for 60-cycle service, and will shortly be prepared to deliver units of 25 H. P. capacity or less for this and other frequencies.

Write for circulars and prices.



We are prepared to undertake the adaptation of this form of motor at once to the following kinds of service:

ELEVATORS
(Rope control, direct coupled or belted.)

HOISTS
of all kinds.

TRAVELING CRANES

VARIABLE SPEED DRIVE
Where 40 per cent speed regulation will be satisfactory.

## WAGNER ELECTRIC MANUFACTURING CO.

**General Offices and Factory**

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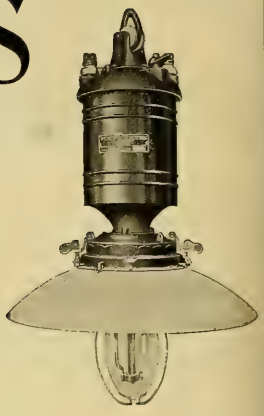

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OTHER LARGE CITIES


# NOW

Send in your order and copy for an attractive advertising announcement for the WESTERN ELECTRICIAN'S NATIONAL ELECTRIC LIGHT CONVENTION REPORT ISSUES, to be dated June 10th and 17th.

The meeting will undoubtedly be the largest and most important ever held and the proceedings, therefore, will be of unusual interest.

As this will be a Western convention your convention announcement should appear in the WESTERN ELECTRICIAN'S convention numbers.

FORWARD COPY TO-DAY.

# WE CAN SHOW YOU

IF ELECTRICAL AND GOOD WE SELL IT

## Some Matters of Interest in the Electrical Supply Line

IF ELECTRICAL AND GOOD WE SELL IT

**A FEW OF THESE ARE**

**New Prices**

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**AMERICAN ELECTRICAL SUPPLY COMPANY**
DEALERS & MANUFACTURERS
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Any man who can handle a soldering iron can make a good joint in lead covered cables by using

**NOVELTY POT HEADS AND SLEEVES**

Samples on Approval. Write for Catalog No. 125E.

Made by

**THE F. BISSELL COMPANY, TOLEDO, O.**

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ALWAYS READY AND DOES THE WORK. WILL MAKE THE SOLDER FLOW WHERE YOU WANT IT, AND STAY WHERE YOU PUT IT. IN COLLAPSIBLE TUBES AND TIN BOXES.

**"NEW IDEA" SOLDERING PASTE** SAMPLE FREE

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NON-CORROSIVE **KESTER** SOLDERING PASTE

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## Electrical Work

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# Bituminized Fibre Conduit

## For Underground Construction

**COMBINES** the **GOOD FEATURES** of other conduits.
**ELIMINATES** the **BAD FEATURES** existing in many kinds.
**HAS VALUABLE FEATURES** not found in any other duct.

The American Conduit Company has a corps of experts in underground construction and is prepared to furnish supervision of work if desired. We would prefer to co-operate with contractors in underground construction, but if desired will submit estimates and bids and take contracts for completed underground systems in any part of the United States or Canada.

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**Marline Cable Hangers**

"SECURITY" BRAND

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**THE F. BISSELL COMPANY.** TOLEDO, O.

WORKS QUICK AND EASY. KEEPS ITS LUSTER. HOLDS OLD TRADE AND MAKES NEW. DOES NOT DETERIORATE. ESTABLISHED 16 YEARS. SOLD BY AGENTS AND DEALERS ALL OVER THE WORLD

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POLISHES ALL METALS. BRANCHES: NEW YORK, CHICAGO, SAN FRANCISCO. 295 E. WASHINGTON ST. INDIANAPOLIS, IND.
HIGHEST AWARD, CHICAGO WORLD'S FAIR, 1893. LOUISIANA PURCHASE EXPOSITION 1904.

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From 0 to 150 Volts.

Also made up to 750 Volts.

FOR A. C. and D. C. WORK.

DISCOUNT TO THE TRADE.

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60-68 W. Van Buren St., Chicago.

**EVERY COMFORT**

Attends the Traveler between

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Who Travels via the

**MONON ROUTE**

Consult Your Local Ticket Agent

# Yost Wins

The General Electric instituted suit against The Yost Electric for infringement of the "Painter Patent" covering Fibre Linings for Sockets. The patent was declared void in the Lower Court and the decision is now affirmed by the Circuit Court of Appeals.

THE YOST ELECTRIC MFG. CO.,
Toledo, Ohio.

We have increased and improved our line by adding

**FOUR NEW ROSETTES**
**WALL SOCKETS WITH SUB-BASE**
**FIBRELITE SHADES**
**DOUBLE FALCON WRENCHES**
**ELECTROGRIP**
**PORCELAIN CLEAT RECEPTACLES**

Do you want our new catalogue?

**THE YOST ELECTRIC MFG. CO.**

**TOLEDO, OHIO**

# JUST READY

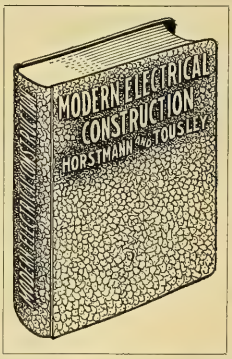
**Another Important Book for Electricians**

BY THE AUTHORS OF

MODERN WIRING DIAGRAMS AND DESCRIPTIONS.

## Modern Electrical Construction

By HENRY C. HORSTMAN & VICTOR H. TOUSLEY




This book treats almost entirely of practical electrical work. It uses the "rules and requirements of the National Board of Fire Underwriters" as a text, and explains by numerous cuts and detailed explanations just how the best class of electrical work is installed.

It is a perfect guide for the beginning electrician and gives him all the theory needed in practical work in addition to full practical instructions. For the journeyman electrician it is no less valuable, because it elaborates and explains safety rules in vogue throughout the United States. It is also of especial value to electrical inspectors, as it points out many of the tricks practiced by unscrupulous persons in the trade.

The book also contains a number of tables giving dimensions and trade numbers of screws, nails, insulators and other material in general use, which will be found of great value in practice.

There is also given a method by which the diameter of conduit necessary for any number of wires of any size can be at once determined.

The motto of the authors, "to omit nothing that *is needed*, and include nothing that is *not needed*," that has made "Wiring Diagrams and Descriptions" so successful, has been followed in this work. No book of greater value to the man who does the work has ever been published.

Pocket Size 4½ x 6½, 250 Pages, 100 Illustrations. Full Seal Leather, Round Corners, Red Edges. PRICE NET **$1.50**

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PUBLISHERS

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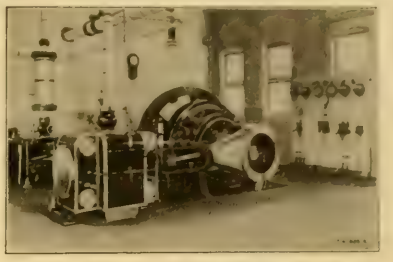
# Central Station Generators

## Alternating and Direct Current.

*Any Size* *All Types*

200 K. V. A. Engine Type Alternating Current Generating Set

There are many valuable features embodied in our generators which are not found elsewhere and which help in making our machines



60 K. V. Engine Type Direct Current Generating Set

## The Ideal Central Station Generators

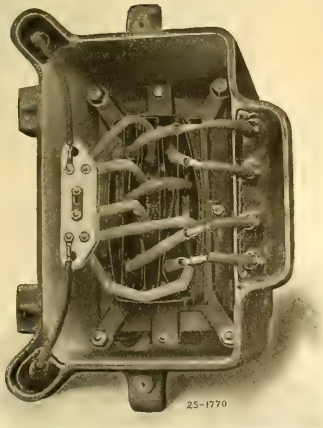
## Crocker-Wheeler Company

Sixteen Branch Offices

Ampere, N. J.

# STANLEY-G.I. ELECTRIC MANUFACTURING COMPANY

PITTSFIELD MASSACHUSETTS



25-1770

TOP VIEW OF B. O. TRANSFORMER SHOWING OIL DUCTS.

## NEW B. O. TRANSFORMERS

**Are unequaled for high all day efficiency. They are superior in points of insulation and regulation over ordinary transformers**

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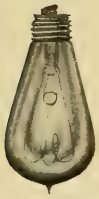
SEATTLE, WASH. Pioneer Building

# "HYLO"

## THE ONLY SUCCESSFUL "TURN DOWN" LAMP

### SAVES 5/6 OF CURRENT



**TURN BULB**

A slight turn to right or left turns the light high or low from 16 to 1 candle power.

**PULL STRING**

Light regulated by cord—high, low or out.

**LONG DISTANCE**

The lazy man's lamp! Regulated by pendant switch from any distance.

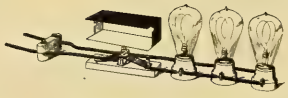
# "SKEDOODLE" SPECIALTIES

**WYNK SIGN FRAME**

**EYE HOLDING EYE COMPELLING**

This sign is 16 inches in diameter inside and 22 inches outside. The sockets are full size. Bulbs to fit can be purchased anywhere. A single skedoodle on the back of the sign winks the 8 bulbs altogether. The bulbs are 2 candle power, and no larger ones can be used unless specially ordered at extra price. Suitable for cardboard sign which can be changed as often as desired. Wonderful eye catching qualities. Appeals to an advertiser. Price complete

**$12.00**



**SKEDOODLE A**

May be connected in series with any sign and flash it off and on eight to twelve times per minute as adjusted.

Maximum capacity three 16 candle power lamps or the equivalent in smaller candle power lamps.

This does the work of a $40 wheel flasher.

Price

**$2.00**

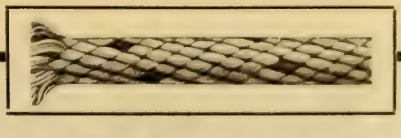
**THE TURNIP ADVERTISING BULB**

**It is a complete electric sign.**
**It is a flashing sign.**

3¼ inches in diameter. Has a skedoodle complete in the lamp base and a spring which makes it possible to turn the reading right side up in any socket. Can be lettered or finished with any design or trade mark, as ordered. The newest and most catchy advertising novelty.

# The Phelps Company

## DETROIT, MICHIGAN



# "SAMSON SPOT CORD"

***If used for hanging Arc Lamps, saves heads, lamps and expensive renewals; BECAUSE:***

FIRST—The stitches double on each other, giving freedom of play and distributing the strain equally over all the strands.

SECOND—It is made of extra quality stock, warranted free from waste.

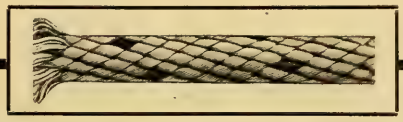
THIRD—Being warranted free from bad splices and rough braiding, the smooth surface causes minimum abrasion and maximum wear.

For the same reasons this cord is much the most durable for Trolley Cord and Bell Cord.

We gladly send tests and samples, with full information, to all interested.

## SAMSON CORDAGE WORKS

**BOSTON, MASS.**



## IN 1904

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## Just What the World Has Been Waiting For.

THE CELL

**This plate is so strong electrically and mechanically that no amount of electrical abuse or of vibration in traction service can dislodge even the slightest particle of its active material.**

**Lowest internal resistance of any storage battery in the world.**

***The weight efficiency is conservatively 14 watts per pound total weight, and electrical efficiency unsurpassed.***

THE PLATE

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*INCORPORATED*

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**Chicago Illinois**

# WASTED POWER

## *You Are A Funny Man!*

## *How Inconsistent You Are!*

You go down into the cellar and you find the cider barrel, the molasses barrel, or even the whiskey barrel leaking—leaking ever so little. You go up stairs and you raise a row with the cook—

## Look At All That Waste Of Your Good Money, Etc., Etc.

### And Then!

You go down to your lighting plant feeling fine. "Guess a man ought to know how to manage his own house," (how careless and thoughtless of his wife too!) You light a cigar—you are feeling real good. You lean back in your office chair and through the open window comes the "puff, puff" of the exhaust from your engine. You watch the beautiful white clouds of steam as they are projected up against the blue sky, **and YOU DON'T REALIZE FOR A MOMENT**—at least that is the way of the average business man—**THAT EVERY "PUFF" OF STEAM (AND THERE ARE MANY THOUSAND PER DAY—MANY, MANY, MANY THOUSAND PER DAY), EACH IS WORTH MORE TO YOU PERHAPS THAN ALMOST THE WHOLE BARREL OF MOLASSES—**

## *STOP THE LEAK!*

Write us, we will show you how to do it; and what is more, we will show you how to make a splendid **PROFIT** out of every single puff of steam that now goes up into the sky and merely **MOISTENS THE ATMOSPHERE AT YOUR EXPENSE.**

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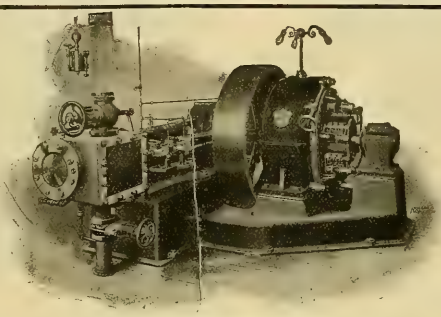

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**12½ Gals. per 100 Kw. Hours**

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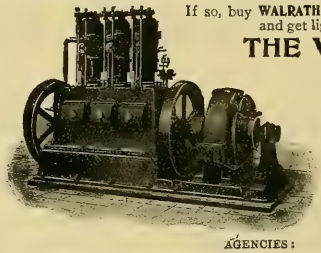
If so, buy WALRATH GAS OR GASOLINE ENGINES and get light on the subject.



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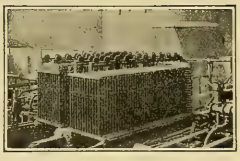

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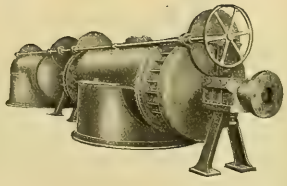

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IDEAL ENGINES

# The Choice of The Man at the Throttle

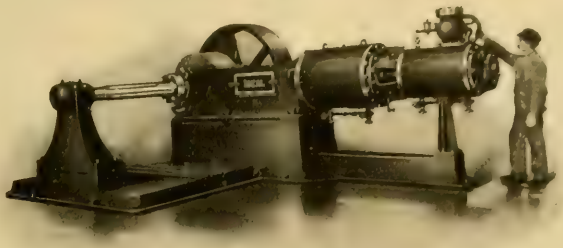

Photo taken from one of a pair of engines in Hillman's Department Store, Chicago

## IDEAL ENGINES

**Write for "There are Reasons"**

## A. L. Ide & Sons

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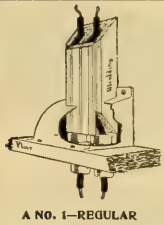

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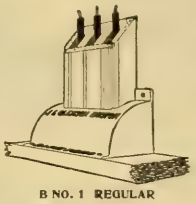
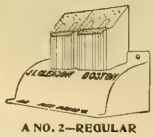


B NO. 1 REGULAR



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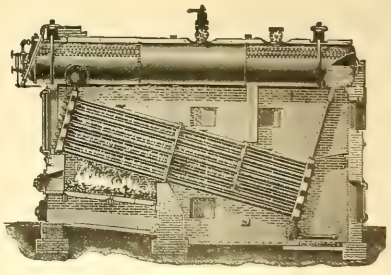

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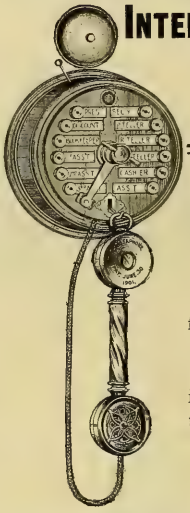

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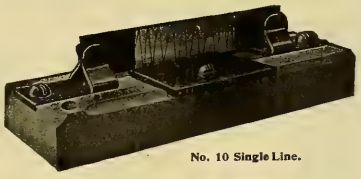
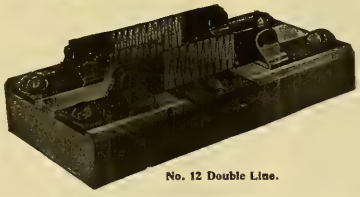


No. 10 Single Line.



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Our patent wrapped fuse used in our protectors are an insurance policy against lightning.

Sample free by mail to any Exchange or Toll Line

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One screw does the work, too, and prevents the knob from turning.

*Ask your jobber for it or write us.*

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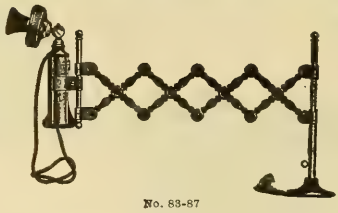

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Compare ours to others. Made any length desired. Send us your orders.

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Has the advantage of being as rapid and costs less to maintain than a lamp signal board. Effective service at small cost.

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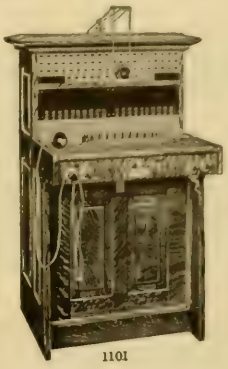

1101

Key shelf is so low, operator can use an ordinary chair

This type of cabinet has all the advantages and none of the disadvantages of many boards twice its size. Bulletin sent free for the asking. Write to-day.

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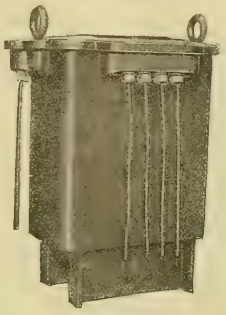

Shell Type, Front View

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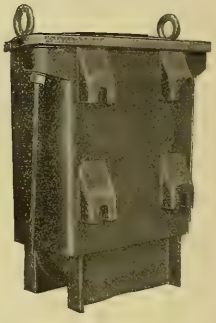

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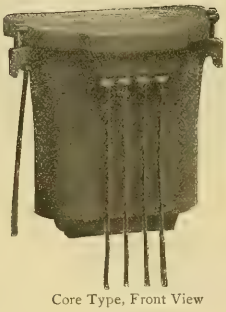

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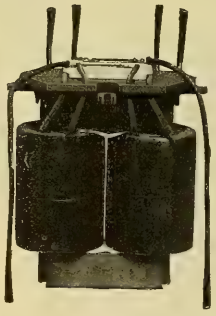

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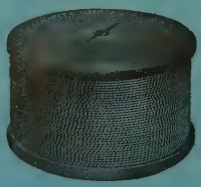

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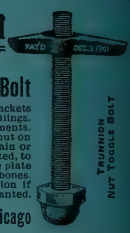


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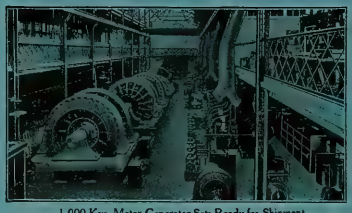

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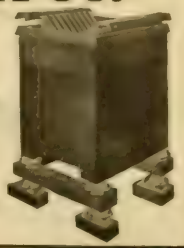

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**OVER 20,000 MILES IN USE**
The St. Louis Exposition, 1904 awarded us the only gold medal for rail joint products.

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**"SAFETY" RUBBER COVERED WIRE AND CABLE**
FOR EVERY ELECTRICAL SERVICE.
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WORKS: Bayonne, N. J. 114-116 LIBERTY STREET, N. Y.

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Any man who can handle a soldering iron can make a good joint in lead covered cables by using
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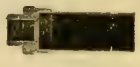

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THE F. BISSELL COMPANY, - TOLEDO, O.

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All forms of electrical contacts.
**Grand Prize**
Universal Exposition
ST. LOUIS, 1904


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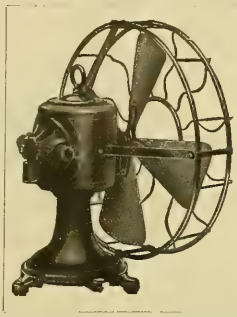

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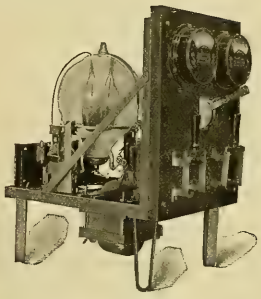
# PARAGON FAN MOTORS

STANDARD FOR YEARS

CALL AND SEE THEM OR WRITE FOR PRICES

CHICAGO EDISON COMPANY,

139 ADAMS ST., CHICAGO.



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COOPER-HEWITT MERCURY VAPOR LAMPS

COOPER-HEWITT

Vapor Converter

For charging storage batteries from alternating currents

Write for Bulletins and Prices

COOPER-HEWITT ELECTRIC CO.

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Remember these rods have no lost motion. These Couplings are of Steel and are made in the best possible manner.

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SAVE TIME, BOXES AND MONEY

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THE NEW ALUMINUM ENCASED FOCUSING FLASHLIGHT

A pocket flashlight with greater power, more lignt, more life—indestructible and no higher in price.

Beware of infringements. Made under patent 520,429, May 29, 1894. Sustained by United States Court of Appeals.

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CHICAGO

No. 157 Edison Key
No. 158 T. H. Key
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The opening in the cap is 13-32, and no socket bushing is required. You can save time and money by using this socket for pendant work.

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SOLVAY, N. Y.

NEW YORK CHICAGO SAN FRANCISCO

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OKONITE WIRES AND CABLES

OKONITE

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OKONITE IT NEVER DISAPPOINTS

**Central Electric Company,**

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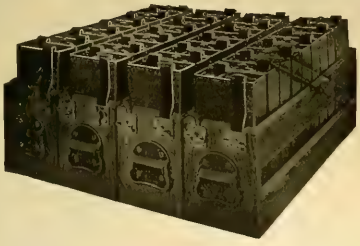

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Cannot be equaled for

Great Capacity, Lightness and Efficiency

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For

ARC LAMP and TROLLEY CORD

Send for Samples and Prices

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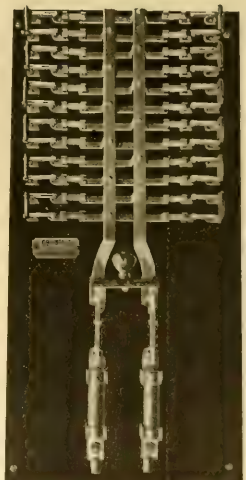

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Send for Bulletin 20E, which shows dimensions and prices of all the Standard Panels and Cabinets ordinarily demanded by Electrical Engineers and Contractors.

Also remember that we build excellent Switchboards and that we print the only catalog, Bulletin No. 19, which gives dimensions and prices by which you can make quotations on the spot.

THE F. BISSELL COMPANY

TOLEDO, O.,

TRADE

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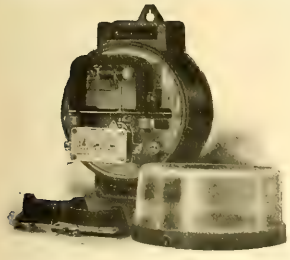

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JEWEL SURFACE ALWAYS NEW—PERMANENT ACCURACY AT ALL LOADS. MADE ALSO IN ROUND, SWITCHBOARD TYPE 6⅞ IN. DIAMETER, BACK CONNECTED.

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"Unit Accumulator"

PATENT ALLOWED JANUARY 11, 1905

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FOR CENTRAL STATION, STREET RAILWAY, TELEPHONE WORK, ETC., ETC.

Electric Storage Batteries

Sales Offices NEW YORK CHICAGO BOSTON PROVIDENCE


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Leather Preserver Mfg. Corp.

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Plume & Atwood Mfg. Co.

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Wesco Supply Co.

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Wesco Supply Co.
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Western Electric Co.
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Western Electric Co.

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General Electric Co.
Westinghouse El. & Mfg. Co.

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Duncan Elec. Mfg. Co.
Electric Appliance Co.
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Stanley Instrument Co.
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Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co
Weston Electrical Inst. Co.

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General Electric Co.

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Brownell Co., The
Ide & Sons, A. L.

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Century Electric Co.
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Robbins & Myers Co., The
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Western Electric Co.
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Vulcanized Fibre Co.

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Munsell & Co., Eugene.
National India Rubber Co.
New York Insulated Wire Co.
Okonite Co., The.
Phillips Insulated Wire Co.
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Ft. Wayne Elec. Wks. Inc.
General Electric Co.
Gregory Electric Co.
Jandus Electric Co., The
Manhattan Elec. Supply Co.
Stanley—G. I. Elec. Mfg. Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

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Buckeye Electric Company.
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Columbia Incan. Lamp Co.
Edison Decorative & Miniature Lamp Dept.
Electric Appliance Co.
Fostoria Incand. Lamp Co.
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Sunbeam Incan. Lamp Co.
Wesco Supply Co.
Western Electric Co.
Westinghouse El. & Mfg. Co.

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**Motors.** (See Dynamos and Motors.)

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Stevens & Co., Milo B.

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Century Electric Co.
Chicago Edison Co.
Electric Appliance Co.
General Electric Co.
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Automatic Electric Co.
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**Toggle Bolts.**
Wrigley Co., Thos

**Tools.**
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Western Electric Co.

**Transformers.**
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Kuhlman Electric Co.
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Wagner Electric Mfg. Co.
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Leffel & Co., Jas.

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Crescent Ins. Wire & Cble. Co
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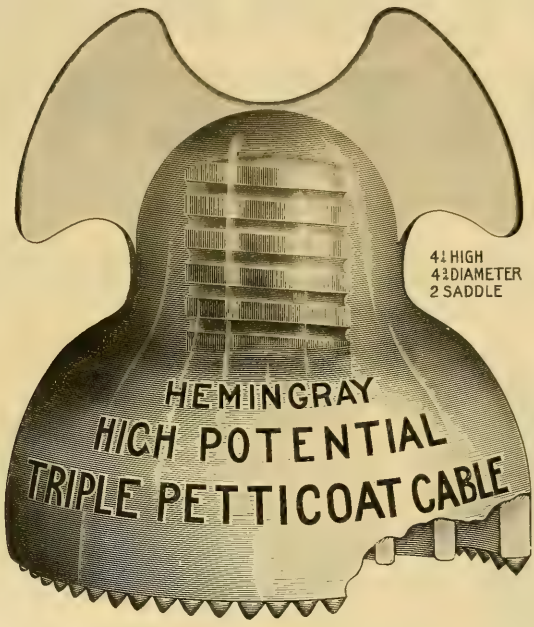
Manhattan Elec. Supply Co.
National Cable & Wire Co.
National India Rubber Co
New York Insulated Wire Co.
Northern Wire & Cable Co.
Okonite Co., The.
Phillips, Eugene F.
Phillips Insulated Wire Co
Roebling's Sons Co., J. A.
Runzel-Lenz Elec. Mfg. Co.
Safety Ins. Wire & Cable Co.
Simplex Electrical Co.
Spargo Wire Co., Jas. A.
Standard Underground C. Co
Wesco Supply Co.
Western Electric Company.


For Alphabetical Index of Advertisements See Page 3.

# SOMETHING NEW




# The Hemingray Glass Co.

**Established 1848.**

**Office: Covington, Ky.** **Factories: Muncie, Ind.**

# THE NEW "MORRISON" STORAGE BATTERY

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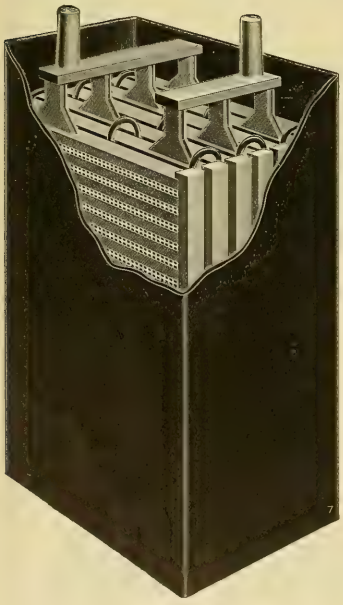
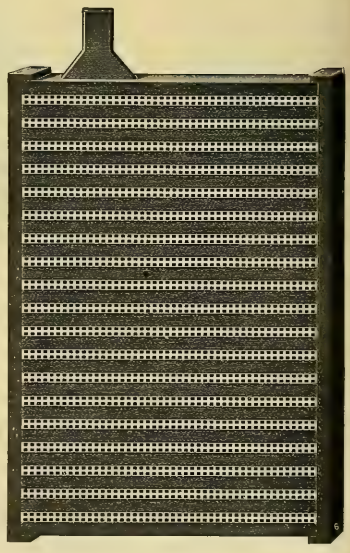


THE CELL

**This plate is so strong electrically and mechanically that no amount of electrical abuse or of vibration in traction service can dislodge even the slightest particle of its active material.**

**Lowest internal resistance of any storage battery in the world.**

***The weight efficiency is conservatively 14 watts per pound total weight, and electrical efficiency unsurpassed.***



THE PLATE

# Universal Electric Storage Battery Co.

*INCORPORATED*

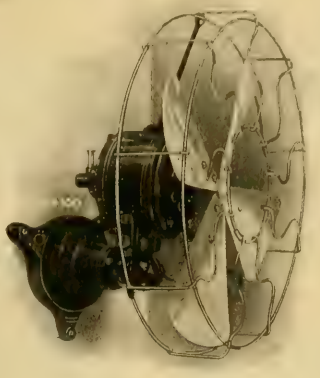
**Office: 1355 Railway Exchange Building**

**Factory: 36-38 Union Park Place**

**Chicago, Illinois**

# "THE STANDARD" FANS

## TEN MODELS



THE BEST PAYING LOAD for any power station is its ELECTRIC FAN load—running all day and in many cases all night. Never varying, and in most cases running on the lighting meters. It really constitutes the ideal station business. Every well-posted manager knows this. What some of them have not yet learned, however, is that the most profitable and satisfied customers can be had by permanently adopting "The Standard" line for direct current circuits, with its ten models to select from, to suit every class and need of the trade.

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ST. LOUIS: 12 N. Eighth Street. LOS ANGELES: 278 S. Main Street. SAN FRANCISCO: 16-18 Second Street.

# *General Electric Company*

Arc Lamp and Concentric Diffuser.

## Arc Lamps with Concentric Diffuser

**Gives the closest imitation of daylight.**

**Best for stores, shops and large halls.**

PRINCIPAL OFFICES: SCHENECTADY, N. Y.

NEW YORK OFFICE 44 BROAD STREET. SALES OFFICES IN ALL LARGE CITIES.

4855

# Transformer Decision Reversed

On May 3rd the United States Court of Appeals for the Southern District of New York handed down a decision in the case of the Westinghouse Electric & Mfg. Co. vs. the Montgomery Light & Power Company involving Stanley Patent No. 469,809, ***REVERSING*** a decision of the Lower Court favorable to the Westinghouse Company.

This decision of the Court of Appeals ***favorable to the Montgomery Light & Power Company*** is one step in a long line of litigation having for its object a monoply of the manufacture, sale and use of standard transformers such as used by all central station lighting and power companies.

Considerable publicity has been given the earlier decision by the Lower Court favorable to the plaintiffs, and this announcement of the reversal by the Court of Appeals will therefore dispel any misapprehension of the true merits of this litigation which may have arisen in the minds of central station people.

Users of Wagner apparatus may rest assured that this apparatus does not infringe the valid patents of other companies. It is the policy of the Wagner Company invariably to carefully investigate all the United States letters patent bearing upon its lines of manufacture, and to so design its apparatus that the patents belonging to others, valid in the opinion of our attorneys, are in no sense infringed. The wisdom of this policy is evidenced by the fact that after thirteen years of continuous manufacture of all its standard lines, there has been no patent decision against this Company or its apparatus which has stopped the manufacture of a single line of product, or inconvenienced a single customer in any way.

*The Montgomery Light & Power Company is using types "M" and "MH" transformers manufactured by this Company.*

**Wagner Electric Manufacturing Co.**

**ST. LOUIS, U. S. A.**

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**The Highest Possible Award**

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## HIGHEST GRADE NUERNBERG CARBONS

**By the International Jury of Awards, of the Louisiana Purchase Exposition, St. Louis, 1904.**

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# The "REFLECTRIC"

**consumes less current and can be read at a greater distance than any other electric sign to-day on the market. Write for booklet.**

**WESTERN DISPLAY COMPANY, SOLE MANUFACTURERS**

**ST. PAUL, - - MINN.**

**THOMAS S. REED, President** **ROBERT E. BENJAMIN, Secretary**

# The Reed Electrical Cordage Company

(INCORPORATED)

MANUFACTURERS OF

## INSULATED CORDS

**637 University Building** **SYRACUSE, N. Y.**

**FACTORY, 419 TRACY STREET**

**ELECTRICIANS PLEASE READ**

**the following test:**

SYRACUSE UNIVERSITY

Syracuse, N. Y., March 6th, 1905.

The Reed Electrical Cordage Co.
Syracuse, N. Y.

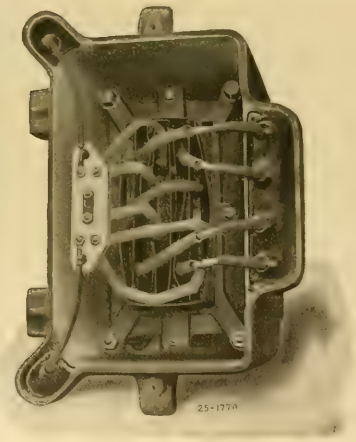
Gentlemen:—I have tested the insulation of the samples of lamp cord which you furnished me and find that both of them exceed the Underwriters' requirements of 50 megohms per mile. Both samples gave an insulation resistance of over 70 megohms per mile, 70 megohms being the limit which the sensibility of my instruments would allow me to specify. The tests were made after the cord had soaked for twenty-four hours in a saturated solution of salt.

Yours very truly,
(Signed) W. P. GRAHAM.
Department of Electrical Engineering.

**To increase our working capital we are offering a few shares of treasury stock at $25.00 per share for a limited time only. Please address secretary for further particulars.**

STANLEY-GI ELECTRIC MANUFACTURING COMPANY
PITTSFIELD MASSACHUSETTS

## Our New B. O. Transformers




TOP VIEW OF B. O. TRANSFORMER SHOWING OIL DUCTS

are unequaled for high all day efficiency.

They are superior in points of insulation and regulation over ordinary transformers.

**Western Sales Office,**

**Monadnock Block, Chicago, Ill.**

AWARDED "GRAND PRIZE" ST. LOUIS EXPOSITION

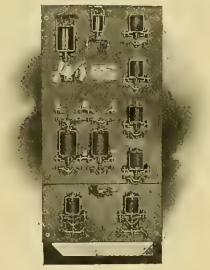
# COLUMBIA CARBONS

USED IN OVER 90% OF THE CENTRAL STATIONS IN THE U.S.

NATIONAL CARBON CO., CLEVELAND, OHIO.

*Our engineering department devotes its whole time to solving problems of electric motor control. Tell us what you wish to accomplish and we'll plan the way.*

# Self Starters for Large Motors



No other form of starter for the automatic control of large motors will operate so effectively as the Cutler-Hammer Multiple Solenoid.

Every contact is made with a snap and without arcing.

Steps of resistance are cut out by solenoid switches, each switch being energized in turn by a master solenoid, the latter's action being governed by a dash pot. This arrangement gives a smooth and easy start to the motor.

The opening of the main circuit is accomplished by a solenoid circuit maker and breaker, equipped with powerful blowouts for disrupting the arc.

The largest size motors can be automatically started and stopped by this system with a switch carrying not over one ampere of current, and controlled by a float switch, or small pressure regulator, or by any kind of small switch operated by hand or automatic devices.

It can be used with either reversing or non-reversing motors for operating pumps, electric elevators, cranes, hoists etc.

Send for bulletin 70 D for full description.

## The Cutler-Hammer Mfg. Co.

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Are the Standard of OUR NAVY AND THE WORLD.

An experience of many years in dry battery manufacture has given this battery the supremacy it holds over all others.

It is the best dry cell ever made.

They are made in all standard and special sizes.

## THE "AUTOGAS" DRY BATTERY

For Portable Service is the Best Made

For Automobiles, Launches, and all Ignition work where compactness is a requisite.

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# ITS FIRST COST

## A Secondary Consideration

The first cost of an Accelerator is a secondary consideration. Of course it costs more than a friction clutch, a number of times more, but it's worth 100 times more because it lasts a 100 times longer, and is 100 times less trouble.

In a certain factory in Wisconsin is a 100-H.P. friction clutch. Once a week the wooden blocks have to be renewed. In a month or two the cost of these renewals amount to as much as the first cost of an Accelerator,—and then the trouble and delay.

An Accelerator in place of that friction clutch would last years and years. It would not have to be adjusted; it would entail no expense except the cost of oil and new carbons, a cost so small that it is hardly worth considering; and it would start the machinery every time without any jerking, simply by pushing a button.

If you have a similar case, don't figure on the first cost. Take your pad and pencil and figure out the cost of repairs, the cost, bother and annoyance of delays, and estimate the saving to your machinery by proper and gradual starting.

We're anxious for an opportunity to prove to you that the Accelerator is the ideal clutch; that it is the only one on the market that has the proper principle of starting; that its construction is such that it gives no trouble, causes no delays, works equally well whether started by push buttons or automatic devices, and that when the current is turned off instantly releases.

Our catalogue will give you an idea of its construction and operation.

## Cutler-Hammer Clutch Co.

MILWAUKEE, WIS.

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THE STANDARD FOR
RUBBER INSULATION

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In our new building, 134 to 140 West Jackson Boulevard, Chicago, we have the largest and best equipped Electrical Supply Warehouse in the world.
We have no side issues; our whole time and thought is given to see how quickly and satisfactorily we can fill orders for Electrical Supplies.
Try us and our methods.

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POCKET SIZE
For testing Batteries and Battery Circuits, Locating Faults, Grounds, etc.
RELIABLE. - ACCURATE.
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The insulation is the most important part of your machine—be sure you buy only the best. Cheap insulation cannot be good insulation.
IF IT'S MICABOND YOU CAN BE SURE YOU HAVE THE BEST—OUR GUARANTEE IS BEHIND IT
CHICAGO MICA CO. : : : Valparaiso, Ind.

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You Who are Troubled with Sparking and Cutting of Commutators to Use

The only article that will PREVENT SPARKING. Will keep the commutator in good condition and PREVENT CUTTING.
Absolutely Will Not Gum The Brushes . . .
It will put that high gloss on the commutator you have so long sought after.
50 Cts. per Stick. $5.00 per Dozen
For Sale by all Supply Houses, or
FREE, Sample Stick.
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Of all Qualities, in any Form at Lowest Prices
EUGENE MUNSELL AND CO.
NEW YORK and CHICAGO

# INSULATION That Is.
Micanite, Linotape, M. I. C. Compound, Empire Cloth and Paper. For Years the Standard.
MICA INSULATOR CO., Originators
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RELIABLE LIGHTING RESULTS
BY ORDERING EDISON LAMPS
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Regular Multiple Lamps
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Miniature Lamps.
General Electric Company
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Harrison, N. J.
(487)

ALWAYS READY AND DOES THE WORK. WILL MAKE THE SOLDER FLOW WHERE YOU WANT IT, AND STAY WHERE YOU PUT IT. IN COLLAPSIBLE TUBES AND TIN BOXES.
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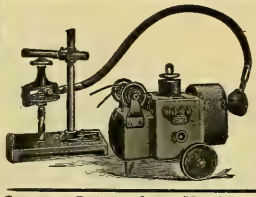
For Electrical Workers and Line Builders.
MATHIAS KLEIN & SONS,
81 W. Van Buren St., Chicago, Ill



ESTABLISHED 1875.
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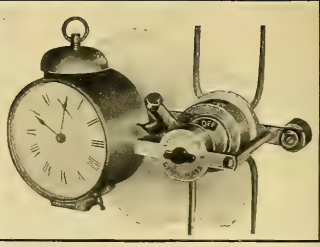

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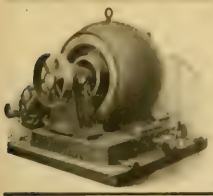

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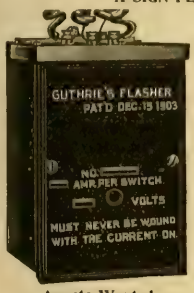


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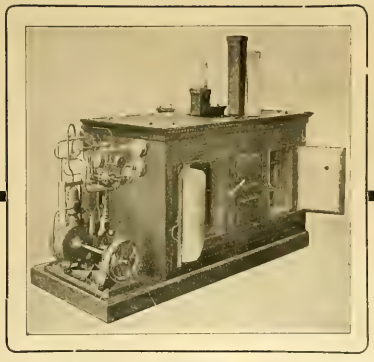

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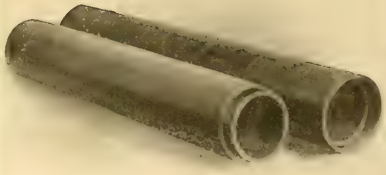

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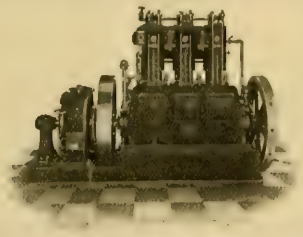

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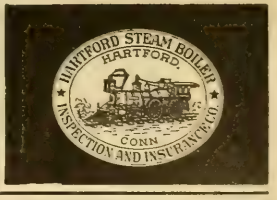


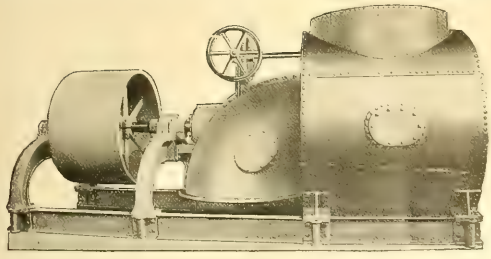

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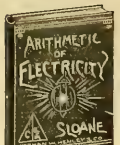

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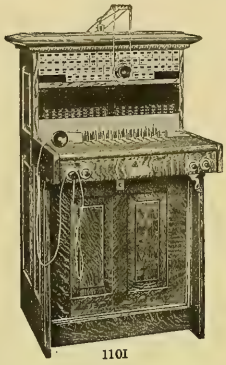

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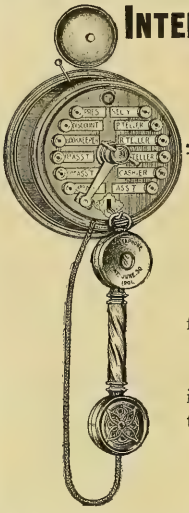

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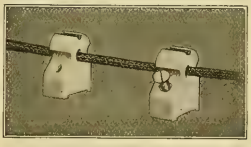

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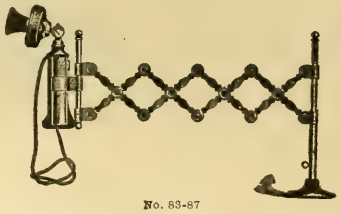

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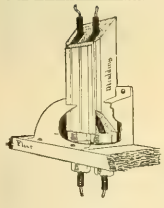

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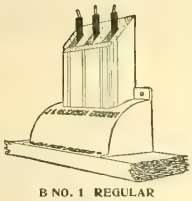

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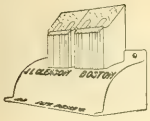

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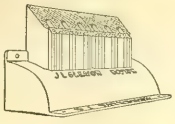

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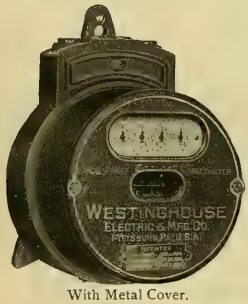

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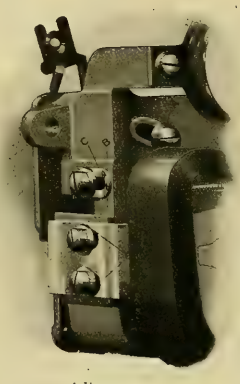

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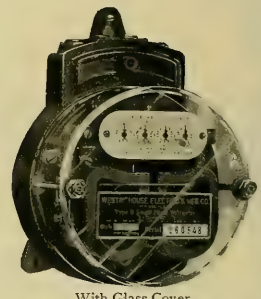
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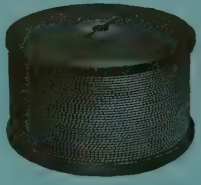

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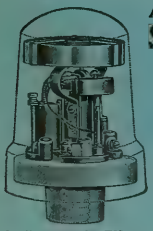

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# Western Electrician

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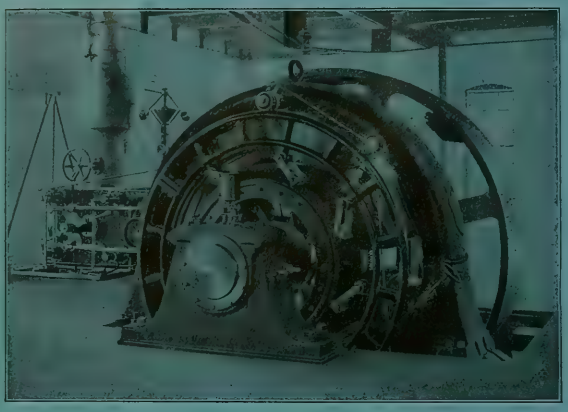

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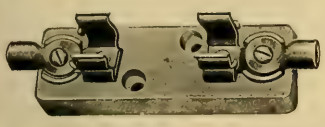

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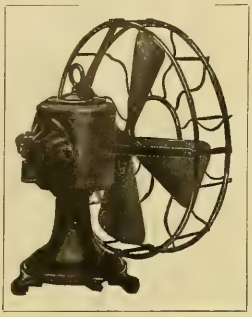

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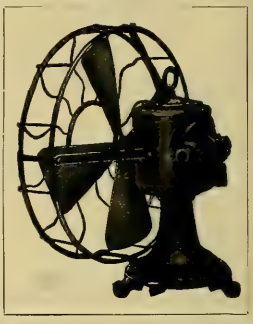

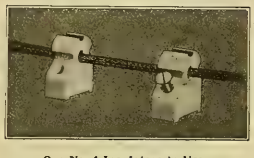

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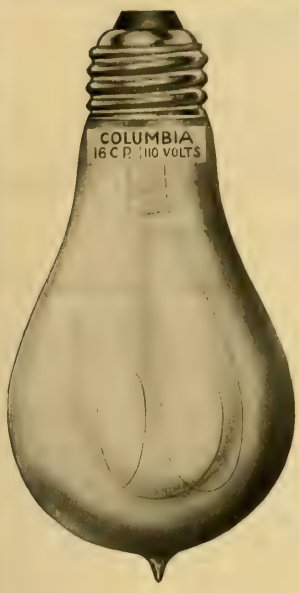


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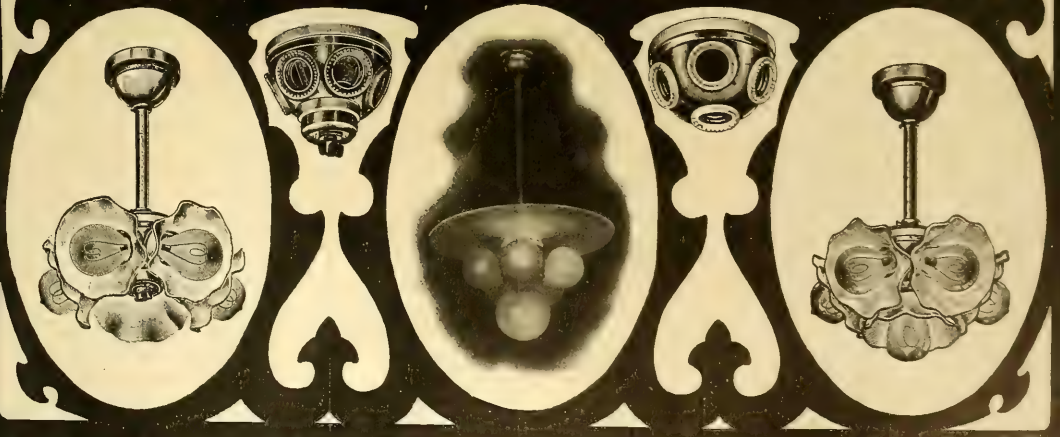

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CHICAGO

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CENTRAL STATION
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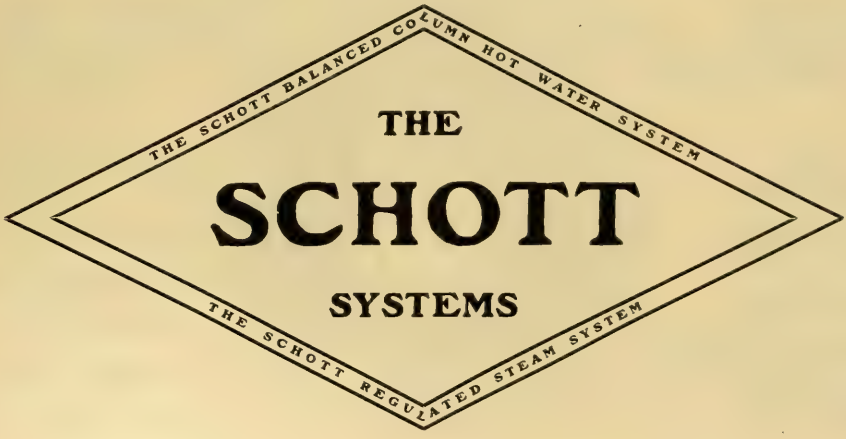


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## THE SCHOTT BALANCED COLUMN SYSTEM

NO BACK PRESSURE
NO NOISE
GREATEST CAPACITY
PERFECT REGULATION

## THE SCHOTT REGULATED STEAM SYSTEM

AUTOMATIC VACUUM CIRCULATION
LEAST BACK PRESSURE
GREATEST PIPE LINE CAPACITY
PERFECT REGULATION

CORRESPONDENCE SOLICITED

# WE CAN SHOW YOU

IF ELECTRICAL AND GOOD WE SELL IT

## Some Matters of Interest in the Electrical Supply Line

IF ELECTRICAL AND GOOD WE SELL IT

### A FEW OF THESE ARE

New Prices

New Material

New Way of Effecting Prompt Shipments

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Fostoria Incandescent Lamps

Newgard Receptacles

Blake Insulating Staples

Westinghouse Arcs

Transformers and Meters

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## There are Other Reasons and Other Specialties

IF ELECTRICAL AND GOOD WE SELL IT

# TRY US

IF ELECTRICAL AND GOOD WE SELL IT

**AMERICAN ELECTRICAL SUPPLY COMPANY**

DEALERS & MANUFACTURERS

CHICAGO

# General Electric Company

## Arc Lamps with Diffuser Ceiling

**Give an agreeable white light equal to strong daylight in which colors show their true values.**

**The diffuser ceiling utilizes the lamp in the scheme of decoration.**

IF INTERESTED, WRITE FOR MORE INFORMATION

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(547)

Packard Lamps.
Sangamo Meters.
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Packard Transformers.
O.K. Weather-proof wires and Cables.
A.B. Arc Lamps.

THESE ARE OUR JEWELS!

Electric Appliance Company.
CHICAGO— SAN FRANCISCO.

NON-CORROSIVE
KESTER
SOLDERING PASTE

NOT EXCELLED
FOR
Electrical Work

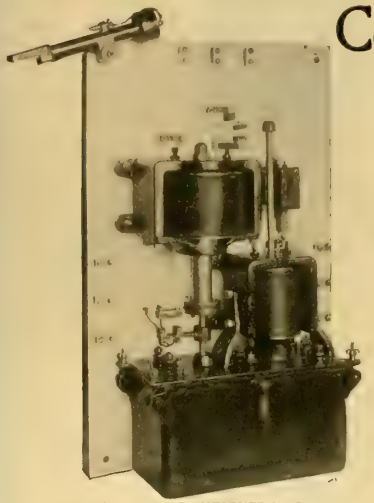
CHICAGO SOLDER CO.
Formerly KESTER ELECTRIC MFG. CO.
46 North Union Street CHICAGO
R. C. MILLER, Burlington Building, St. Louis, Mo., Gen'l Western Agent

Your Lights Will Burn Brighter
IF YOU USE
KLEIN'S TOOLS
IN YOUR CONSTRUCTION WORK
THEY WERE THE BEST WHEN FIRST INTRODUCED IN 1857
THEY HAVE BEEN THE BEST EVER SINCE
ASK YOUR LINEMAN

*Climber's Splicing Clamps, Pliers, Lag Screw Wrenches, Pulley Blocks, Wire Grips, Linemen's Leather Goods, Wire Reels, Shovels, Spoons.*

MATHIAS KLEIN & SONS, Standard Tools, 51 W. Van Buren St., CHICAGO, ILL.

Notice What We Claim for our Automatic Controller for Induction Motors



50 H. P. AUTO-TRANSFORMER STARTER.

Absolute control of motor by temperature changes, pressure variations, time movements or water level float switches. This device offers a solution to many problems heretofore unsolved. It increases production, decreases operating expenses. Apparatus protected by overload and no voltage release devices.

We also manufacture Drum Type Controllers, Solenoids, Solenoid Switches, etc.

Our Solenoid Switch is the only alternating current switch on the market that both opens and closes automatically.

American Electric and Controller Co.
136 Liberty Street, NEW YORK
Licensees under patents to H. Ward Leonard, covering no voltage and overload protective devices.

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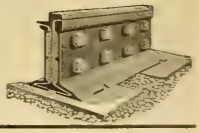
In Sheet or Wire for all Purposes.
SCRAP PURCHASED.
AMERICAN PLATINUM WORKS
251 to 255 New Jersey R. R. Ave., Newark, N. J.

CONTINUOUS RAIL JOINT CO. OF AM.
NEWARK, N. J.
OVER 20,000 MILES IN USE
Highest Award at Paris Exposition, 1900, Buffalo, 1901, and St. Louis, 1904.



STANLEY WATTMETERS
FOR ALTERNATING CURRENT, SINGLE PHASE AND POLYPHASE SERVICE
ROTATED JEWEL BEARING
JEWEL SURFACE ALWAYS NEW—PERMANENT ACCURACY AT ALL LOADS. MADE ALSO IN ROUND, SWITCHBOARD TYPE 6⅞ IN. DIAMETER, BACK CONNECTED.
STANLEY INSTRUMENT COMPANY, GREAT BARRINGTON, MASS.

# IT IS RATHER ODD

## To Place This Lamp and "This" Side by Side!

But really it will not seem so strange when we tell you that "THIS" is not a "freak" picture—on the contrary it represents the ramifications of the nerve system of the human body and serves well to remind us that when you look at a thing *outside* you cannot tell about its *insides.* "A man's a man," is all right, and "a lamp's a lamp" *would be* all right if 'twasn't all wrong. You must *test* both men and lamps—get into them, as it were—and then in the case of the lamp you'll find out what "THIS" No. 2 really means and THIS ("too") 3

# "Banner Betterness"

means if you look into the "nerves" or "lamp insides" with a photometer you'll see why we "play" so strong on that big type expression above—"Banner Betterness" simply means we *court* your photometric test—we beg you to test—because *if* you test

## You'll Buy Our "BB" Lamps==See?

# THE BANNER ELECTRIC CO.

## YOUNGSTOWN, OHIO.

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**WATTS & UTHOFF, Managers**
**Complete Assortment of Lamps in Stock.**

**Northwestern Office**
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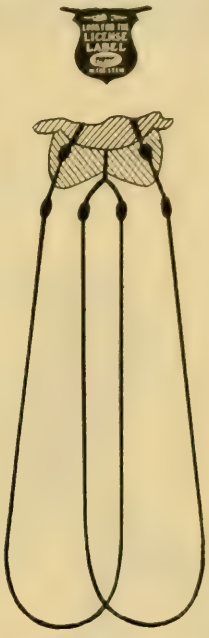
**T. V. CARNEY, Manager**
**Complete Assortment of Lamps in Stock.**

# "MOST LIGHT FOR 1 CENT"

## THAT'S WHAT THIS:

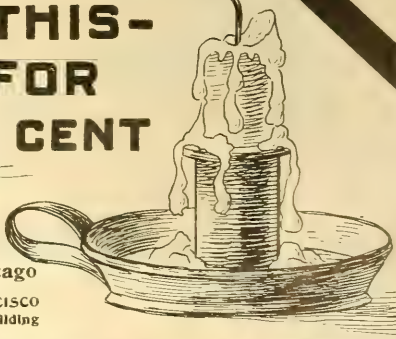


MEANS!

IN A BRYAN-MARSH DOUBLE FILAMENT LAMP

YOU GET THIS

NOT THIS- FOR 1 CENT



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These men are not hired for their short-sightedness nor inexperience.

We look at it this way—imperfect globes that go into the cull barrel cost money; imperfect globes that reach *you* cost *customers*.

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The fact that three-fourths of the inner globes used in this country are NOBLAC Inner Globes is, in our minds, partly due to our system of rigid inspections.

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Makers of Electrical, Gas, Railway and Special Glasswares.

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IT'S ON TOP AND IS GOING TO REMAIN THERE.

IT'S THE STANDARD OF AMERICA.

IT'S THE ONE THAT EVERYBODY SPEAKS WELL OF.

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# Self Starters for Large Motors

No other form of starter for the automatic control of large motors will operate so effectively as the Cutler-Hammer Multiple Solenoid.

Every contact is made with a snap and without arcing.

Steps of resistance are cut out by solenoid switches, each switch being energized in turn by a master solenoid, the latter's action being governed by a dash pot. This arrangement gives a smooth and easy start to the motor.

The opening of the main circuit is accomplished by a solenoid circuit maker and breaker, equipped with powerful blowouts for disrupting the arc.

The largest size motors can be automatically started and stopped by this system with a switch carrying not over one ampere of current, and controlled by a float switch, or small pressure regulator, or by any kind of small switch operated by hand or automatic devices.

It can be used with either reversing or non-reversing motors for operating pumps, electric elevators, cranes, hoists etc.

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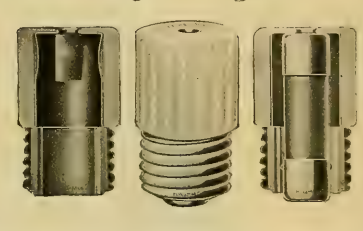
## FUSE PLUG

250 VOLTS — 3-60 AMPS.



The make up of the "National Standard" fuse plug consists of a cylindrical brass shell on one end of which the Edison Standard screw thread is formed. The other end of the shell is provided with inwardly projecting clip contacts, and on the outside of this upper end of the plug a corrugated porcelain cap is fitted and firmly secured. The screw thread end of the plug shell forms one contact. Inside of the screw thread portion is a porcelain button having annular hole. The plug is now made complete by simply inserting through the hole in the porcelain button a "National Standard" fuse of the desired capacity which is pushed directly into the clips on the inside of the upper portion of the shell. The other end of the fuse projects slightly from the porcelain button and forms the other terminal of the plug. When blown the fuse may be ejected from the plug shell by simply pushing through the small hole through the top of the porcelain cap.

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Every clutch ever made with the sole exception of the Accelerator depends entirely on friction for a starting torque.

The Accelerator gets most of its starting torque from induction—a magnetic drag that exerts its greatest strength at the start, thus using the least friction at the point where every other clutch experiences the most friction and consequently receives the most wear.

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These are the reasons why the Accelerator will last for years and years without any adjustment of faces.

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4 C.P.—19 watts
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2 C.P.—13 or 9 watts

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We supply a number of 2 C. P. sign lamps taking only 9 watts and operating two in series on 100-130 volt circuits.

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Absolutely Will Not Gum The Brushes.

It will put that high gloss on the Commutator you have so long sought after.

50 Cents per Stick. $5.00 per Dozen.
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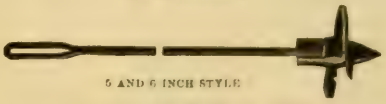

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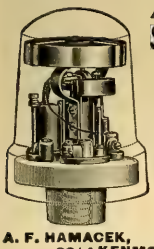

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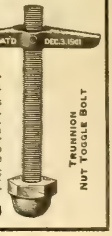


The Thomas Wrigley Co., 300-306 Dearborn St., Chicago

June 20th, 21st and 22d is the time when, and the Auditorium Hotel, Chicago, is the place where the National-Interstate Independent Telephone Association will hold its annual convention.

This will be the first convention of the consolidated associations, and 15 states will be represented.

The issue of the Western Electrician of June 24th will contain much matter of practical value to those interested in telephony, and will be distributed at the convention.

The issue of July 1st will contain the convention report.

Both issues will be of more than ordinary advertising value to manufacturers of telephone apparatus and supplies.

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Good all around electric light and railway man. Would accept position in construction but central station operation preferred. Employed at present but could consider good position at once. Address BOX 488 care Western Electrician, 510 Marquette Bldg., Chicago, Ill.

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| 2 | 50 Am. Engine Co., M. P. |
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| 7,500 | 2—0 | 3 | 6,600 |
| 14,500 | 1—0 | 3 | 6,600 |
| 18,500 | No. 1 | 3 | 6,600 |
| 11,500 | No. 2 | 3 | 6,600 |
| 4,700 | No. 3 | 3 | 6,600 |
| 7,100 | No. 4 | 3 | 6,600 |
| 11,500 | No. 6 | 3 | 6,600 |
| 23,000 | 4—0 | 1 | 2,200 |
| 1,900 | 2—0 | 1 | 2,200 |
| 11,000 | 1—0 | 1 | 2,200 |
| 9,000 | No. 1 | 1 | 2,200 |
| 11,000 | No. 2 | 1 | 2,200 |
| 18,000 | No. 4 | 1 | 2,200 |
| 48,000 | No. 6 | 1 | 2,200 |
| 1,900 | No. 8 | 1 | 2,200 |
| 25,000 | 500 M-C. M. | 1 | 600 |
| 50,000 | 4—0 | 1 | 600 |
| 11,000 | 3—0 | 1 | 600 |
| 1,000 | 2—0 | 1 | 600 |
| 3,700 | No. 1 | 1 | 600 |
| 2,900 | No. 6 | 1 | 600 |
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Built in a wide range of sizes for operation where a vertical shaft is required, enabling operation of machine without the use of bevel gears, etc.

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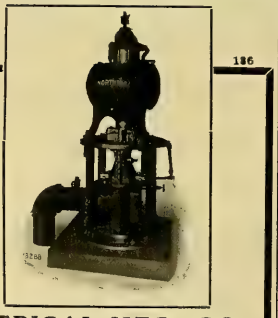


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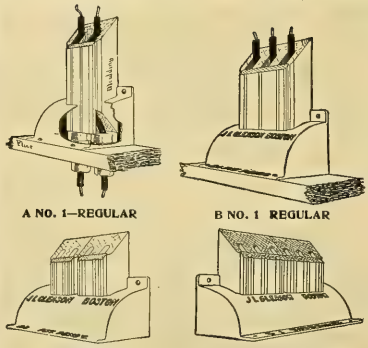

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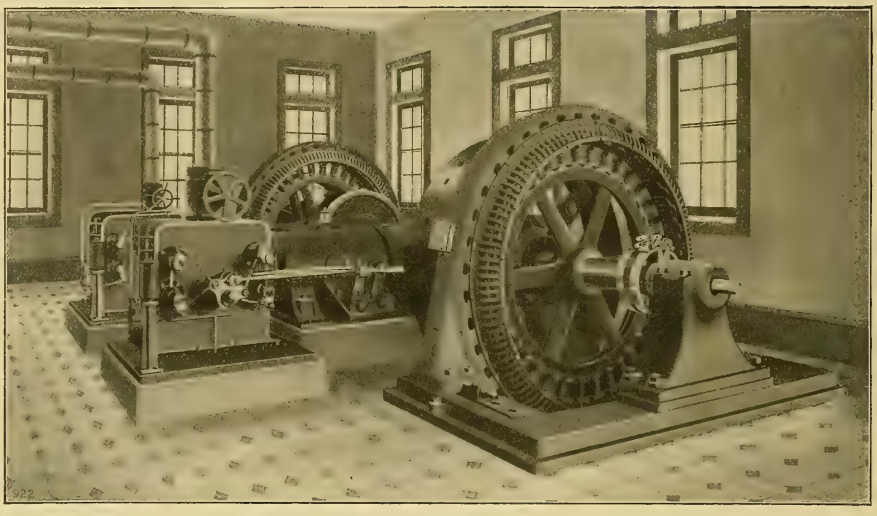

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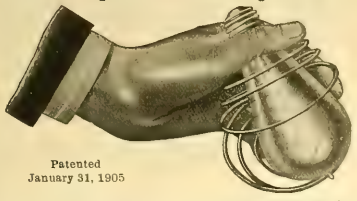

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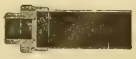

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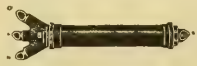

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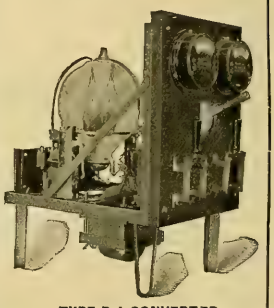

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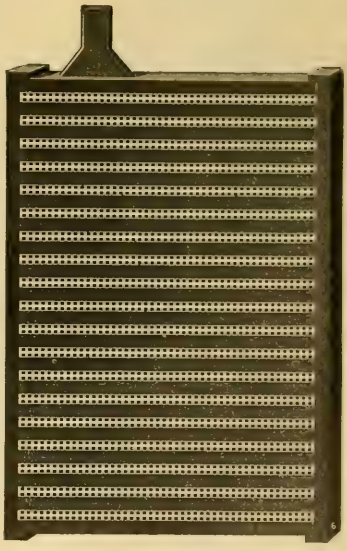

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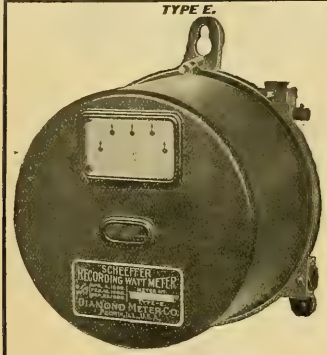


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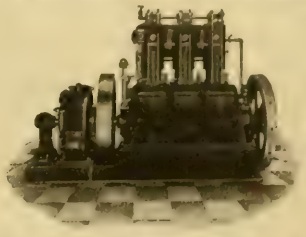

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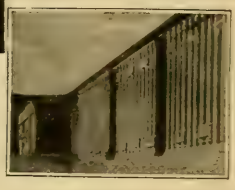

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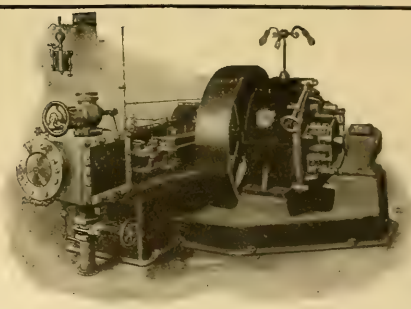

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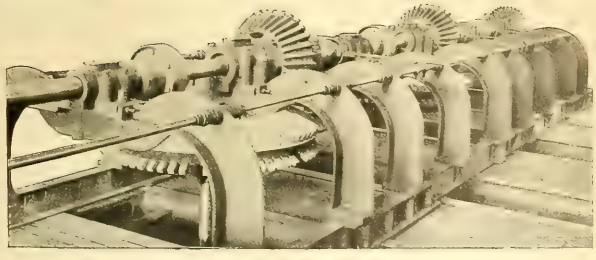

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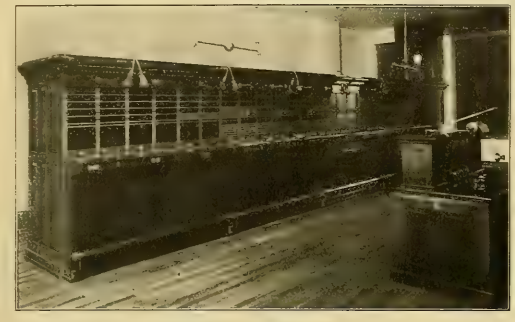

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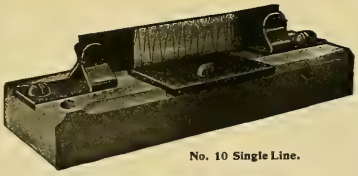

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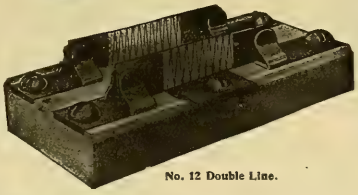

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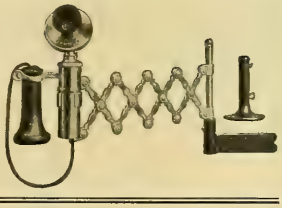

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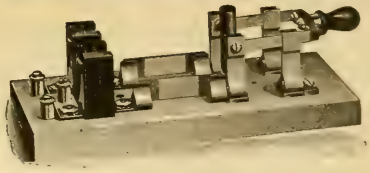

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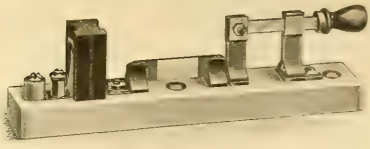

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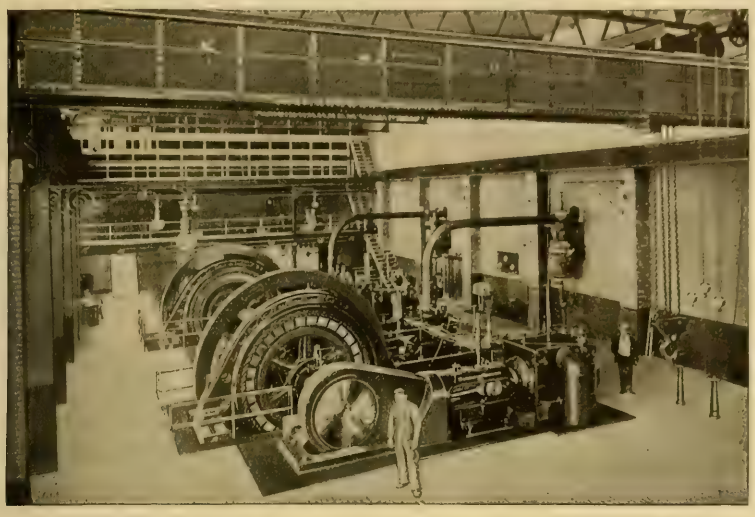

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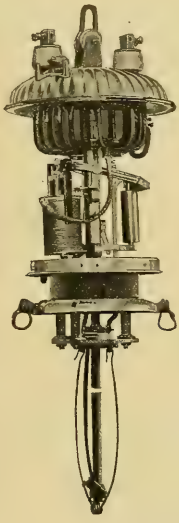
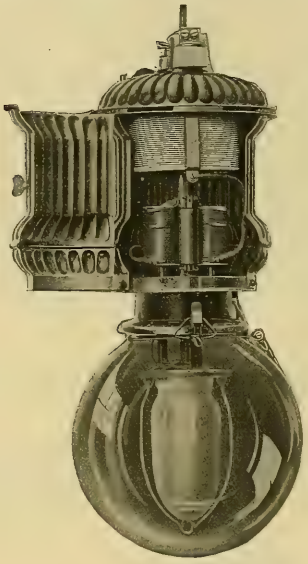
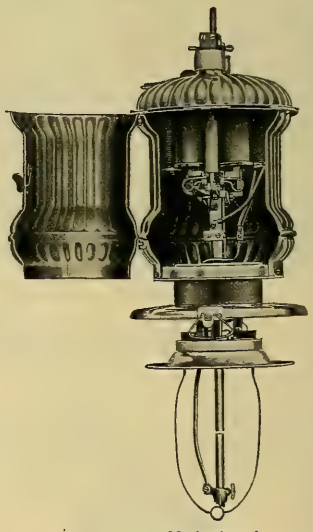


Mechanism of
Multiple Alternating Current Lamp



Multiple Direct Current Lamp
Showing Mechanism



Mechanism of
Series Alternating Current Lamp

## Some Features of the Three Leaders Follow:

### Multiple A. C. Lamp

Single Coil.
Phosphate Bronze Spring Mounting.
20 Coils on Reactive Devices.
Counterbalanced Armature.
Insect Proof.
Adjustable for 3 Amperages.
Fire-proof Uninjured by Short Circuit.

### Multiple D. C. Lamp

Strictly Fireproof.
Adjustable for 3 Amperages.
Well Ventilated.
Average Life: 150 Hours.
Few Parts.
Snap Hook on Globe Chain Holder.
Unaffected by Short Circuit.

### Series A. C. Lamp

No Iron Parts Exposed to Weather.
Inner Reflector.
Solid Copper Case.
Substantial Construction.
Non-Sticking Dash Pot.
Cut-Out: Heavy Coin Silver.
Insulation Unequalled.

**No Moving Leads Attached To Lamp Switches**

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This Week You See Our Type W

BOTH METERS ARE
ABSOLUTELY
ACCURATE,
TAMPER-PROOF,
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**Fort Wayne, Indiana**

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# YOUR MACHINE
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AND
SELL WHAT WE
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THOMAS S. REED, President ROBERT E. BENJAMIN, Secretary

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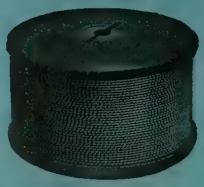

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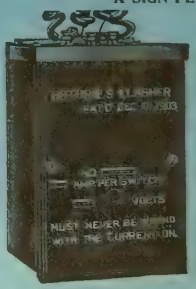

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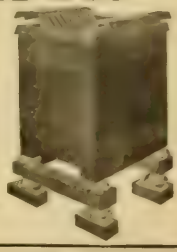

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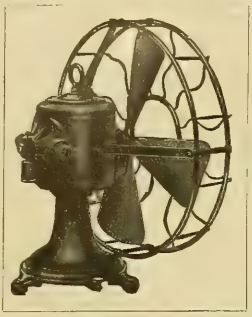

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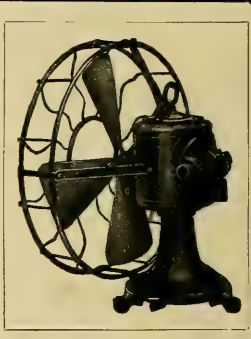

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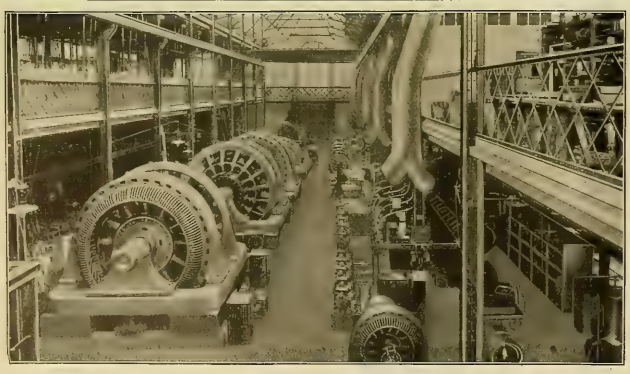

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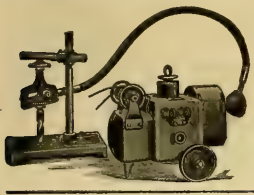

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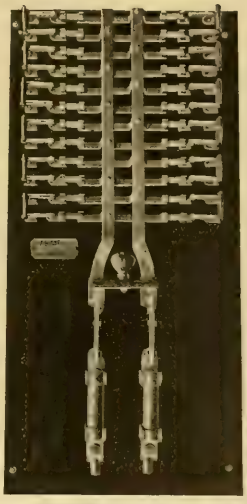

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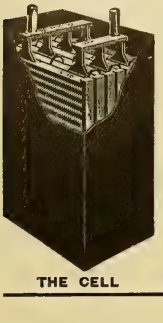

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**The Highest Possible Award**

**Has Been Given to**

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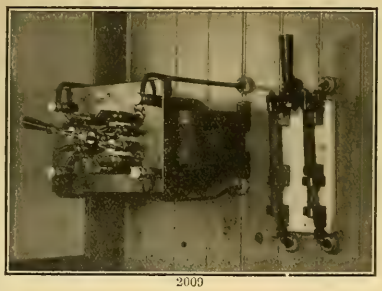
**HUGO REISINGER, Sole Importer, 11 BROADWAY, NEW YORK**

Variable Speed Single Phase Alternating Current

# VENTILATING FANS

WITH AUTO TRANSFORMER CONTROL Regulation from ⅛ to Full Speed



2009

The direct attachment of single phase motors to ventilating fans CAPABLE OF WIDE SPEED RANGE has been effected by us in the following sizes:

| 60 Cycle | Rev. per min. maximum speed | Cu. ft. Air per minute |
|---|---|---|
| ¼HP | 1165 | 1400 |
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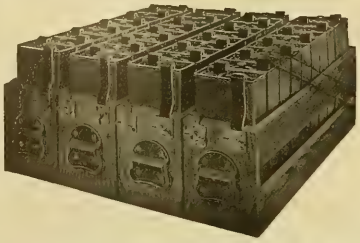

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Both the Motor and Regulator are fully protected by the use of the Cutler-Hammer "Universal" speed regulator.

It also comprises every necessary device for the complete installation of a motor, being equipped with no voltage and overload release magnets, fuses and knife switch.

In case of cessation of current the operation of the no voltage magnet will allow the lever to return to "off" position. The overload magnet will act in the same manner for overloads up to 50 per cent increase of the normal current.

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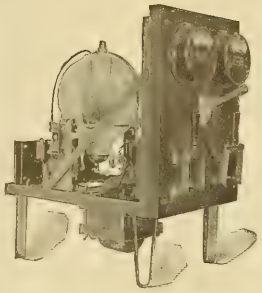

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For charging storage batteries from alternating currents

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Every clutch ever made with the sole exception of the Accelerator depends entirely on friction for a starting torque.

The Accelerator gets most of its starting torque from induction—a magnetic drag that exerts its greatest strength at the start, thus using the least friction at the point where every other clutch experiences the most friction and consequently receives the most wear.

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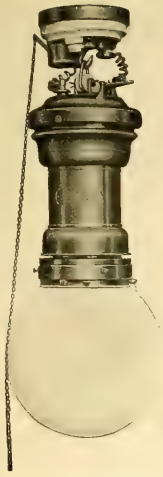

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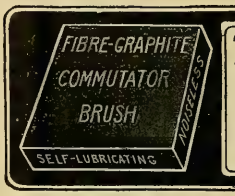


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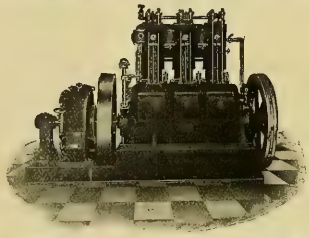

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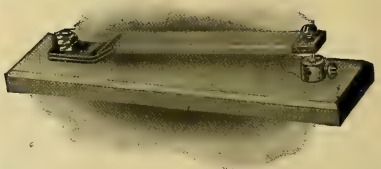

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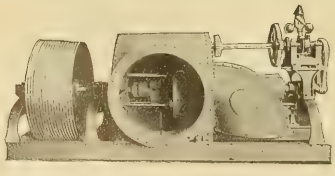

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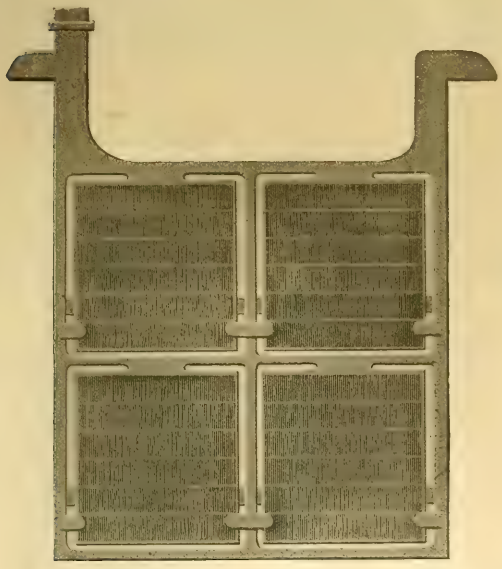

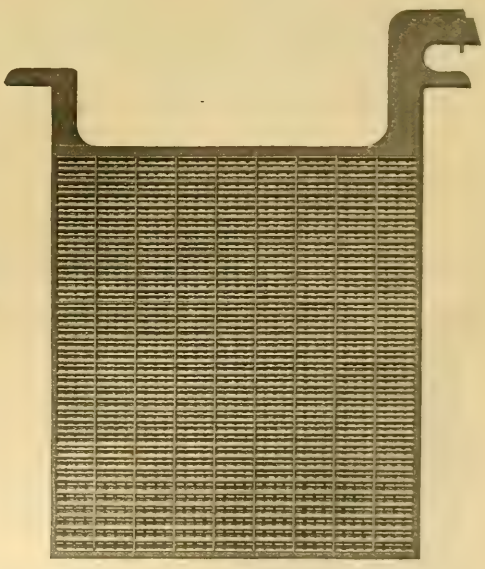

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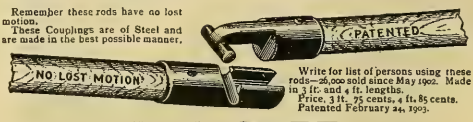


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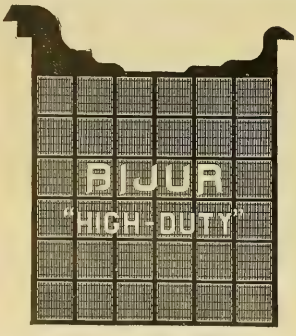


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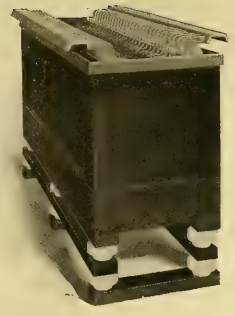

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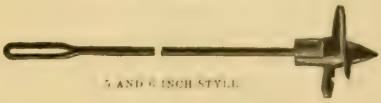

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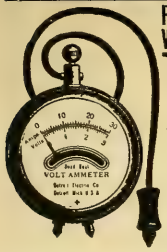

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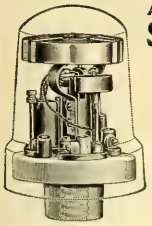

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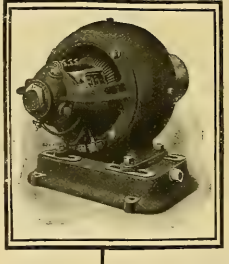

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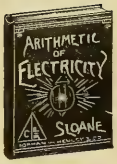


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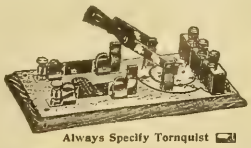

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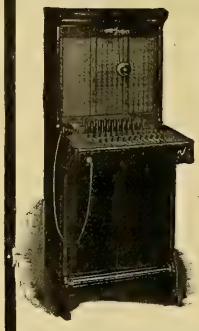

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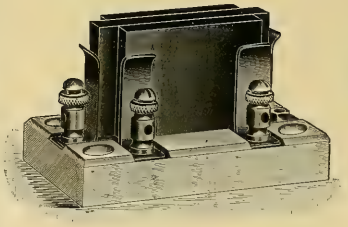

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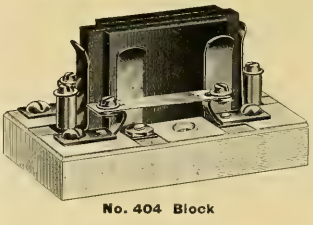

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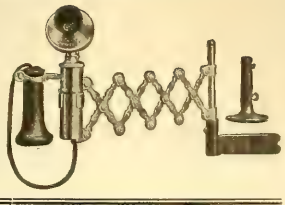

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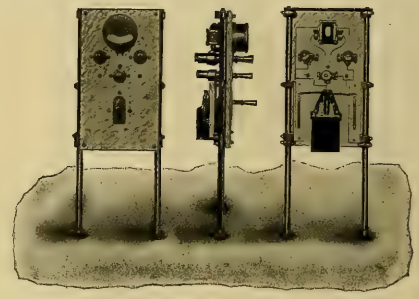

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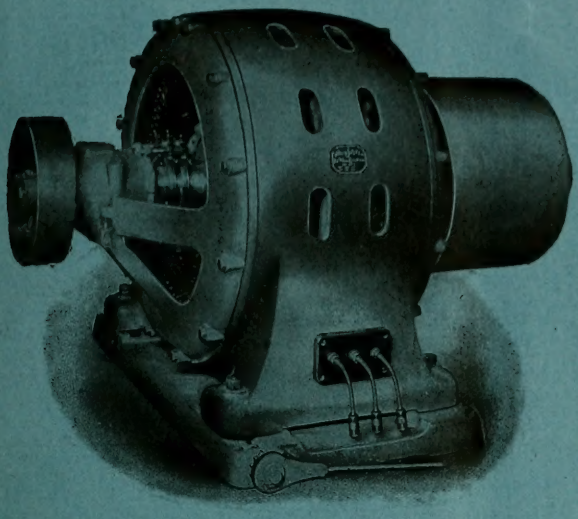

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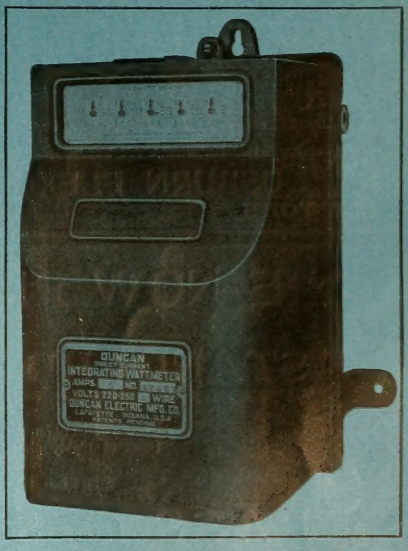


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